Preliminary Ecological Assessment of Seyhan River Basin with Reference to Climate Change Predictions

For the "Enhancing Capacity to Adapt to Climate Change" Project

April 2009

Preliminary Ecological Assessment of Seyhan River Basin with Reference to Climate Change Predictions

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Executive Summary

This report presents biodiversity (species, areas, ecosystems, ecological and evloutianry processes and ecosystem services) of the Basin and develp a rationale in terms of priorities, vulnarabilities to cliamet change and recommendations for future studies.

Seyhan Basin is situated in the junction of three main biogeographical sectors and elongates through the Anatolian Diagonal which is accepted as one of the evolutionary nodes in Turkey. The Basin harbors biological elements of all three biogeographic regions, namely Mediterranean, Middle East and Irano-Turanian. This characteristic makes it a very important location for biodiversity with unique species compositions.

This biodiversity need to be protected and managed carefully as it has high conservation value and it provides many goods and services to people. Throughout the report biological importance of the area is presented and assesd for sustainable use and conservation in the prone of climate change. The priority species and areas for conservation in the Basin were determined using the Systematic Conservation Planning tool, which is an optimization process to predict the conservation priorities combining highest representation of biodiversity, minimum number of sites, minimum conservation cost and maximum conservation opportunities.

On the other hand, Intact or natural ecosystems generate a variety of goods and services important for human wellbeing, collectively called ecosystem services. The Millennium Ecosystem Assessment categorizes these services as provisioning, regulating, supporting and cultural. Though many natural ecosystems in the Seyhan Basin have been altered for human use, the remaining intact or semi-intact ecosystems serve increasingly valuable services, as they become rarer, to support both human and wildlife and to mitigate climate change. Human activities to date have hindered many ecosystem services. Climate change will further modify the way these ecosystems provide services.

It is recommended that:

- Modelling of forest ecosystems that will be affected by climate change and development of recomendtaions for forest planning and manegment,
- Modelling of selected critical species that will be affected by climate change and development of recomendtaions for their conservaton,
- Identification of potential new ranges and refugia for priority species and priority ecosystem according to principles of landscape ecology, ecological and evolutianry processes,
- Modeling ecosystem services that will be affected by climate change and developing adaptation measures for the critical ones,

- A spatial and functional prioritization of which ecosystem services to invest for protecting

be performed for the Seyhan Basin.

In light of the information gathered with the above processes, work should be started to incorporate more climate-change-mitigation-friendly policies, management approaches and techniques into programmes of certain government agencies. As the main land use types in the Seyhan Basin are agriculture, animal husbandry and forestry, the Ministries of Environment and Forestry, and Agriculture and Rural Affairs should particularly be involved in these efforts.

Introduction

The purpose of this report is to provide the ecological background for the Joint Programme whose core objective is to develop capacity for managing climate change risks to rural and coastal development in Turkey. Natural resources, such as soil, biodiversity, forest, grassland and wetland ecosystems form the basis of economical production and therefore of development (MA Reports, WRI 2005). It is important to first assess and then monitor the status of natural resources under the changing climatic conditions to be able to take pre-emptive actions to conserve them, and to secure our future.

This report will shed light to the biotic resources in the Seyhan Basin, prioritize them in terms of their biodiversity importance, assess climatic threats to them, and finally provide recommendations for their management for their adaptation to the climatic changes. More specifically the report will provide the following:

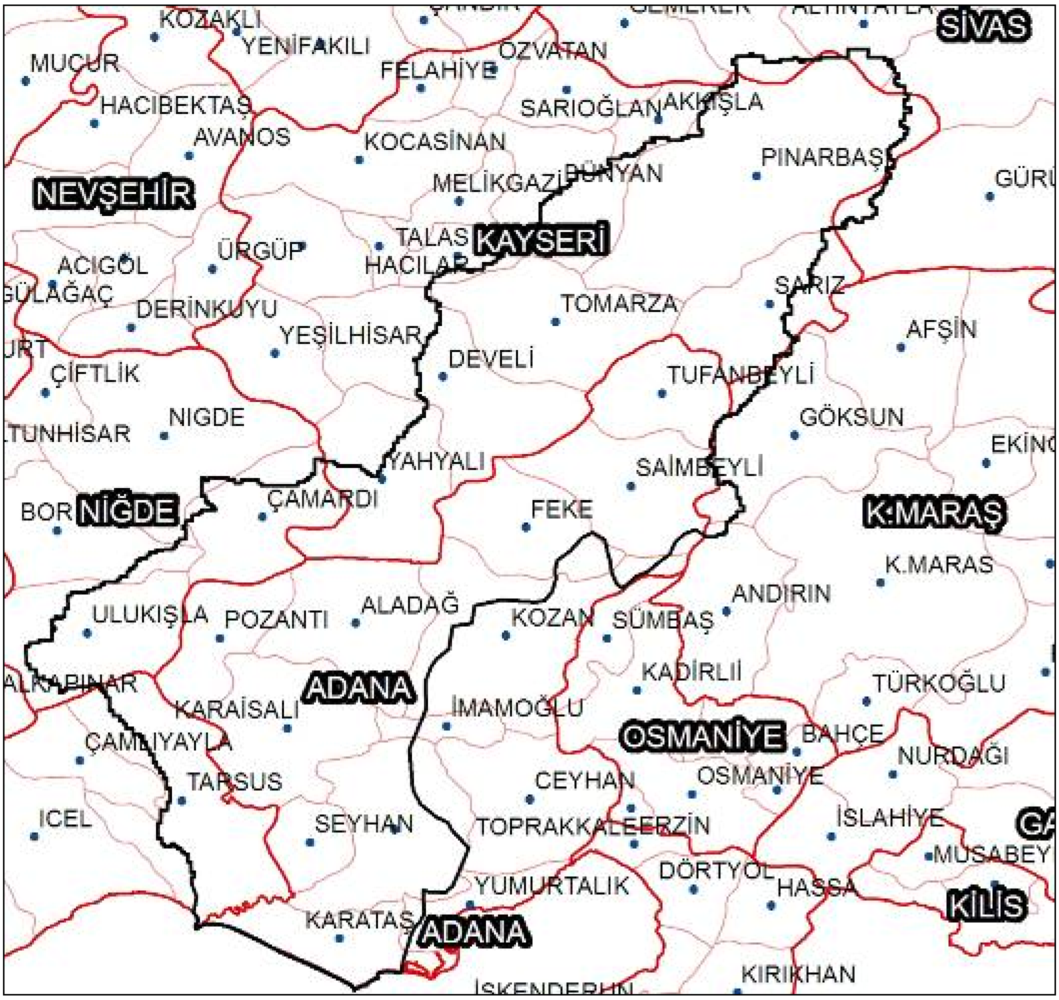
1. Ecological regionalization of Seyhan River Basin,
2. Defining priority natural systems (priority biodiversity areas),
3. Threat and sensitivity analysis giving due emphasis on changing climate and adaptation (spatial: in priority areas, thematic: whole basin; including drivers of change),
4. Identification of key ecosystem services in light of changing climate conditions so as to provide hints on the adaptive capacity,
5. Conservation and sustainable use recommendations towards adaptation to climate

1. Geographic Position

Seyhan Basin is situated in the eastern Mediterranean Region of Turkey. Central and Eastern Anatolia lie on the northwest and northeast respectively. It extends between 36° 30' - 39° 15' north latitude and 34° 45' - 37° 00' east longitudes. The basin covers an area of 20 731 km².

The Basin spreads over 2.073.100 hectares of area in total. It is extended in six provinces and 33 districts. Namely;

1. Adana (more than %50)
2. Mersin (more than % 5)
3. Niğde (more than % 5)
4. Kayseri (more than % 50)
5. Kahramanmaraş (less than % 5)
6. Sivas (less than % 5)



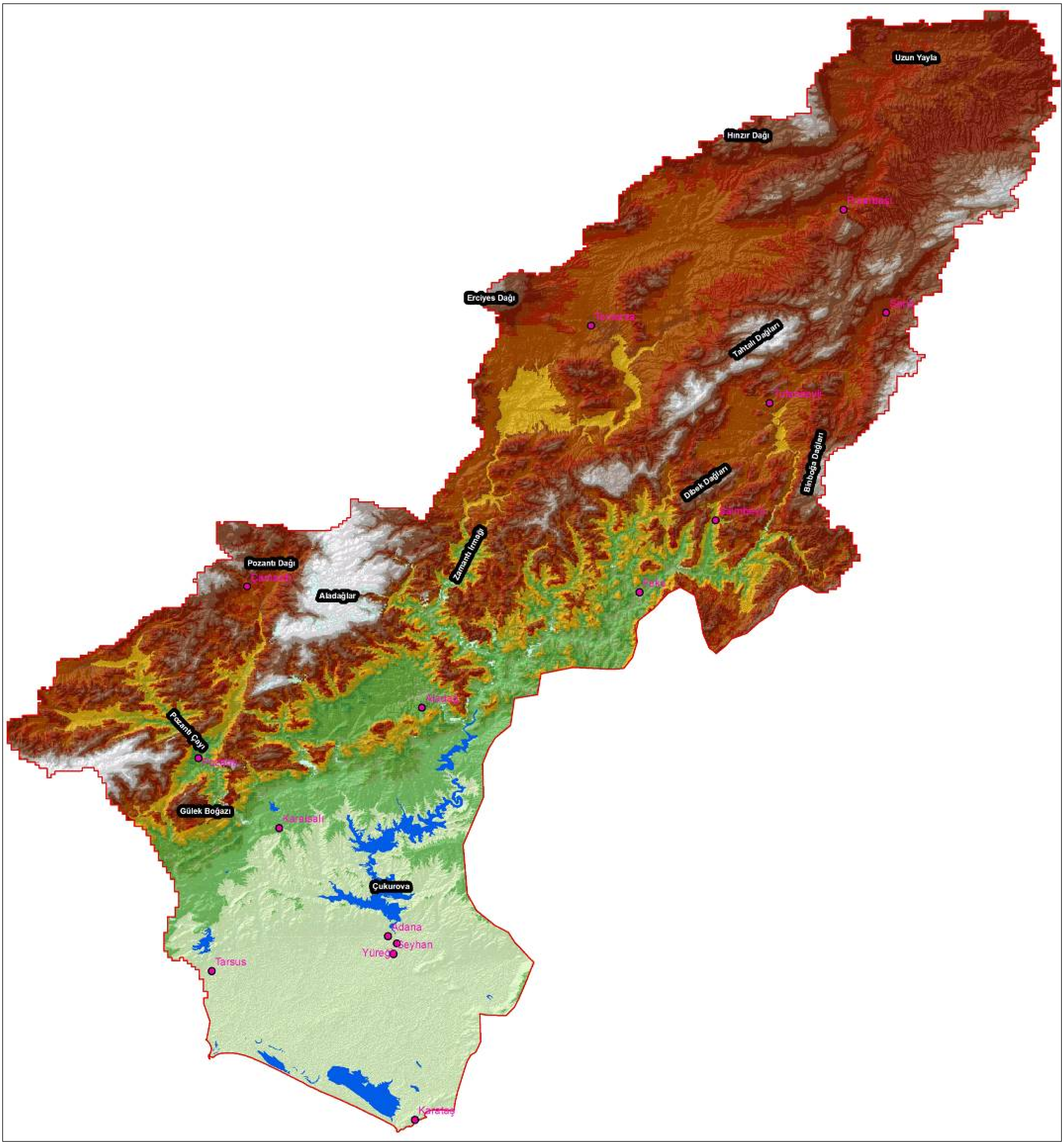
Map 1: Provinces and districts in Seyhan Basin

The dominating mountainous nature of the Seyhan Basin is contrasted by the Çukurova Plain in south, formed with the alluvial deposits washed from these mountains. A plateau called Uzun Yayla rises in the north.

Tahtali Mountains (Bey Dağı 3075 m.), Dibek Mountains (2230 m.), Binboğa Mountains (2917 m.), Bolkar Mountains (Medetsiz Tepe 3524) and Aladağlar (3756 m) are the main geographic formations in the region. Seyhan Basin is delineated by Tecer Mountains (l600 m) in the north, Tahtalı Mountains (3075m) in the east and Bolkar Mountains (3524m) in the west.

Seyhan Dam Lake and Çatalan Dam Lake now compensate for the lack of major water bodies in the region. In terms of hydrological features, Göksu, Zamantı and Pozantı streams are the main streams and they merge to form Seyhan River in the Northern Çukurova.

While the southern part of the Basin shows an alluvial plain formation, northern part is highly mountainous in topography. Tahtalı Mountains divides the Basin in north-south direction. The southern part is influenced by the Central Anatolian climatic features while the northern part is influenced by the penetration of the Eastern Anatolian realm. These features influence in the biological composition of the region. Mediterranean climatic regime dominates the basin with a stronger presence in the south than in the north.

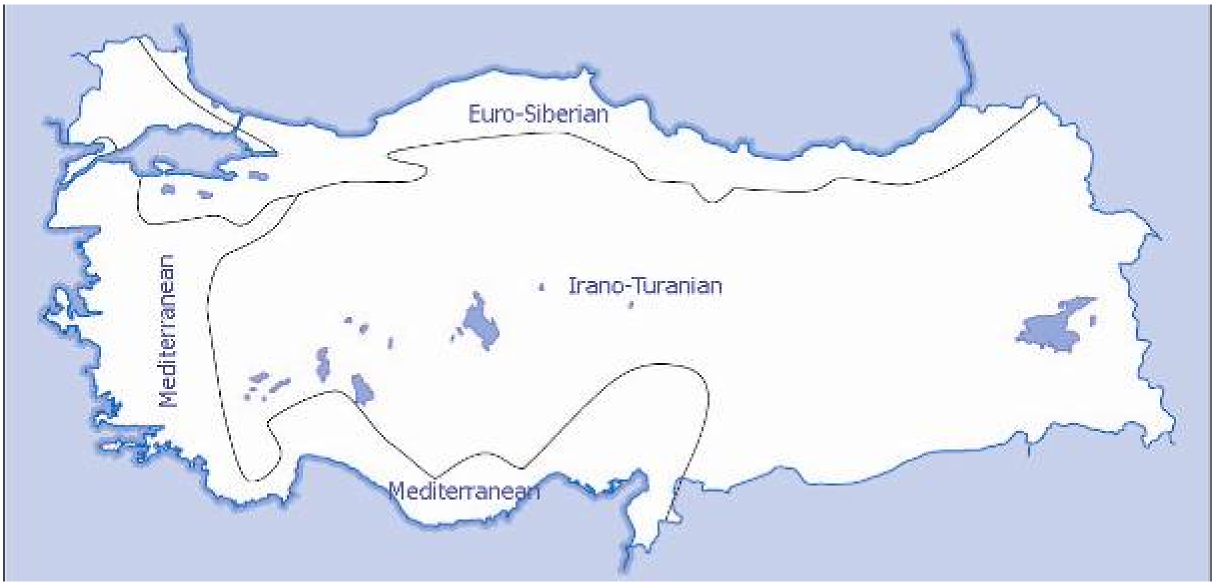


Map 2: Geographic features of Seyhan

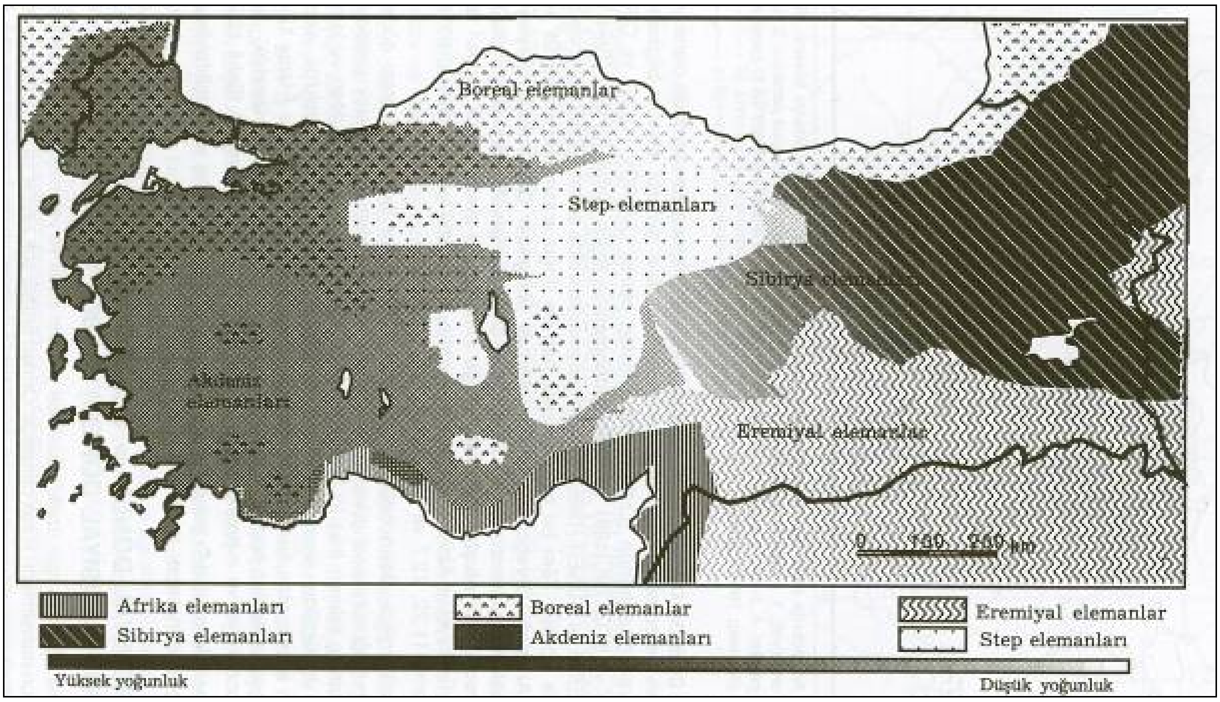
2. Biogeographic Position

Seyhan Basin is situated in three main biogeographical sectors and elongates through the Anatolian Diagonal which is accepted as one of the evolutionary nodes in Turkey (Davis 1971, Davis and Hedge 1974, Ekim and Güner 1986). These biogeographical regions area Mediterranean, Middle East and Irano-Turanian terrains. Each of these terrains has unique features and harbours species and habitats unique to their biogeographical realms (see Map 3 and Map 4).

Being situated in the junction of these three Biogeographic realms, the Seyhan Basin demonstrates unique features in terms of species composition.



Map 3: Phytogeographic regions of Turkey and Seyhan Basin (Davis 1965)



Map 4: Zoogeographic regions of Turkey and Seyhan Basin (Demirsoy 1977)

After the formation of the Taurus and the North Anatolia Mountains 65-70 million years ago, the Anatolian Plateau was raised around 1000 m. The Inner Anatolia region did not get its share from this rising, and is therefore now covered with water bodies in different sizes. These mountains and water systems in Central Anatolia acted as a barrier between eastern and western Anatolia. This is accepted as one of the biogeographic explanation of the differentiation and evolution of flora and fauna of Turkey (De Lattin 1967, Demirsoy 2002). For this reason, the Anatolian Diagonal appears as one of the differentiation nodes in the Anatolian Plateau, especially after the glaciations period. This node passes through Seyhan Basin in south-north direction and forms one of the most important biogeographical features of the Basin.

During the glaciations period Iran-Caspian, Balkan-Macedonian and Iberian Peninsula acted as refuge for many species migrating southward in Europe. Species that took a refuge in Balkan-Macedonian and Iran-Hazar systems migrated to Anatolia in subsequent years. However elements of these two refuges could not merge due to the barriers of water systems in Central Anatolia, Northern and Southern Mountains and the Anatolian Diagonal. Existence of Euxinic species in the high mountains (boreal forests in Uludağ, Kazdağı, Sandras Mountain) and differences of the species of Eastern and Western Anatolia are accepted as evidences of this explanation (Demirsoy 1973, 1994).

The Postglacial or Eremial Era (10.000 years ago) is another important era that needs to be considered to explain the biogeographical features of Seyhan Basin. The increase in temperatures and decrease in precipitation have lead to the migration of the eremial species from the Sahara, Sinai Deserts, Arabian Peninsula etc, towards Anatolia. Afroeremial elements have migrated to Turkey through Sinai, Palestine and Syria and they have spread all the way to Silifke in west. Syroeremial species can be found throughout Southern Anatolia. Although Taurus Mountains acted as a barrier, there are many Syroeremial species distributed in the rest of Anatolia as well. Iranoeremial species have limited distribution in Anatolia due to the Eastern Anatolian Mountains. Iğdır depression is the most typical area that hosts Iranoeremic elements. Although there is a high number of Iranoeremic elements in the northern part of the Basin, we expect to see very few of these elements in south of the Basin.

3. Sub-regions of Seyhan Basin

There is a long and rich history of attempts to divide the world into discrete regions that describe biologically meaningful spatial patterns based on the;

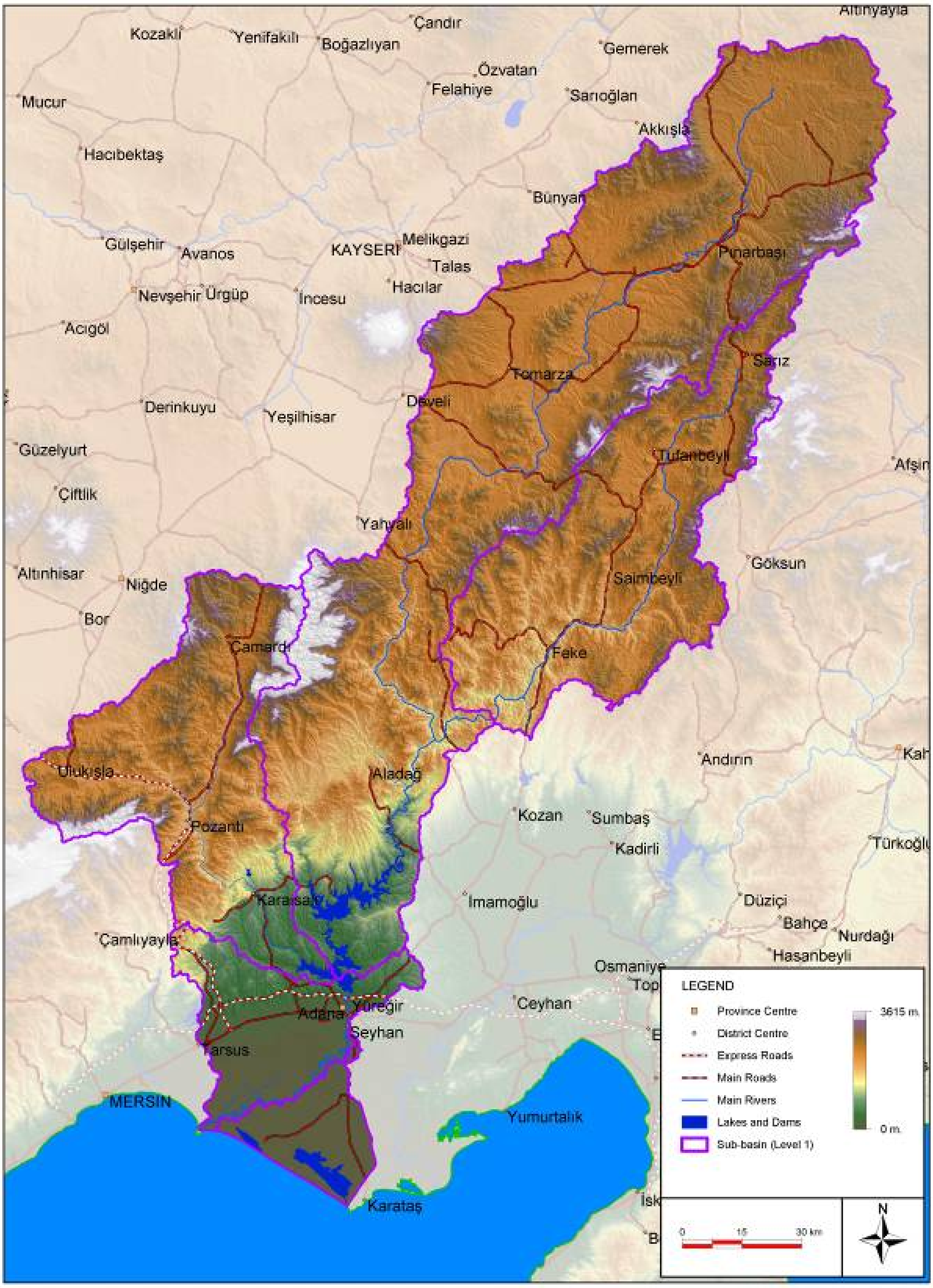
- zones of relatively broad spatial extent,
- based on climatic regimes (lifezones, Merriam, 1895; Holdridge, 1947),
- dominant plant physiognomy (biomes, Carpenter, 1939),
- biogeographic history (realms, provinces, Agassiz, 1850; Wallace, 1894).

Regionalization is one of the major tools for the conservation planning and natural resource management. It has been used as management units (Rohm *et al*., 1987), crop pattern identification source (Merriam 1898) and conservation planning tool (Davis *et al*. 1996, Bailey 1995, Magnusson 2004), monitoring (Wikramanayake *et al.* 2002).

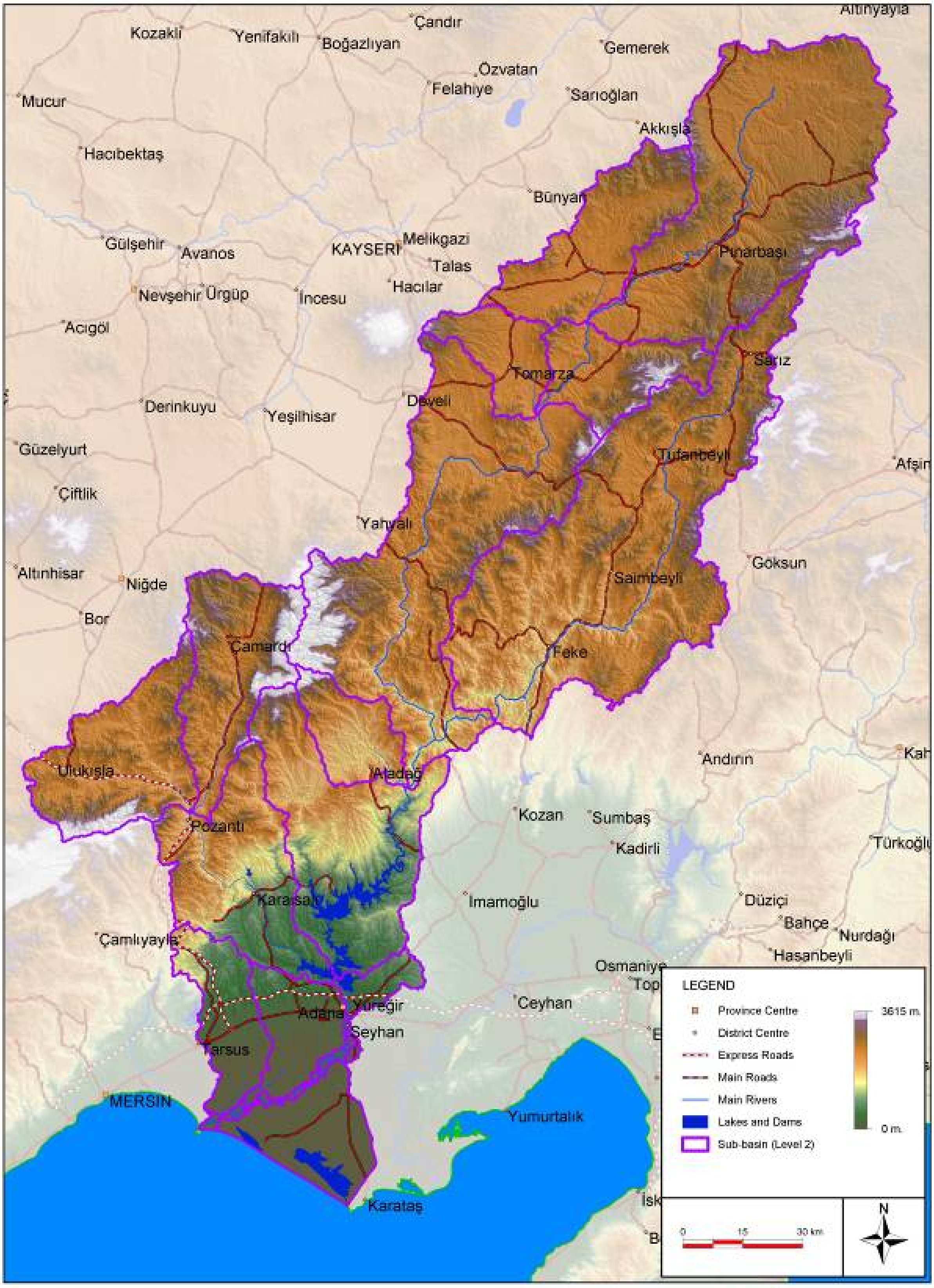
The two major approaches used for regionalization in biodiversity and conservation related studies are:

1) Watersheds: Identified according to basins of the streams
2) Ecoregions: Identified according to major vegetation types, climate and land use types.

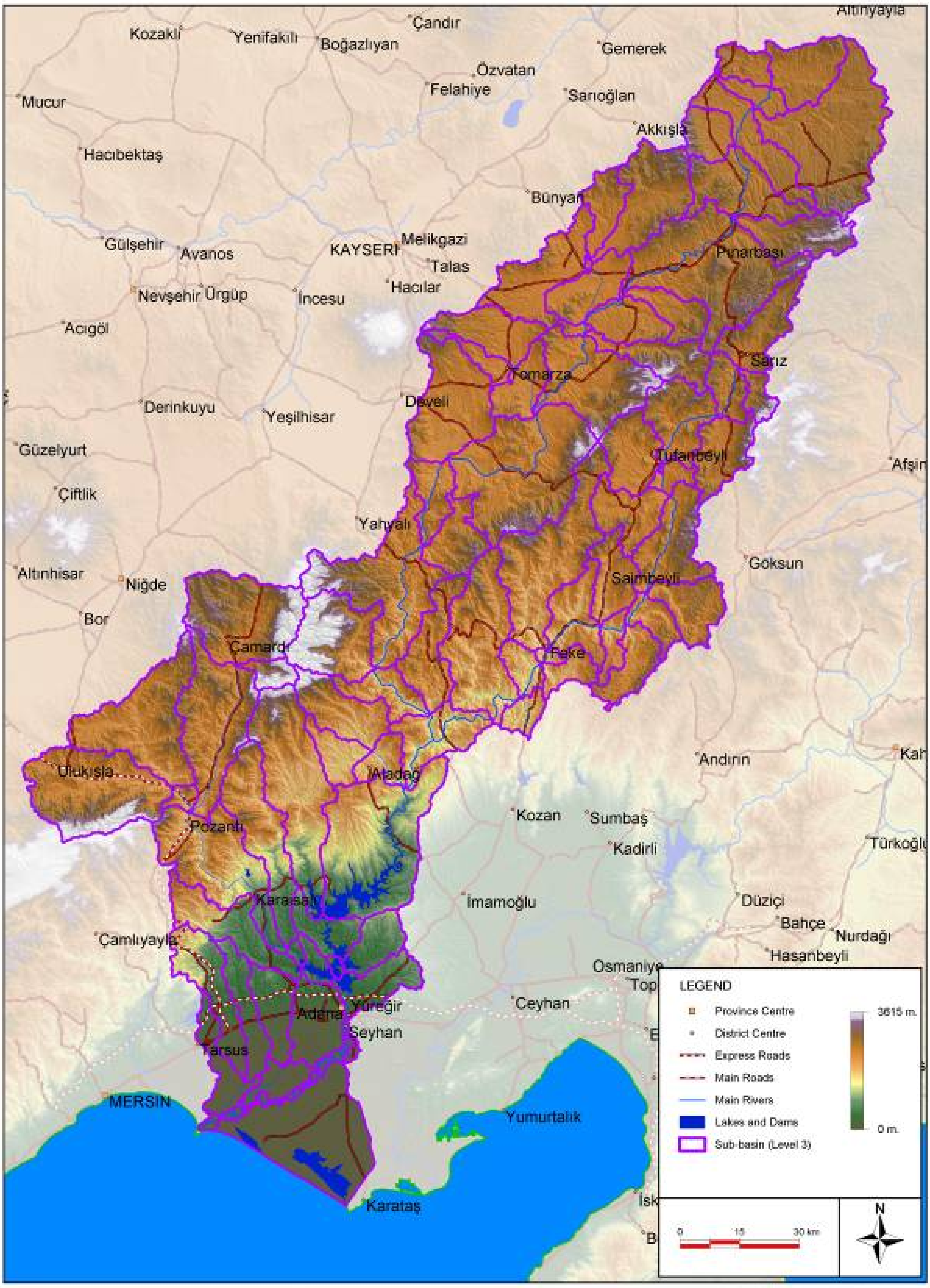
Watersheds of the Seyhan Basin are reproduced in different scales in GIS environment by using elevation data. An SRTM-DEM with 90 m. resolution was used to depict watershed basin and sub-basins of Seyhan. TauDEM (Terrain Analysis Using Digital Elevation Models) program as a plug-in in ArcGIS 9.2 was used for this purpose. There were some successive processes to produce watershed basins. First, flow directions, slope, contributing area, network order, network tree and network coordinates were obtained. Using flow direction, network tree and coordinates, watershed grid was produced. This watershed grid was formed from small sub-basins which designated the properties like slope of related stream pieces. The outer boundaries of these small sub-basins were accepted as the main basin boundary. Afterwards, network grid production process was repeated using the order of streams as thresholds. Finally, sub-basins were obtained at different levels.



Map 5: Level 1 sub-watersheds of Seyhan Basin



Map 6: Level 2 sub-watersheds of Seyhan Basin



Map 7: Level 3 sub-watersheds of Seyhan Basin

Although there is a big debate about the definition of ecoregion, there is little disagreement about the definition of watersheds. Watersheds are, simply, topographic areas within which apparent surface water runoff drains to a specific point on a stream or to a water body. Identification of the watershed boundaries of large rivers can be done with great accuracy, but this can not be said for many of the smaller streams (Omernick and Bailey 1997).

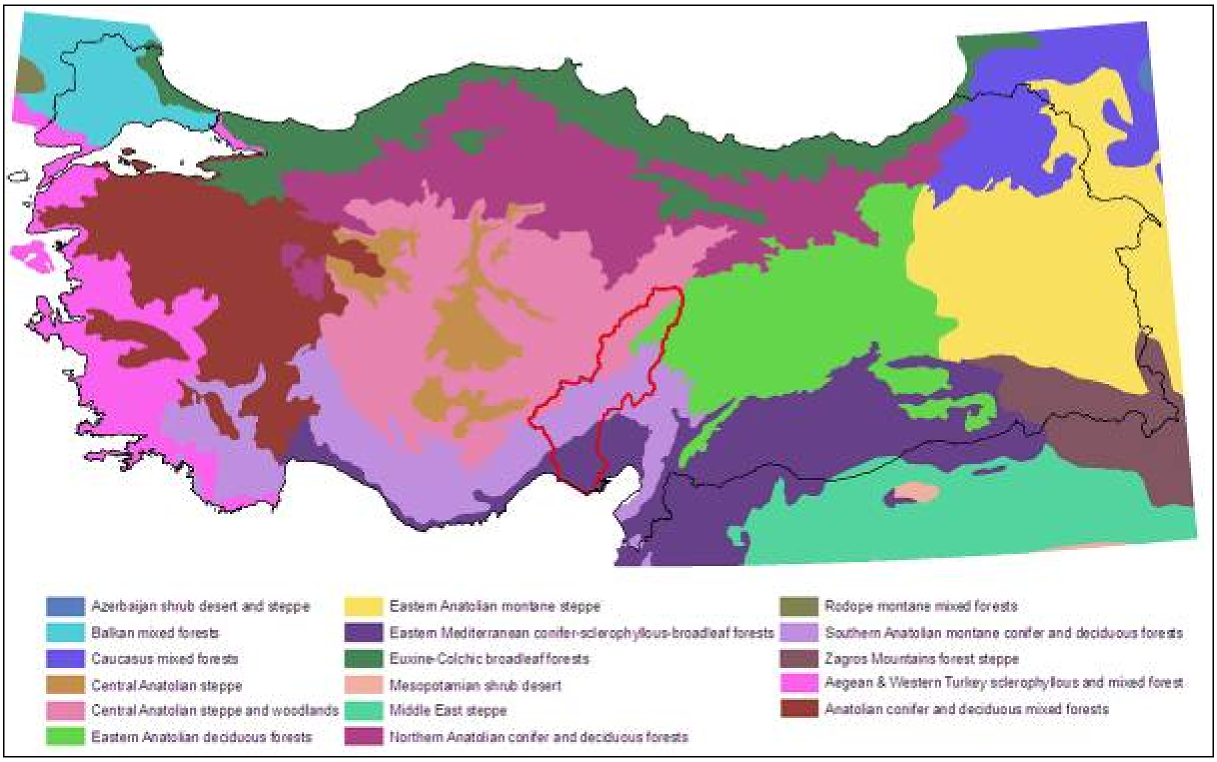
"Ecoregions are generally defined as finite spatial areas, smaller than a biome, where environmental conditions or species assemblages are presumed to be relatively homogeneous compared with the heterogeneity that occurs over a broader spatial area" (cf., Ray 1987, Olson *et al.* 2001). Ecoregions are intended to provide a spatial framework for ecosystem assessment, research, inventory, monitoring, and management. These regions delimit large areas within which local ecosystems reoccur more or less throughout the region in a predictable pattern. In broad terms, ecological regions, at any scale, can be defined as areas with relative homogeneity in ecosystems (Omernik and Bailey 1997).

However, it is worth mentioning that there is not one single regionalization study that could serve all purposes and reflect all features correctly. Although ecoregions are globally recognized and commonly used in conservation and resource management, they do come with many limitations. Ecoregions were accepted to reflect the distribution of vegetation, soil, precipitation and hydrological characteristics but, watersheds are more accurate in representation of the macroinvertebrate communities (Lyons, 1989; Inkley and Anderson, 1982; Poff and Allan, 1995). Watersheds will be critical spatial framework for the water quality and quantity (Omernick and Bailey 1997). Frequently there are many species and natural features whose distributions are not restricted to one ecoregion (McDonald 2005, Gerring *et al.* 2003)

Ecoregions are the recommended approach for the regionalization in this study. Seyhan Basin was regionalized by various organizations and scientists and the results vary in geographical extend.

Table 1: Ecoregional classification studies also covering Seyhan Basin.

Institutions &Scientists	Scale	Reference
WWF Mediterranean	Regional (whole Mediterranean Basin)	WWF 2001
WWF US	Global	Olson *et al*. 2001
WWF Turkey	Regional (Mediterranean Turkey)	Zeydanlı *et al.* 2005
Atalay	National	Atalay 2002
DKM	Regional (Anatolian Diagonal)	DKM 2009



Map 8: Ecoregions of Turkey and Seyhan Basin (Olson *et al*. 2001)

Mediterranean Transition Region

Mountain Grass Subregion

Mediterranean Region

Lower Mediterranean Red Pine Subregion

Mediterranean Mountain Black Pine, Cedar, Fir Subregion

Southeastern Anatolia Transition Region

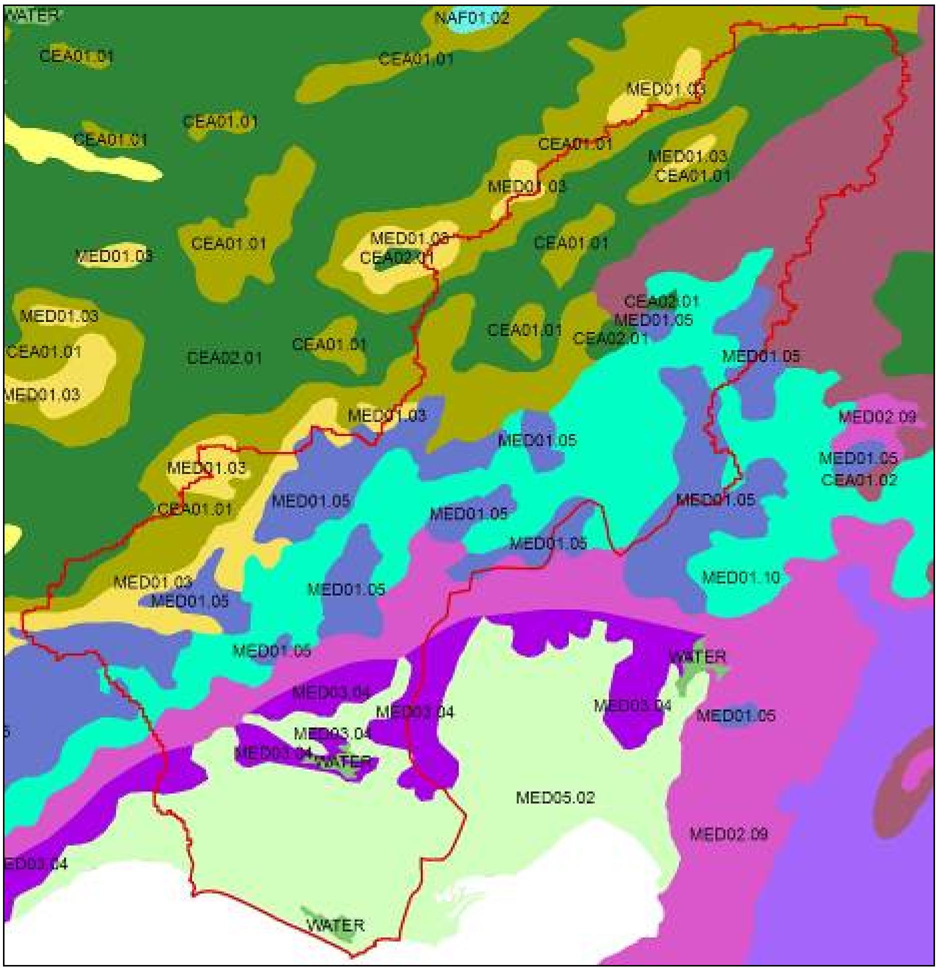
Dry Oak-Red Pine Subregion

Eastern Anatolia Region

Mountain Steppe-Grass Subregion

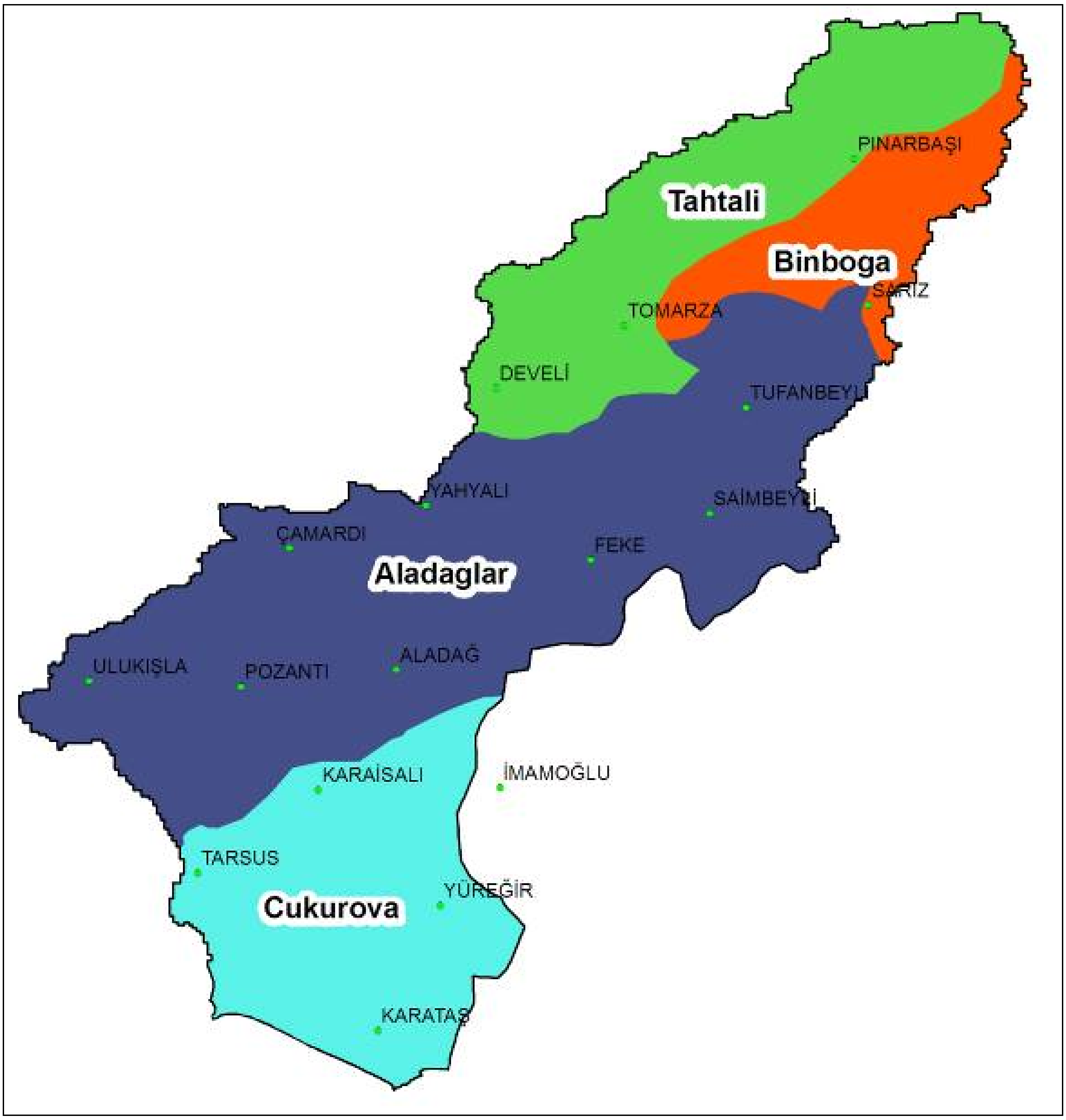
Mountain Grass Subregion

Map 9: Atalay (2002) ecoregions and sub-ecoregions of Seyhan Basin



CEA01.01	Central and Eastern Anatolian Ecoregion (CEA) - Deciduous Forests and Woodlands - Central Anatolia forests
CEA01.02	Central and Eastern Anatolian Ecoregion (CEA) - Deciduous Forests and Woodlands - Eastern Anatolia forests
CEA02.01	Central and Eastern Anatolian Ecoregion (CEA) - Steppes - Central Anatolia tree steppes
MED01.03	Mediterranean Forests, Woodlands and Scrublands Ecoregion (MED) - Mountain Conifer Forests - Juniper high mountain woodlands Southern Anatolia and Middle East
MED01.05	Mediterranean Forests, Woodlands and Scrublands Ecoregion (MED) - Mountain Conifer Forests - Cedar and fir forests Southern Anatolia, Cyprus and Middle East
MED01.10	Mediterranean Forests, Woodlands and Scrublands Ecoregion (MED) - Mountain Conifer Forests - Pine and fir forests Southern and Western Anatolia
MED02.09	Mediterranean Forests, Woodlands and Scrublands Ecoregion (MED) - Deciduous and mixed Forests - Oak and mixed deciduous forests Western Anatolia
MED03.04	Mediterranean Forests, Woodlands and Scrublands Ecoregion (MED) - Lowland Dry Conifer Forests - Greece, Anatolia, Cyprus and Middle East
MED05.02	Mediterranean Forests, Woodlands and Scrublands Ecoregion (MED) - Wild olive tree, carob and pistachio woodlands and maquis - Eastern Mediterranean

Map 10: Ecoregions of Turkey and Seyhan Basin (WWF 2001)



Map 11: Subecoregions by Anatolian Diagonal Biodiversity Project (DKM 2009)

In all of the regionalization studies Seyhan Basin is divided into two main realms; Mediterranean and Inner Anatolia. Mediterranean can be subdivided as coastal and mountainous, Inner Anatolia can be subdivided as Eastern and Central Anatolia. These subdivisions can be easily recognized from the topographic and also biological features.

In this study we recommend using DKM 2009 regionalization as it is the most recent and carried out by more accurate spatial data and strong biological background such as vegetation, species distribution data. It includes four sub-ecoregions;

<u>Çukurova:</u>

It covers 514.306 hectares of area. It is an alluvial plain under the influence of coastal Mediterranean Climate. Agricultural activities are extensive and most of the subecoregion is converted into agricultural field (*circa* 261.337 ha).

Aladağlar:

It is covered by the Taurus Mountains and is host to one of the highest peaks of Turkey Medetsiz (3524 m). 254.475 out of 799.915 hectares of this subecoregion is covered with forests. This sub-ecoregion has typical Mediterranean climate but is cooler due to high altitude. Animal keeping is a historical and extensive economical activity in the area.

Tahtalı Mountains:

It is a highly mountainous sub-ecoregion in the southwest of the basin. It has continental climate and is much drier in comparison to Aladağlar. Although it is much similar to Eastern Anatolia with its mountainous features it also bears species of the Central Anatolia low mountain steppe. These mountains are in the transition zone between eastern and western part of Turkey. From a total area of 663.337 hectares, 219.464 hectares are steppe and 24.872 hectares forest.

Binboğa Mountains:

This sub-ecoregion is situated in the northeast of the basin and it is highly mountainous. It has a continental climate. These mountains are much more similar to eastern Anatolia in its biological features and they show transition features like Tahtalı Mountains. With 3011 hectares of forest and 39.61 hectares of steppe, the ecoregions totals 59.470 hectares.

4. Biodiversity

4.1. Ecosystems and Vegetation

Ecosystems of the Basin can be studied in four main types;

- Forests, woodlands and shrublands
- Grasslands
- Freshwaters
- Costal systems

Vegetation cover differs in great extend in south-north direction according to climate and biogeographic regions. Natural areas of the southern most part of the Basin are dominated by maquis formation. Aladağlar Mountains is dominated by coniferous forests. Northern parts are mainly dry steppe with scattered patches of oak shrublands.

Table2: Extend of the forest, steppe and agricultural areas according to sub-ecoregions

Sub-ecoregion	Total Area (ha)
Aladağlar Sub-ecoregion	
Forest	254474,98
Agriculture	94379,97
Steppe	372905,22
Çukurova Sub-ecoregion	
Forest	140435,93
Agriculture	261337,24
Steppe	70492,73
Binboğa Mountains Sub-ecoregion	
Forest	3011,22
Agriculture	12286,63
Steppe	39611,45
Tahtali Mountains Sub-ecoregion	
Forest	24872,86
Agriculture	380093,46
Steppe	219464,16

4.1.1. Forests, Woodlands and Shrublands

Woody formations are more extensive in the southern part of the Basin, especially in Çukurova and Aladağlar sub-ecoregions. Coastal areas are mainly covered with maquis formation (dominated by *Arbutus andrachne, Olea europea, Quercus coccifera, Phillyrea latifolia, Styrax officinalis, Myrtus communis, Pistacia lentiscus*) and Red Pine forests (*Pinus brutia*). Maquis formation is extensive up to 500-600 m of altitude, but they can be seen up to 900-1000 m. Red Pine forests go up to 1200-1300 m in altitude but they start to decrease in abundance and are replaced by *Pinus nigra*, *Cedrus libani* around 1000 m. *Pinus nigra*, *Cedrus libani* and *Abies cilicica* forests are common between 1100-1900 m. *Juniperus sp*. dominates higher altitudes and the northern slopes of the Taurus Mountains. They form more open woodland formations.

Deciduous oak and Juniper shrublands are scattered in Tahtalı Mountain and Binboğa Mountain sub-ecoregions. These formations are sensitive to climate change as they are already remnants of the long regression processes.

More detailed information about the forest and shrubland cover of Çukurova and Aladağlar can be found in Altan et al. (2007), Atik *et al.* (2007) and vegetation of the whole Basin can be found in DKM (2009).

The woody formations of the Basin should be considered in five main themes to study the impact of the climate change and to discuss adaptation and mitigation measures;

- Coastal Maquis formations
- Costal and Lowland Red Pine Forests
- Mountain Mixed Coniferous Forests (*Pinus nigra, Cedrus libani, Abies cilicica*)
- High Mountain Juniper Woodlands
- Dry Oak and Juniper Shrublands and Woodlands

4.1.2. Grassland

Grassland ecosystems of the Seyhan Basin can be divided into three main different types.

<u>Alpine Grasslands:</u>
Extends above the timberline and most extensively disturbed in Aladağlar Mountain Tahtalı Mountain sub-ecoregions.

<u>Transitory Mediterranean Grasslands:</u>
These grasslands are formed with anthropogenic influence and they are called transitionary because if anthropogenic pressure will be removed from these grasslands they are expected to turn back to forest or shrubland. Basically grassland areas in Çukurova and Aladağlar Mountain (below the timberline) sub-ecoregions are formed trough long history of land use and these places supposed to be covered with maquis or forests (Zohary 1973).

<u>Mountain Steppe:</u>
This formation is dominant in the northern part of the Basin in Tahtalı and Binboğa Mountains where Irano-Turanian phytogeographic regions extends. These dry grasslands are dominated by the chamaeophytic plants with strong and deep root systems. These mountains have high plant species richness and plant endemism ratio.

Alpine grasslands and mountain steppe formations need to be studied separately to project the impact of the climate change on these areas as they have different ecosystem dynamics. Alpine grasslands expected to shrink as timberline will escalated. On the contrary, steppes will be expanding through forested areas as temperature rises and precipitation decreases in the transition zones between steppe and forest.

4.1.3. Wetlands and Coastal System:

The major wetland area of the Basin is the Seyhan Delta. Two lagoons, Tuzla and Akyatan are important areas for fish reproduction. The original sand dune system of the delta has mostly been lost due to afforestation policies and agriculture. A very small proportion of the dunes remain intact today.

Other habitats in the Delta are the mud plains, salty and freshwater marshes. All these habitats are part of the Mediterranean halophytic meadows, Mediterranean halophytic steppes, sand dunes and Mediterranean wet meadows habitats, all listed as threatened natural habitats in the Bern Convention.

The overgrazed wet halophytic depressions contain three identified plant communities: *Schoeno nigricantis-Saccharetum ravennae*, *Junco acuti-Tamaricetum hampeanae* and *Polypogono maritimi ssp. maritimi-Juncetum littoralis* (Çakan *et al.*2003).

The halophytic plains created by the seasonal flooding by salty water around the lagoons harbour seven plant communities which are *Junco gerardii ssp. gerardii-Halimionetum portulacoidis*, *Atriplici hastatae-Juncetum*, *Phragmiti australis-Juncetum maritimi*, *Salicornio europaeae-Arthrocnemetum fruticosi*, *Bolboschoeno maritimi-Juncetum subulati*, *Spergularia marinae-Arthrocnemetum glauci* and *Petrosimono brachiatae-Halocnemetum strobilacei.*

Coastal ecosystems are important ecosystems where terrestrial ecosystems end and marine ecosystems begin. Coastal ecosystems allow for the very important economic activity of fish nurseries. The coastal area around the Seyhan Delta is known to be particularly productive in terms of marine products. This system has to be considered carefully as they are very sensitive to changes in hydrological system. Even without the impact of the global climate change there is a problem with the system due to over use of freshwater for agriculture. As a result of the projected impact of the global climate change in the Basin, decrease in the precipitation, lagoon system would be damaged and salt water intrusion to inland would happen.

4.2. Priority Areas Studies

4.2.1. Important Plant Areas

Important Plant Areas (IPA) concept was developed by PlantLife, an international conservation organization for plants, for effective conservation of plants. Turkey was one of the first countries that completed IPA study. The identification of IPAs is based on three broad criteria:

A. Threatened Species: The site holds significant populations of species of global or regional concern.
B. Botanical Richness: The site has exceptionally rich flora in a regional context in relation to its biogeographic zone.
C. Threatened Habitats: The site is an outstanding example of a habitat type of global or regional importance.

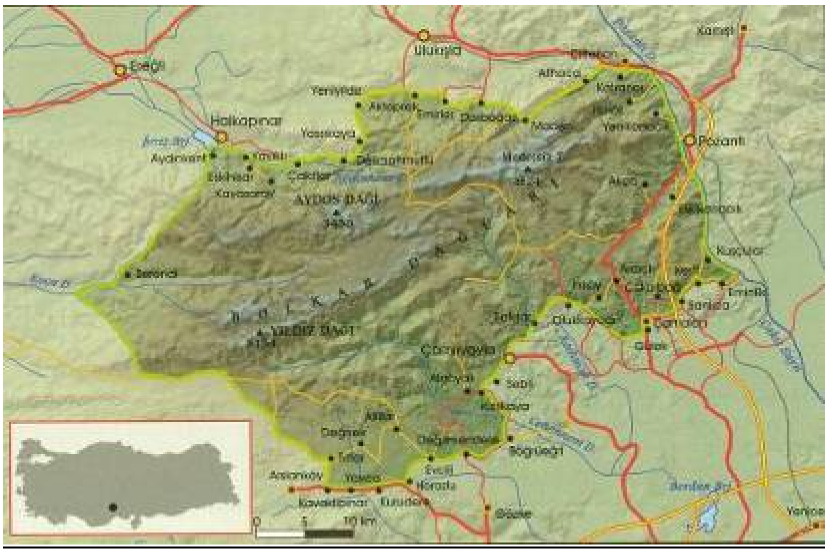
A site qualifies as an IPA if it fulfils one or more of the above criteria.

The IPA study in Turkey was conducted by DHKD (Turkish Society for the Conservation of Nature) and WWF Turkey (Özhatay et. al. 2003, 2005). Each IPA is then studied in more detail, if there is a shortage of information about species, habitats, threats and conservation status. Site descriptions were prepared by scientists who had detailed knowledge about the area or who studied the site.

There are three IPAs in Seyhan Basin:

Name	Code	Writer
Bolkar Mountains	74	Yusuf Gemici, Andrew Byfield
Aladağlar	75	Mehmet Koyuncu, Neriman Özhatay
Seyhan Delta	76	Halil Çakan, Andrew Byfield

74 Bolkar Dağları IPA



Map 12: Bolkar Mountain Important Plant Area (Özhatay *et al.* 2003)

Criteria for IPA Designation:

A1: 16 globally threatened Species (including 2 species listed in Appendix I of Bern Convention)

A2: 152 regionally (European) threatened species

B: Site containing high number of species within a range of defined habitat types - *34, 36, 41, 61*

C2: Site containing threatened habitats - *42.1952*, *42.6643*, *42.85B1*, *42.A351*, *42.A43, 42.B12*

Other Important Features:

- Other nationally important species: 15
- Total endemic taxa: 323
- Number of threatened taxa: 183 (172 endemic)
- Critical Species: A relict endemic species *Flueggea anatolica.* It is distributed only in one hectares of area in IPA.

Habitats:

Mediterranean maquis, pine, cedar, fir and oak forests; Enclaves of Euro-siberian vegetation cover on limestone canyons, Mountain steppe communities; glacial lakes and associated small peat bogs; alpine scree, steep rocky habitats and associated plant communities.

Table 3: List of globally threatened species (16 taxa) for Bolkar Mountain Important Plant Area

Name	End/NonEnd	IUCN Threat
Alkanna Pinardii	END	V
Asplenium reuteri	END	E
Astragalus aydosensis	END	V
Colchicum 0balansae	END	V
Consolida cruciata	END	I
Cyclamen cilicium	END	V
Cyclamen pseudibericum	END	V
Echinops mersinensis	END	V
Flueggea anatolica	END	n/l
Galanthus nivalis ssp. *Cilicicus*	END	V
Helichrysum peshmenianum	END	E
Iris junonia	END	V
Ophrys cilicica	END	V
Polygala inexpectata	END	V
Silene pompeiopolitana	END	E
Myosotis ramosissima ssp. *uncata*	END	I

Table 4: List of regionally threatened species (152 taxa) for Bolkar Mountain Important Plant Area

Name	End/NonEnd	IUCN Threat
Achillea kotschyi ssp. *canescens*	END	R
A. monocephala	END	K
A. spinulifolia	END	R
Aethionemacapitatum	END	R
A. cordatum		R
A. demirizii	END	R
A. glaucescens	END	K

Name	End/NonEnd	IUCN Threat
A. huber-morathii	END	R
A. schistosum	END	R
Ajuga postii	END	R
Alchemilla paracompactilis	END	K
Alkannaaucherana	END	R
Allium alpinarii	END	R
A. decidum	END	R
A. gayi	END	R
Alyssumargyrophyllum	END	R
A. cilicicum	END	R
A. giosnanum	END	R
Anthemis fimbriata	END	R
A. oxylepis	END	R
A. pauciloba var. *sieheana*	END	R
Anthyllis vulneraria ssp. *variegata*	END	R
Arabis androsaceae	END	R
A. aubretioides	END	R
Aristolochia cilicica	END	R
Asperula cilicica	END	R
A. stricta ssp. *grandiflora*	END	R
Astragalus chrysochlorus	END	R
A. goeznensis	END	R
A. plumosus var. *akardaghicus*	END	R
A. plumosus var. *plumosus*	END	R
A. stenosemioides	END	R
A. suberosus ssp. *mersinensis*	END	K
Brachypodium kotschyi	END	R
Campanula psilostachya	END	R
C. trachyphylla	END	R
Centaureaamanicola	END	R
C. antiochia ssp. *praealta*	END	R
C. calcitrapa ssp. *cilicica*	END	R
C. chrysantha	END	R
C. kotschyi var. *kotschyi*	END	R
C. sieheana	END	K
C. solstitialis ssp.*carneola*	END	R
Chamaecytisus drepanolobus	END	R
Cicer floribundum	END	R
Cicerbita brevirostris	END	R
Cirsium cilicicum	END	R
Corydalissolida ssp. *tauricola*	END	R
Cousinia ermenekensis	END	R
Crocus cancellatus ssp. *cancellatus*	END	R
C. reticulatus ssp. *hittiticus*	END	R
C. sieheanus	END	R
Dianthus elegans var. *actinopetalus*	END	R
Draba acaulis	END	R
D. elegans	END	R
Ebenus cappadocica	END	R
E. longipes	END	R
Echinophora carvifolia	END	R
Erodiumcedrorum ssp. *salmoneum*	END	R
E. leucanthum	END	R
E. micropetalum	END	R
Euphorbiarhytidosperma	END	R

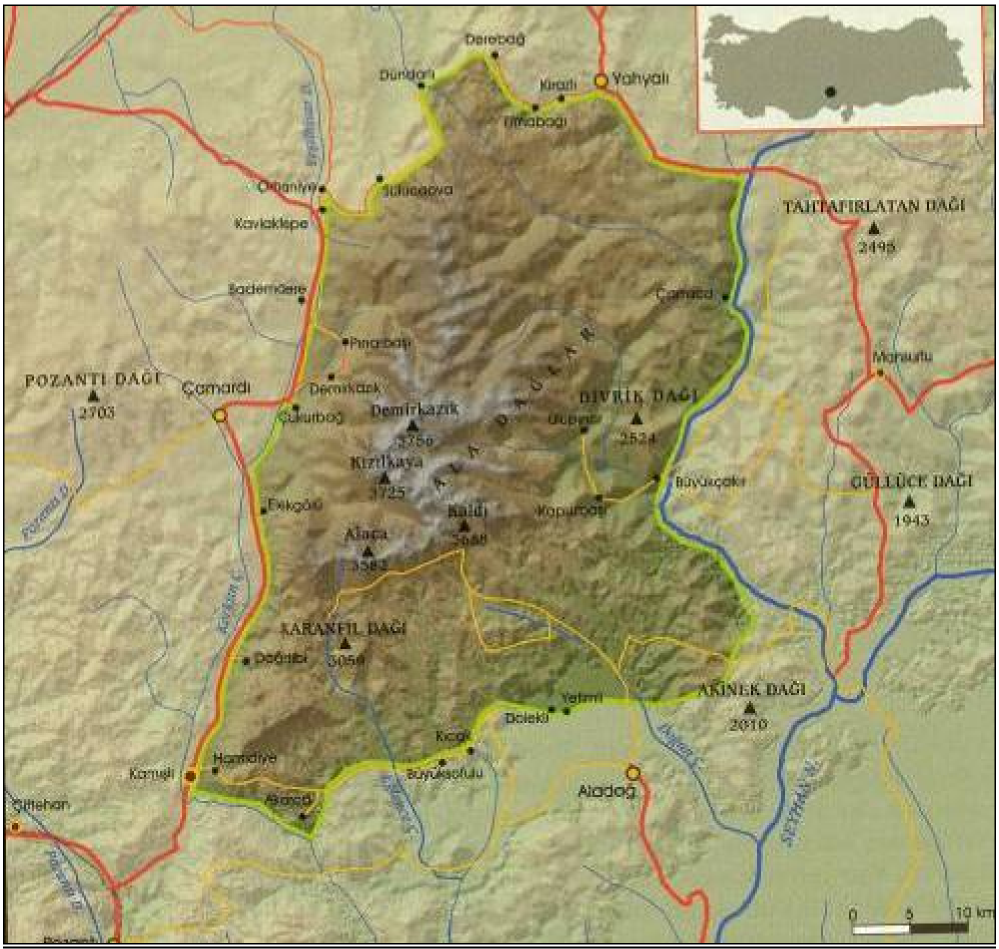
Name	End/NonEnd	IUCN Threat
E. schottiana	END	K
Ferulagopachyloba	END	R
Festuca cataonica	END	R
Fritillaria aurea	END	R
Galium membranaceum	END	R
Gentiana boissieri	END	R
Gentianellaholosteoides	END	K
Geranium lasiopus	END	K
Gnaphalium leucopilinum	END	R
Gypsophilacurvifolia	END	R
Helianthemum strickeri	END	K
Heptaptera cilicica	END	R
Heracleum pastinaca	END	R
Hesperis campicarpa	END	R
*H. matronalis*ssp. *cilicica*	END	R
Hyacinthella glabrescens	END	R
H. hispida	END	R
Hypericum crenulatum	END	R
H. kotschyanum	END	R
H. rupestre	END	R
H. vacciniifolium	END	R
Irissprengeri	END	R
Isatis callifera	END	R
I. frigida	END	R
Johrenia alpina	END	R
Kitaibelia balansae	END	R
Lamium eriocephalum ssp. *eriocephalum*	END	R
L. garganicum ssp. *nepetifolium*	END	R
Lathyrus cilicicus	END	R
*Linaria genistifolia*ssp. *polyclada*	END	R
Linum anisocalyx	END	R
L. ciliatum	END	R
L. empetrifolium	END	R
Michauxia thyrsoidea	END	R
Micromeriacilicica	END	R
Minuartia anatolica var. *scleranthoides*	END	R
M. umbellulifera ssp. *umbellulifera* var. *kurdica*	END	R
Minuartia umbellulifera ssp.*umbellulifera* var. *umbellulifera*	END	R
Omphalodesluciliae ssp. *cilicica*	END	R
Onosma angustissimum	END	R
Origanum boissieri	END	K
O. micranthum	END	R
Ornithogalum alpigenum	END	R
Pastinaca zozimioides	END	K
Phryna ortegioides	END	R
Poa speluncarum	END	R
Potentillapulvinaris ssp. *argentea*	END	R
*P. pulvinaris*ssp. *pulvinaris*	END	R
P. tauricola	END	R
Prenanthes glareosa	END	R
Reseda balansae	END	R
Rhamnus hirtellus	END	R
*Salvia aucheri*var. *aucheri*	END	R
S. cilicica	END	R
S. modesta	END	R

Name	End/NonEnd	IUCN Threat
S. quezelii	END	R
Scandix balansae	END	R
Scorzonera lacera	END	R
Scrophularialibanotica ssp. *libanotica* var. *oligantha*	END	R
Scutellaria rubicunda ssp. *pannosula*	END	R
Senecio farfarifolius	END	R
S. tauricolus	END	R
Serratula lasiocephala	END	R
Sideritis serratifolia	END	R
Silene caryophylloides	END	R
S. squamigera	END	R
Stachys annua ssp. *cilicica*	END	R
Tanacetum argenteum ssp. *flabellifolium*	END	R
Thlaspi cilicicum	END	R
T. elegans	END	R
Thymelaea cilicica	END	R
*Thymus sipyleus*ssp. *sipyleus* var. *sipyleus*	END	R
Tordyliumelegans	END	R
Trigonella cilicica	END	R
T. rhytidocarpa	END	R
T. rigida	END	R
Tripleurospermumkotschyi	END	R
Valeriana bolkarica	END	R
Verbascum chlorostegium	END	R
V. cilicicum	END	R
V. cilicium	END	R
V. linearilobum	END	R
V. lyratifolium	END	R
V. meincheanum	END	R
V. tauri	END	R
Veronica bombycina ssp.*bolkardaghensis*	END	R
V. kotschyana	END	R
V. macrostachya ssp. *sorgerae*	END	R
V. surculosa	END	R
Viola crassifolia	END	R

Table 5: List of nationally rare species (15 taxa) for Bolkar Mountain Important Plant Area

Name	IUCN Threat
Allium calyptratum	R
A. curtum	R
A. roseum	V
A. trifoliatum	R
Anthericum liliago	R
Arumdioscoridis var. *liepoldtii*	R
Colchicum stevenii	R
Eminium rauwolffii var. *kotschyi*	E
Eranthis hyemalis	V
Erica sicula ssp. *libanotica*	V
Fritillariaacmopetala ssp. *acmopetala*	R
Hyacinthus orientalis	V
Ophrys fleischmanni	R
*Ruscus aculeatus*var. *angustifolius*	V
Scilla cilicica	R

75 Aladağlar IPA



Map 13: Aladağlar Important Plant Area (Özhatay *et al.* 2003)

Criteria for IPA Designation:

A1: 1 globally threatened Species

A2: 65 regionally (European) threatened species

C2: Site containing threatened habitats - *42.66431*, *42.85B13*, *42.85B1*, *42.B12*

Other Important Features:

- Other nationally important species: 68
- Total endemic taxa: 101 (of which 20 endemic to this specific IPA)
- Number of threatened taxa: 65
- Critical Species: A globally threatened species *Ferula longipedunculata.*

Habitats:

Serpentine and ophiolite rocks have taken karstic formations. There are deep glacial canyons, steep rocks, scree and glacial lakes and the associated rare flora. While steppe habitat dominates the Northern alpine zone of the IPA, Mediterranean maquis and Pine and Cedar forest habitats prevail in the South Eastern parts.

Table 6: List of regionally threatened species (64 species) for Aladağlar Important Plant Area

Name	End/NonEnd	IUCN Threat
Achillea goniocephala	END	R
A. spinulifolia	END	R
Alchemilla rivularis	END	K
Alyssum argyrophyllum	END	R
A.aurantiacum	END	R
A.caespitosum	END	R
A.trapeziforme	END	R
Arabis androsaceae	END	R
Asphodeline damascena ssp. *rugosa*	END	R
A.prismatocarpa	END	R
Astragalus chrysochlorus	END	R
A.stridii	END	R
Ballota macrodonta	END	R
Campanulatrachyphylla	END	R
Centaurea aladaghensis	END	K
C. antitauri	END	R
C. chrysantha	END	R
C. kotschyi var. *decumbens*	END	R
Cirisumellenbergii	END	R
Cousinia cirsioides	END	R
Delphinium cilicicum	END	R
D.nydeggeri	END	R
Dianthus goerkii	END	R
Draba acaulis	END	R
Ebenus cappadocica	END	R
E. laguroides var. *cilicica*	END	R
Erodiumcedrorum ssp. *cedrorum*	END	R
E. cedrorum var. *salmoneum*	END	R
Euphorbia petrophila var.*armena*	END	R
Ferula lycia	END	R
Ferulagopachyloba	END	R
Galium aladaghense	END	n/l
Gnaphalium leucopilinum	END	R
Hesperiscampicarpa	END	R
Hieracium argaeum	END	R
Hypericum crenulatum	END	R
Isatis frigida	END	R
Lamium eriocephalum ssp. *eriocephalum*	END	R
L.garganicum ssp. *pulchrum*	END	R
Minuartia dianthifolia ssp. *cataonica*	END	R
Nepetaaristata	END	R
Omphalodes luciliae ssp. *cilicica*	END	R
Onobrychis sulphurea var. *sulphurea*	END	R
Ononis sessilifolia	END	R
Onosma cappadocicum	END	R
Paracaryum reuteri	END	R
Potentilla aladaghensis	END	R
P.pulvinaris ssp. *argentea*	END	R
Salvia eriophora	END	R
Scorzonera violacea	END	R
Scrophularia scopolii var. *parryi*	END	R
Senecio tauricolus	END	R
Sideritis phlomoides	END	R

Name	End/NonE nd	IUCN Threat
Thesiumcilicicum	END	R
Thlaspi crassum	END	R
T.rosulare	END	R
Thurya capitata	END	R
Thymelaea cilicica	END	R
Trigonella rhytidocarpa	END	R
Valeriana bolkarica	END	R
Verbascumadenocaulon	END	K
Veronica kotschyana	END	R
V. tauricola	END	R
Viola crassifolia	END	R

Table 7: List of nationally rare species (2 species) for Aladağlar Important Plant Area

Name	IUCN Threat
Artemisia caucasica	n/l
Campanula fastigiata	K

76 Seyhan Delta IPA

Map 14: Seyhan Delta Important Plant Area (Özhatay *et al.* 2003)

Criteria for IPA Designation:

A1: 8 globally threatened Species (including 6 species listed in Appendix I of Bern Convention)

A2: 15 regionally (European) threatened species (including 1 specie listed in Appendix I of Bern Convention)

B: Site containing high number of species within a range of defined habitat types – 15, 16, 21, 53

C2: Site containing threatened habitats – *15.51, 15.8, 16.2112, 16.2122, 16.224*, 16.227, 21

Other Important Features:

- Other nationally important species: 59
- Local endemic taxa: 9

- Number of threatened taxa: 82 (21 endemic)

Habitats:

Dry and humid habitats and their associated vegetation alternate. The vegetation cover of the IPA spans over four major habitat types which are the sandy dunes, salty planes, brackish lagoons and freshwater marshes.

Table 8: List of globally threatened species (8 taxa) for Seyhan Delta Important Plant Area

Name	End/NonEnd	IUCN Threat
Alkanna pinardii	END	V
*Alopecurus myosuroides*var. *latialatus*	END	V
Anthemis halophila	END	V
Bellevalia modesta	END	V
Beta adanensis		V
Bromus psammophilus	END	E
Silenepompeiopolitana	END	E
Trigonella halophila	END	V

Table 9: List of regionally threatened species (15 taxa) for Seyhan Delta Important Plant Area

Name	End/NonEnd	IUCN Threat
Allium gayi	END	R
Astragalus suberosus ssp. *mersinensis*	END	K
Bupleurum polyactis	END	R
B. zoharii	END	R
Centaurea calcitrapa ssp. *cilicica*	END	R
C. solstitialis ssp. *carneola*	END	R
Cephalaria cilicica	END	K
Glycyrrhiza flavescens	END	R
Heptaptera cilicica	END	R
Hypericumpolyphyllum ssp. *polyphyllum*	END	R
Linum anisocalyx	END	R
Rhamnus hirtellus	END	R
Stachys annua ssp. *cilicica*	END	R
Trigonella raphaniniana	END	K
Typha minima var. *gracilis*	n/l]	

Table 10: List of nationally rare species (59 taxa) for Seyhan Delta Important Plant Area

Name	IUCN Threat
Aegilops kotschyi	V
Alhagi mannifera	K
Altheniafiliformis	V
Ambrosia maritima	V
Ammochloa palaestina	V
Argyrolobium uniflorum	E
Arthrocnemumglaucum	R
Arum dioscoridis var. *liepoldtii*	R
Astragalus epiglottis ssp. *epiglottis*	K
Atriplextornabeni	V
Avena clauda	I
Bassia hirsuta	E
Bromus alopecurus ssp. *caroli-henrici*	K

Name	IUCN Threat
Bromuschrysopogon	V
Bupleurum lancifolium	R
Capnophyllumperegrinum	E
Catapodium rigidum var.*hemipoa*	V
Chenopodium urbicum	R
Citrullus colocynthis	E
Consolida scleroclada ssp. *scleroclada*	I
Crepis aspera	R
Cutandia dichotoma	V
Cutandiamemphitica	V
Cyprina gracilis	R
Damasoniumalisma	R
Daucus littoralis	V
Eclipta prostrata	V
Elatine macropoda	I
Euphorbia arguta	R
E. villosa	V
Evax eriosphaera	R
Factorovskyaaschersoniana	R
Fuirena pubescens	R
Galiumghilanicum	R
Hedysarum spinosissimum	R
Helianthemumstipulatum	V
Hippocrepis bisiliqua var.*bisiliqua*	K
Hippocrepis multisiliquosa	R
Iflagospicata	E
Lathyrus palustris ssp. *palustris*	R
Lavateratrimestris	V
Medicago rotata var. *rotata*	R
Melilotus elegans	R
Onobrychis crista-galli	V
Ononis serrata	R
Pancratium maritimum	V
Ranunculusscandicinus	R
Salsola kali	R
Scandixturgida	R
Sium latifolium	n/l
Stachys obscura	R
Tamarix tetragyna	n/l
Teucrium spinosum	R
Trifolium latinum	R
Trigonella cylindracea	R
Triplanche nitens	V
Withania somnifera	E
Ziziphuslotus	R
Zygophyllum album	E

4.2.2. Important Bird Areas

The Important Bird Areas is one of the most important tools developed by BirdLife International to protect bird diversity globally. By 2004, over 7500 sites in 170 countries have been identified as Important Bird Areas. Important Bird Areas (IBAs) has to have one of following features;

- Hold significant numbers of one or more globally threatened species

- Are one of a set of sites that together hold a suite of restricted-range species or biome-restricted species
- Have exceptionally large numbers of migratory or congregatory species

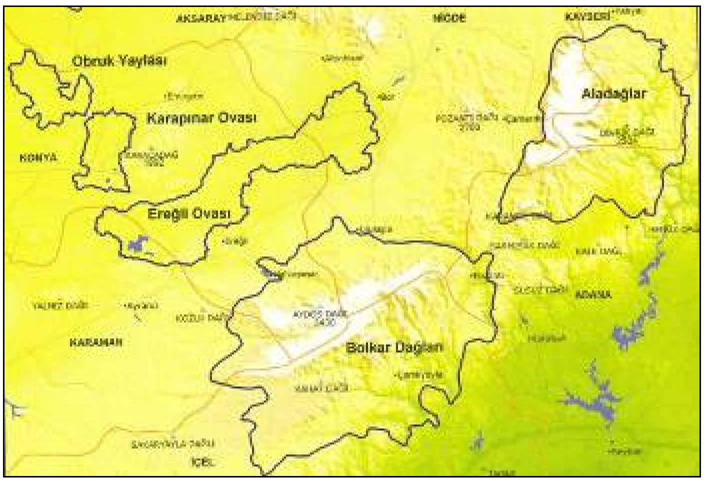
Global IBA Criteria are as follows:
A1. Globally threatened species: The site qualifies if it is known, estimated or thought to hold a population of a species categorized by the IUCN Red List as Critically Endangered, Endangered or Vulnerable.
A2. Restricted-range species: The site forms one of a set selected to ensure that, as far as possible, all restricted-range species of an EBA or SA are present in significant numbers in at least one site and, preferably, more.
A3. Biome-restricted species: The site forms one of a set selected to ensure, as far as possible, adequate representation of all species restricted to a given biome, both across the biome as a whole and, as necessary, for its entire species in each range state.
A4. Congregations: There are various features to fulfil these criteria such as; waterbird species, seabird species, wetlands of international importance, sites for migratory species at bottleneck etc.

The first IBA study in Turkey was conducted in 1989 by Ertan et al. This preliminary study was renewed in 1997 by Yarar and Magnin by Turkish Society for the Conservation of Nature (DHKD). The most recent version is published in 2004 by Doğa Derneği (Kılıç and Eken 2004).

There are three IBAs in Seyhan Basin:

Name	Code
Bolkar Mountains	AKD 049 / TR 076
Aladağlar	AKD053 / TR075 Aladağlar IBA
Seyhan Delta	AKD051 / TR077 Seyhan Delta IBA

AKD049 / TR076 Bolkar Dağları IBA



Map 15: Bolkar Mountain and Aladağlar Important Bird Areas (Kılıç and Eken 2004)

The Eastern half of the Bolkar IBA falls in the Seyhan Basin.

Criteria for IBA Designation:

A3: 14 species with a significant assemblage whose breeding distributions are largely or wholly confined to one biome (Of which 2 species also fulfil B2 criterion).

B2: 6 species that fulfil the criteria for this IBA to become one of the most important sites in the country in which the 6 species have an unfavourable conservation status in Europe (SPEC 2, 3) and for which the site-protection approach is thought to be appropriate.

Other Important Features:

This site is one of the few sites in Turkey that fulfil the A3 criterion for both the Mediterranean and the alpine biomes.

Habitats:

In addition to what was described for the Bolkar IPA, a habitat that is important for this IBA is the deep canyons harbour a humid micro-climate. This habitat can therefore host a number of semi-tropical species not seen elsewhere in Turkey.

Table 11: List of important bird species for Bolkar Mountain Important Bird Area

Latin Name	**English Name**	**IUCN Red List Status**	**Criteria for this IBA**
Gypaetus barbatus	Lammergeier	LC	B2
Gyps fulvus	Griffon Vulture	LC	B2
Aquila chrysaetos	Golden Eagle	LC	B2
Falco biarmicus	Lanner Falcon	LC	B2
Tetraogallus caspius	Caspian Snowcock	LC	A3, B2
Prunella ocularis	Radde’s Accentor	LC	A3, B2
Oenanthe hispanica	Black-eared Wheatear	LC	A3
Hippolais olivetorum	Olive-tree Warbler	LC	A3
Sylvia melanocephala	Sardinian Warbler	LC	A3
Sylvia rueppelli	Ruppell's Warbler	LC	A3
Sitta krueperi	Krüper's Nuthatch	NT	A3
Tichodroma muraria	Wallcreeper	LC	A3
Lanius nubicus	Masked Shrike	LC	A3
Pyrrhocorax graculus	Yellow-bellied Chough	LC	A3
Montifringilla nivalis	Snowfinch	LC	A3
Serinus pusillus	Red-fronted Serin	LC	A3
Emberiza caesia	Cretzschmar's Bunting	LC	A3

AKD051 / TR077 Seyhan Delta IBA

Map 16: Seyhan Delta Important Bird Area (Kılıç and Eken 2004)

Criteria for IBA Designation:

A1: The site holds 4 species of global conservation concern

A4i: The site holds on a regular basis, ≥ 1% of the global population of 12 species of a congregatory seabird or terrestrial species

A4iii: The site holds, on a regular basis, ≥ 20,000 waterbirds or ≥ 10,000 pairs of seabird of one or more species

B1i: The site is holds ≥ 1% of a flyway or other distinct population of 17 species of waterbirds

B1iv: The site is a 'bottleneck' site where over 5,000 storks regularly pass on spring or autumn migration

B2: 8 species that fulfil the criteria for this IBA to become one of the most important sites in the country in which the 8 species have an unfavourable conservation status in Europe (SPEC 2, 3) and for which the site-protection approach is thought to be appropriate.

Other Important Features:

The Akyatan Lake situated in this IBA is a declared Ramsar Site

Habitats:

In addition to what was described for the Bolkar IPA, other habitats important for this IBA are the agricultural lands and the sea.

Table 12: List of important bird species for Seyhan Delta Important Bird Area

Latin Name	English Name	IUCN Red List Status	Criteria for this IBA
Phalacrocorax pygmeus	Pygmy Cormorant	LC	A1
Casmerodius albus	Great Egret	LC	A4i, B1i

Latin Name	English Name	IUCN Red List Status	Criteria for this IBA
Ciconia ciconia	White Stork	LC	B1iv
Phoenicopterus ruber	Greater Flamingo	LC	A4i, B1i
Anser anser	Greylag Goose	LC	B1i
Tadorna tadorna	Common Shelduck	LC	B1i
Anas penelope	Eurasian Wigeon	LC	B1i
Anas crecca	Common Teal	LC	B1i
Marmaronetta angustirostris	Marbled Duck	VU	A1, A4i, B1i, B2
Aythya ferina	Common Pochard	LC	A4i, B1i
Oxyura leucocephala	White-headed Duck	EN	A1, A4i, B1i,
Porphyrio porphyrio	Purple Swamphen	LC	B2
Fulica atra	Common Coot	LC	A4i, B1i
Grus grus	Common Crane	LC	B1i
Himantopus himantopus	Black-winged Stilt	LC	B1i
Recurvirostra avosetta	Pied Avocet	LC	A4i, B1i
Burhinus oedicnemus	Stone-curlew	LC	B2
Glareola pratincola	Collared Pratincole	LC	A4i, B1i, B2
Charadrius alexandrinus	Kentish Plover	LC	A4i, B1i, B2
Vanellus spinosus	Spur-winged Lapwing	LC	A4i, B1i, B2
Calidris minuta	Little Stint	LC	A4i, B1i
Sterna albifrons	Little Tern	LC	A4i, B2
Halcyon smyrnensis	Smyrna Kingfisher	LC	B2

AKD053 / TR075 Aladağlar IBA

Criteria for IBA Designation:

A3: 7 species with a significant assemblage whose breeding distributions are largely or wholly confined to one biome (Of which 2 species also fulfil B2 criterion)

B2: 4 species that fulfil the criteria for this IBA to become one of the most important sites in the country in which the 4 species have an unfavourable conservation status in Europe (SPEC 2, 3) and for which the site-protection approach is thought to be appropriate.

Habitats:

As described in the IPA section.

Table 13: List of important bird species for Aladağlar Mountain Important Bird Area

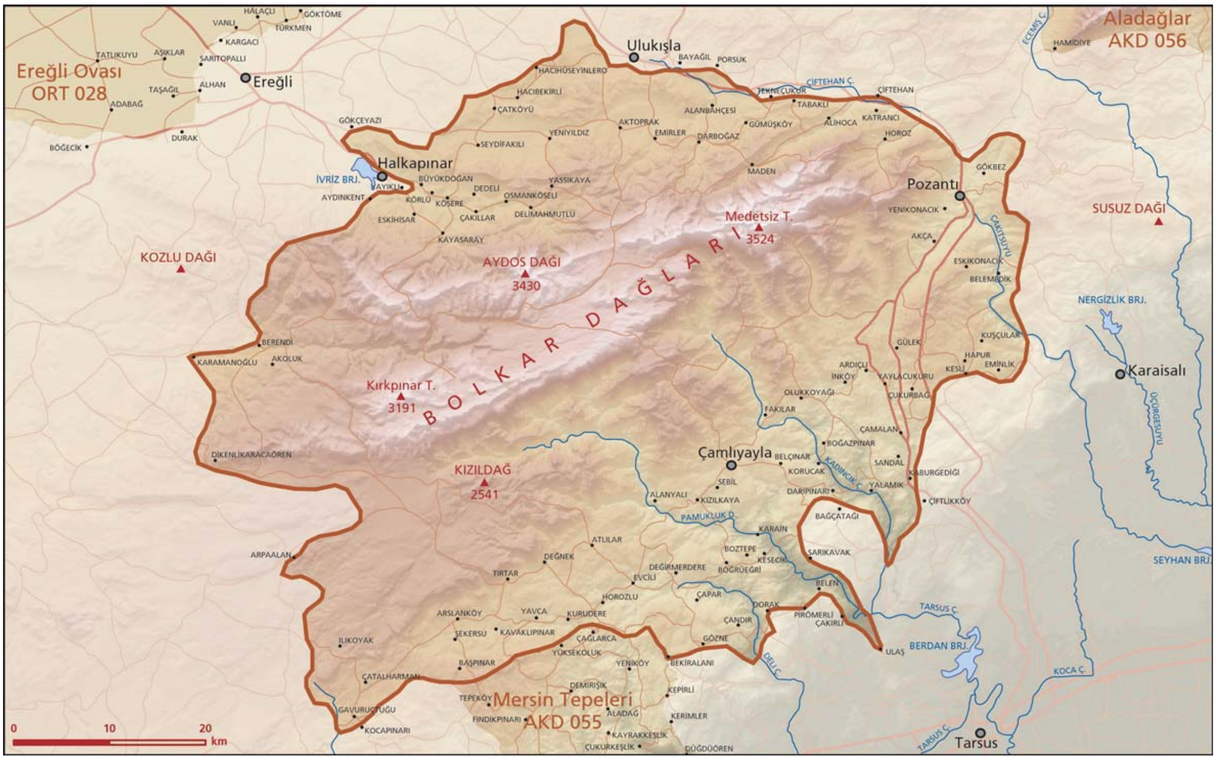
Latin Name	English Name	IUCN Red List Status	Criteria for this IBA
Gypaetus barbatus	Lammergeier	LC	B2
Gyps fulvus	Griffon Vulture	LC	B2
Tetraogallus caspius	Caspian Snowcock	LC	A3, B2
Prunella ocularis	Radde's Accentor	LC	A3, B2
Prunella collaris	Alpine Accentor	LC	A3
Tichodroma muraria	Wallcreeper	LC	A3
Pyrrhocorax graculus	Yellow-bellied Chough	LC	A3
Montifringilla nivalis	Snowfinch	LC	A3
Serinus pusillus	Red-fronted Serin	LC	A3

4.2.3. Key Biodiversity Areas

The KBA approach was developed by a consortium of nature conservation organizations around the world. KBAs are areas of international importance and are selected by using criteria such as vulnerability and irreplaceability. KBAs selected for the vulnerability criterion contain significant populations of threatened species. Those selected for the irreplaceability criterion consist of sites that are important for restricted range, congregatory and biome restricted species (Eken *et al.* 2006).

There are three KBAs in Seyhan Basin; Bolkar Mountains, Aladağlar, Seyhan Delta.

Bolkar Dağları



Map 17: Bolkar Mountain Key Biodiversity Area (Eken *et al.* 2006)

<u>Criteria for KBA Designation:</u>
A1: 95 species that are threatened either globally, regionally or nationally

A2: 153 species that have a total home range of 50.000 km2 or less around the globe

A4: the site is home to at least 5% of the global population of 6 species that are endemic to the biomes in this KBA

B1: the site is home to 31 subspecies or subpopulations that are regionally threatened

B2: 26 subspecies whose home range is less than 20.000 km2 or whose local populations have been separated from the main populations

B3: The major part of 1 specie's global population is concentrated in the site

C1: important site for 49 species threatened in the EU

Note: Only the North East quarter of the Bolkar KBA falls in the Seyhan Basin.

The KBA hosts around 300 national endemic plants, of which about 10 are local endemic.

The area is also important for birds, mainly for raptors. Some important species are lanner falcon (*Falco biarmicus*), lammergeier (*Gypaetos barbatus*), Egyptian vulture (*Neophron percnopterus*), black kite (*Milvus migrans*) and caspian snowcock (*Tetragallus caspius*).

Important wildlife for the area is wild goat (*Capra aegagrus*), lynx (*Lynx lynx*), woolly dormouse (*Dryomys laniger*) and three different bat species. A local endemic, the Taurus Frog (*Rana holtzi*) only lives in the glacial depression lakes in the Bolkar KBA. Bolkar KBA is also important for butterflies and dragonflies as two national endemic butterflies are found in the KBA.

Ecosystem Use:

Main human activities in the Bolkars are forestry and animal husbandry. The Bolkars are one of the rare locations that still support the Mediterranean nomadic lifestyle.

Threats:

Construction of dams as it will alter natural water regimes,

Over grazing

Illegal forest cutting

The important species found in the Bolkar KBA are presented in Table 14-20.

Table 14: List of important plant species for Bolkar Mountain Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Achillea kotschyi ssp. canescens	Yes	No	_	LC	B2
Achillea monocephala	Yes	No	_	EN	A1, A2
Achillea spinulifolia	Yes	No	_	CD	A2
Aethionema demirizii	Yes	No	_	EN	A1, A2
Aethionema glaucescens	Yes	No	_	_	A2
Aethionema huber-morathii	Yes	No	_	CD	A2
Aethionema schistosum	Yes	No	_	NT	A2
Ajuga postii	Yes	No	_	VU	A1, A2
Ajuga postii	Yes	No	_	VU	A1, A2
Alchemilla paracompactilis	Yes	No	_	DD	A2
Alkanna aucherana	Yes	No	_	LC	A2
Alkanna pinardii	Yes	No	_	EN	A1, A2
Allium alpinarii	Yes	No	_	VU	A1, A2
Allium deciduum ssp. retrorsum	Yes	No	_	VU	B1, B2
Allium gayi	Yes	No	_	NT	A2
Alyssum cilicicum	Yes	No	_	VU	A1
Anthemis adonidifolia	Yes	No	_	CR	A1, A2
Anthemis fimbriata	Yes	No	_	VU	A1, A2

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Anthemis oxylepis	Yes	No	_	VU	A1, A2
Anthemis oxylepis	Yes	No	_	VU	A1, A2
Anthyllis vulneraria ssp. variegata	Yes	No	_	LC	B2
Aristolochia cilicica	Yes	No	_	CD	A2
Asperula cilicica	Yes	No	_	CR	A1, A2
Asperula stricta ssp. grandiflora	Yes	No	_	NT	B2
Asplenium reuteri	Yes	No	_	_	A2
Astragalus aydosensis	Yes	No	_	VU	A1, A2
Astragalus aydosensis	Yes	No	_	VU	A1, A2
Astragalus goeznensis	Yes	Yes	_	EN	A1, A2
Astragalus nigrifructus	Yes	No	_	VU	A1, A2
Astragalus pineticola	Yes	No	_	VU	A1, A2
Astragalus schottianus	Yes	No	_	NT	A2
Astragalus stenosemioides	Yes	No	_	EN	A1, A2
Astragalus suberosus ssp. mersinensis	Yes	No	_	VU	B1, B2
Brachypodium kotschyi	Yes	No	_	VU	A1
Bupleurum pauciradiatum	Yes	No	_	VU	A1, A2
Bupleurum pauciradiatum	Yes	No	_	VU	A1, A2
Campanula axillaris	Yes	No	_	VU	A1, A2
Campanula axillaris	Yes	No	_	VU	A1, A2
Campanula bluemelii	Yes	Yes	_	EN	A1, A2
Campanula psilostachya	Yes	No	_	NT	A2
Centaurea amanicola	Yes	No	_	VU	A1, A2
Centaurea anthemifolia	Yes	No	_	EN	A1, A2
Centaurea calcitrapa ssp. cilicica	Yes	No	_	CD	B2
Centaurea chrysantha	Yes	No	_	EN	A1, A2
Centaurea sieheana	Yes	No	_	VU	A1, A2
Centaurea solstitialis ssp. carneola	Yes	No	_	NT	B2
Chamaecytisus drepanolobus	Yes	No	_	NT	A2
Colchicum balansae	Yes	No	_	LC	A2
Consolida cruciata	Yes	No	_	VU	A1, A2
Cousinia ermenekensis	Yes	No	_	NT	A2
Crocus cancellatus ssp. cancellatus	Yes	No	_	LC	B2
Crocus paschei	Yes	No	_	EN	A1, A2
Crocus reticulatus ssp. hittiticus	Yes	No	_	VU	B1, B2
Crocus sieheanus	Yes	No	_	VU	A1, A2
Cyclamen cilicium	Yes	No	_	NT	A2
Cyclamen pseud-ibericum	Yes	No	_	EN	A1, A2
Cynoglottis chetikiana ssp. chetikiana	Yes	No	_	VU	B1
Cyprinia gracilis	No	No	_	EN	A2, B1
Dianthus nihatii	Yes	No	_	CR	A1, A2
Draba acaulis	Yes	No	_	VU	A1, A2
Draba acaulis	Yes	No	_	VU	A1, A2
Draba elegans	Yes	Yes	_	CR	A1, A2
Ebenus cappadocica	Yes	No	_	NT	A2
Ebenus longipes	Yes	No	_	CD	A2
Echinophora carvifolia	Yes	No	_	NT	A2
Echinops mersinensis	Yes	No	_	CR	A1, A2
Erodium leucanthum	Yes	No	_	EN	A1, A2
Erodium micropetalum	Yes	No	_	NT	A2
Euphorbia rhytidosperma	Yes	No	_	VU	A1, A2
Euphorbia rhytidosperma	Yes	No	_	VU	A1, A2
Euphorbia schottiana	Yes	No	_	DD	A2
Euphorbia thompsonii	No	No	_	VU	A2, B1
Ferulago pachyloba	Yes	No	_	VU	A1, A2
Festuca cataonica	Yes	No	_	CD	A2
Flueggea anatolica	Yes	Yes	EN	CR	A1, A2

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Fritillaria aurea	Yes	No	_	LC	A2
Galanthus nivalis ssp. cilicicus	No	No	_	EN	B1, B2
Galium membranaceum	Yes	No	_	DD	A2
Gentiana boissieri	Yes	No	_	VU	A1, A2
Gentiana boissieri	Yes	No	_	VU	A1, A2
Gentianella holosteoides	Yes	No	_	DD	A2
Geranium lasiopus	Yes	No	_	VU	A1, A2
Gnaphalium leucopil	Yes	No	_	NT	A2
Helichrysum peshmenianum	Yes	Yes	_	EN	A1, A2
Heptaptera cilicica	Yes	No	_	EN	A1, A2
Heracleum pastinaca	Yes	No	_	CD	A2
Hesperis campicarpa	Yes	No	_	CD	A2
Hesperis kotschyi	Yes	No	_	VU	A1
Hesperis matronalis ssp. cilicica	Yes	No	_	NT	B2
Hyacinthella glabrescens	Yes	No	_	CD	A2
Hyacinthella hispida	Yes	No	_	VU	A1, A2
Hyacinthella lazulina	Yes	No	_	EN	A1, A2
Hypericum crenulatum	Yes	No	_	CD	A2
Hypericum havvae	Yes	No	_	_	A2
Hypericum kotschyanum	Yes	No	_	NT	A2
Hypericum rupestre	Yes	Yes	_	EN	A1, A2
Hypericum vacciniifolium	Yes	No	_	VU	A1, A2
Iris junonia	Yes	No	_	CD	A2
Iris sprengeri	Yes	No	_	VU	A1, A2
Isatis callifera	Yes	No	_	VU	A1, A2
Isatis frigida	Yes	No	_	VU	A1, A2
Isatis frigida	Yes	No	_	VU	A1, A2
Johrenia alpina	Yes	No	_	CD	A2
Kitaibelia balansae	Yes	No	_	EN	A1, A2
Lamium eriocephalum ssp. eriocephalum	Yes	No	_	CD	B2
Lathyrus cilicicus	Yes	No	_	VU	A1, A2
Limonium tamaricoides	Yes	No	_	EN	A1, A2
Linaria genistifolia ssp. polyclada	Yes	No	_	NT	B2
Linum anisocalyx	Yes	No	_	EN	A1, A2
Linum ciliatum	Yes	No	_	DD	A2
Linum empetrifolium	Yes	No	_	DD	A2
Micromeria cilicica	Yes	Yes	_	EN	A1, A2
Myosotis diminuta - Anatolia	No	No	_	EN	B1
Myosotis ramosissima ssp. uncata	Yes	No	_	EN	B1
Omphalodes luciliae ssp. cilicica	Yes	No	_	NT	B2
Onobrychis beata	Yes	No	_	VU	A1, A2
Onosma papillosum	Yes	No	_	EN	A1, A2
Ophrys cilicica	Yes	No	_	LC	A2
Ophrys iceliensis	Yes	No	_	_	A2
Origanum boissieri	Yes	Yes	_	CR	A1, A2
Origanum micranthum	Yes	No	_	VU	A1, A2
Papaver arachnoideum	Yes	No	_	EN	A1, A2
Pastinaca zozimioides	Yes	No	_	DD	A2
Poa speluncarum	Yes	No	_	EN	A1, A2
Polygala inexpectata	Yes	No	_	EN	A1, A2
Potentilla pulvinaris ssp. argentea	Yes	No	_	VU	B1, B2
Potentilla pulvinaris ssp. pulvinaris	Yes	No	_	EN	B1, B2
Potentilla tauricola	Yes	No	_	VU	A1, A2
Prenanthes glareosa	Yes	No	_	VU	A1, A2
Prenanthes glareosa	Yes	No	_	VU	A1, A2
Prenanthes glareosa	Yes	No	_	VU	A1, A2
Reseda balansae	Yes	No	_	EN	A1, A2
Rosularia tauricola	Yes	No	_	EN	A1, A2

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Salvia cilicica	Yes	No	_	VU	A1, A2
Salvia modesta	Yes	No	_	VU	A1
Salvia quezelii	Yes	No	_	EN	A1, A2
Scandix balansae	Yes	No	_	VU	A1, A2
Scandix balansae	Yes	No	_	VU	A1, A2
Scilla cilicica	No	No	_	VU	A2, B1
Scorzonera lacera	Yes	No	_	NT	A2
Scutellaria rubincunda ssp. pannosula	Yes	No	_	CR	B1, B2
Sedum ince	Yes	No	_	_	A2
Senecio farfarifolius	Yes	No	_	LC	A2
Senecio tauricolus	Yes	No	_	LC	A2
Serratula lasiocephala	Yes	No	_	CD	A2
Sideritis serratifolia	Yes	No	_	VU	A1, A2
Silene fenzlii	Yes	Yes	_	EN	A1, A2
Silene pompeipolitana	Yes	No	_	VU	A1, A2
Silene squamigera	Yes	No	_	_	A2
Tanacetum argenteum ssp. flabellifolium	Yes	No	_	CD	B2
Thlaspi cilicicum	Yes	No	_	CD	A2
Thlaspi elegans	Yes	No	_	VU	A1, A2
Thurya capitata	Yes	No	_	VU	A1, A2
Thymelaea cilicica	Yes	No	_	LC	A2
Tordylium elegans	Yes	No	_	NT	A2
Tordylium pustulosum	Yes	No	_	NT	A2
Trigonella cilicica	Yes	Yes	_	EN	A1, A2
Trigonella cilicica	Yes	Yes	_	EN	A1, A2
Trigonella plicata	Yes	No	_	VU	A1, A2
Trigonella rhytidocarpa	Yes	No	_	NT	A2
Trigonella rigida	Yes	No	_	CD	A2
Triplerospermum kotschyi	Yes	No	_	CD	A2
Valeriana bolkarica	Yes	No	_	VU	A1, A2
Verbascum chlorostegium	Yes	No	_	VU	A1, A2
Verbascum cilicicum	Yes	No	_	VU	A1, A2
Verbascum cilicium	Yes	No	_	VU	A1, A2
Verbascum linearilobum	Yes	No	_	EN	A1, A2
Verbascum lyratifolium	Yes	No	_	CD	A2
Verbascum meincheanum	Yes	No	_	CD	A2
Verbascum tauri	Yes	No	_	CD	A2
Veronica bombycina ssp. bolkardaghensis	Yes	No	_	NT	B2
Veronica kotschyana	Yes	No	_	NT	A2
Veronica macrostachya ssp. sorgerae	Yes	No	_	VU	B1, B2
Veronica surculosa	Yes	No	_	DD	A2

Table 15: List of important bird species for Bolkar Mountain Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Aegolius funereus	No	No	LC	LC	C1
Aquila chrysaetos	No	No	LC	LC	C1
Bubo bubo	No	No	LC	LC	C1
Buteo rufinus	No	No	LC	(NT)	C1
Caprimulgus europaeus	No	No	LC	LC	C1
Circaetus gallicus - Europe	No	No	LC	LC	C1
Dendrocopos medius	No	No	LC	LC	C1
Dendrocopos syriacus	No	No	LC	LC	C1

Emberiza caesia	No	No	LC	LC	C1
Emberiza hortulana	No	No	LC	LC	C1
Falco biarmicus - Europe ve Anatolia	No	No	LC	VU	B1, C1
Falco peregrinus	No	No	LC	LC	C1
Gypaetus barbatus - Mediterranean and Anatolia	No	No	LC	VU	B1, C1
Gyps fulvus	No	No	LC	LC	C1
Lanius collurio	No	No	LC	LC	C1
Lanius minor	No	No	LC	LC	C1
Lanius nubicus	No	No	LC	LC	C1
Lullula arborea	No	No	LC	LC	C1
Milvus migrans - Europe	No	No	LC	VU	B1, C1
Neophron percnopterus - Europe	No	No	LC	EN	B1, C1
Pyrrhocorax pyrrhocorax	No	No	LC	LC	C1
Sitta krueperi	No	No	NT	(NT)	C1
Sylvia rueppelli	No	No	LC	LC	C1
Tetraogallus caspius - Anatolia and Caucasus	No	No	LC	VU	B1, C1

Table 16: List of important large mammal species for Bolkar Mountain Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Capra aegagrus	No	No	VU	_	A1, C1
Chionomys nivalis – Mid Tauruses	No	No	NT	LC	B2, C1
Crocidura arispa	Yes	No	_	LC	A2, A4, C1
Dryomys laniger	Yes	No	NT	LC	A2, A4, C1
Dryomys laniger - Bolkar Mountains	Yes	No	NT	LC	B2, C1
Lynx lynx	No	No	NT	_	C1
Plecotus macrobullaris macrobullaris	No	No	_	NT	B3, C1
Rhinolophus ferrumequinum	No	No	NT	NT	C1
Rhinolophus hipposideros	No	No	LC	NT	C1

Table 17: List of important amphibian species for Bolkar Mountain Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Rana holtzi	Yes	Yes	CR	LC	A1, A2, A4, C1
Salamandra infraimmaculata – Eastern Taurus	No	No	LC	NT	B2, C1

Table 18: List of important reptile species for Bolkar Mountain Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Coronella austriaca - Bolkar Mountains	No	No	_	LC	B2, C1
Eirenis aurolineatus	Yes	No	_	LC	A2, A4, C1
Lacerta danfordi	Yes	No	_	LC	A2, A4, C1
Montivipera xanthina - Bolkar Mountains	No	No	CR	(CR)	B1, B2, C1

Table 19: List of important butterfly species for Bolkar Mountain Key Biodiversity Area

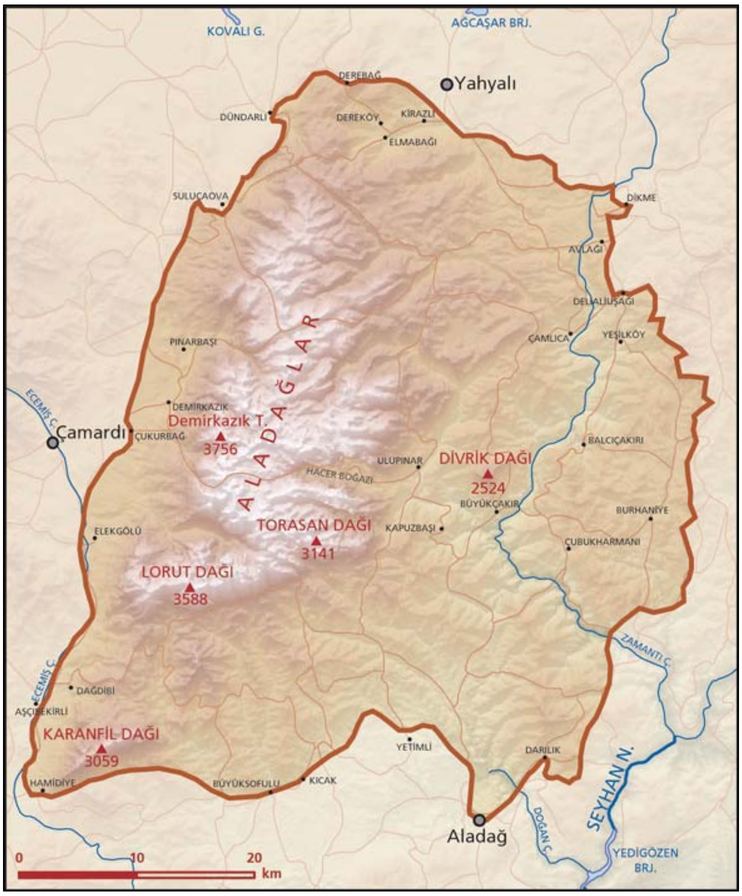
Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Anthocharis damone - Anatolia	No	No	_	VU	B1
Archon apollinus - Anatolia	No	No	_	EN	B1, C1
Glaucopsyche alexis - Anatolia	No	No	_	VU	B1
Melanargia titea - Eastern Mediterranean	No	No	_	EN	B1, C1
Muschampia proteides - Anatolia	No	No	_	EN	B1, C1
Nymphalis xanthomelas - Anatolia	No	No	_	VU	B1

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Polyommatus eros molleti	Yes	No	_	_	B2, C1
Polyommatus poseidon - Anatolia	No	No	_	EN	B1, C1
Pseudophilotes bavius - Anatolia	No	No	_	EN	B1, C1
Pseudophilotes vicrama - Anatolia	No	No	_	VU	B1
Pyrgus bolkariensis	Yes	No	_	_	A2, A4, C1
Thymelicus acteon - Anatolia	No	No	_	VU	B1
Tomares nogelli - Anatolia	No	No	_	EN	B1, C1

Table 20: List of important dragonfly species for Bolkar Mountain Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Coenagrion ornatum	No	No	_	_	C1
Onychogomphus assimilis	No	No	VU	VU	A1, C1

Aladağlar



Map 18: Aladağlar Key Biodiversity Area (Eken *et al.* 2006)

<u>Criteria for KBA Designation:</u>

A1: 38 species that are threatened either globally, regionally or nationally

A2: 53 species that have a total home range of 50.000 km2 or less around the globe

A4: the site is home to at least 5% of the global population of 2 species that are endemic to the biomes in this KBA

B1: the site is home to 16 subspecies or subpopulations that are regionally threatened
B2: 10 subspecies whose home range is less than 20.000 km2 or whose local populations have been separated from the main populations
C1: important site for 29 species threatened in the EU

A total of 57 plant taxa fulfil the KBA criteria. Local endemic plants only found in the Aladağlar are *Alchemilla ricularis, Astragalus stridii, Delphinium nydeggeri, Dianthus goerkii, Galium aladaghense, Hedysarum antitauricum, Potentilla aladaghensis, Thlaspi crassum* and *Veronica tauricola*.
The area is also important for birds such as golden eagle (*Aquila chrysaetos*), peregrine falcon (*Falco peregrinus*), lammergeier (*Gypaetus barbatus*), griffon vulture (*Gyps fulvus*), booted eagle (*Hieraaetus pennatus*), Egyptian vulture (Neophron percnopterus), eurasian eagle-owl (*Bubo bubo*), red-billed chough (*Pyrrhocorax pyrrhocorax*), Caspian snowcock (*Tetragallus caspius*).

Important wildlife of the area are wild goat (*Capra aegagrus*), snow vole (*Chionomys nivalis*), jungle cat (*Felis chaus*), otter (*Lutra lutra)*, and transcaucasian water shrew (*Neomys teres*). Baran dwarf snake (*Eirenis barani*), a national endemic and a species restricted to the Mediterranean biome lives in this KBA. A globally threatened species of ray-finned fish, *Barbatula seyhanensis* is also found in this KBA.

The site is also important for butterfly species such as *Parnassius apollo* which is globally threatened, *Polyommatus poseidon, Pseudophilotes bavius* and *Nymphalis xanthomelas* which are regionally threatened and *Pyrgus aladaghensis* which is a national endemic.

Ecosystem Use:
Animal husbandry, especially during summertime by the Yoruk nomads.
Agriculture
Some tourism. Especially in favour with trekkers and mountaineers throughout the whole year.

Threats:
Overgrazing in the summer months threatened the vegetation.
Overload of tourists in the summer months threatened the vegetation.

The important species found in the Aladağlar KBA are presented in Table 21-27.

Table 21: List of important plant species for Aladağlar Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Achillea spinulifolia	Yes	No	_	CD	A2
Alchemilla rivularis	Yes	Yes	_	DD	A2

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Alyssum caespitosum	Yes	No	_	NT	A2
Alyssum trapeziforme	Yes	No	_	EN	A1, A2
Asphodeline cilicica	Yes	No	_	VU	A1, A2
Asphodeline prismatocarpa	Yes	No	_	VU	A1
Asphodeline prismatocarpa	Yes	No	_	VU	A1
Astragalus bakirdaghensis	Yes	No	_	EN	A1, A2
Astragalus stridii	Yes	Yes	_	EN	A1, A2
Ballota macrodonta	Yes	No	_	VU	A1, A2
Centaurea antitauri	Yes	No	_	VU	A1, A2
Centaurea chrysantha	Yes	No	_	EN	A1, A2
Centaurea ptosimopapoides	Yes	No	_	VU	A1, A2
Cirsium ellenbergii	Yes	No	_	VU	A1, A2
Cousinia cirsioides	Yes	No	_	VU	A1, A2
Cousinia cirsioides	Yes	No	_	VU	A1, A2
Crocus sieheanus	Yes	No	_	VU	A1, A2
Delphinium nydeggeri	Yes	Yes	_	EN	A1, A2
Dianthus goerkii	Yes	Yes	_	EN	A1, A2
Draba acaulis	Yes	No	_	VU	A1, A2
Ebenus cappadocica	Yes	No	_	NT	A2
Ferula drudeana	Yes	No	_	CR	A1, A2
Ferula longipedunculata	Yes	No	_	EN	A1, A2
Ferulago pachyloba	Yes	No	_	VU	A1, A2
Ferulago pachyloba	Yes	No	_	VU	A1, A2
Galium aladaghense	Yes	Yes	_	EN	A1, A2
Galium aladaghense	Yes	Yes	_	EN	A1, A2
Galium sieheanum	Yes	No	_	VU	A1, A2
Gnaphalium leucopil	Yes	No	_	NT	A2
Hedysarum antitauricum	Yes	Yes	_	EN	A1, A2
Hesperis campicarpa	Yes	No	_	CD	A2
Hieracium argaeum	Yes	No	_	EN	A1
Hyacinthella lazulina	Yes	No	_	EN	A1, A2
Hypericum crenulatum	Yes	No	_	CD	A2
Isatis frigida	Yes	No	_	VU	A1, A2
Lamium eriocephalum ssp. eriocephalum	Yes	No	_	CD	B2
Lamium garganicum ssp. pulchrum	Yes	No	_	NT	B2
Nepeta aristata	Yes	No	_	NT	A2
Omphalodes luciliae ssp. cilicica	Yes	No	_	NT	B2
Onosma cappadocicum	Yes	No	_	CD	A2
Paracaryum reuteri	Yes	No	_	NT	A2
Potentilla aladaghensis	Yes	Yes	_	CD	A2
Potentilla pulvinaris ssp. argentea	Yes	No	_	VU	B1, B2
Potentilla pulvinaris ssp. pulvinaris	Yes	No	_	EN	B1, B2
Rosularia sempervivum ssp. glaucophylla	Yes	No	_	EN	B1
Salvia eriophora	Yes	No	_	VU	A1, A2
Sedum ince	Yes	No	_	_	A2
Senecio tauricolus	Yes	No	_	LC	A2
Sideritis phlomoides	Yes	No	_	NT	A2
Thesium cilicicum	Yes	No	_	NT	A2
Thlaspi crassum	Yes	Yes	_	EN	A1, A2
Thlaspi rosulare	Yes	No	_	CR	A1, A2
Thurya capitata	Yes	No	_	VU	A1, A2
Thymelaea cilicica	Yes	No	_	LC	A2
Trigonella kotschyi	Yes	No	_	VU	A1
Trigonella rhytidocarpa	Yes	No	_	NT	A2
Valeriana bolkarica	Yes	No	_	VU	A1, A2
Verbascum adenocaulon	Yes	No	_	CR	A1, A2
Veronica kotschyana	Yes	No	_	NT	A2
Veronica tauricola	Yes	Yes	_	CD	A2

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Viola sandrasea ssp. cilicica	Yes	No	_	EN	B1, B2

Table 22: List of important amphibian species for Aladağlar Mountain Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	ÖDA Kriteri
Salamandra infraimmaculata – East Tauruses	No	No	LC	NT	B2, C1

Table 23: List of important freshwater species for Aladağlar Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	ÖDA Kriteri
Barbatula seyhanensis	Yes	No	VU	EN	A1, A2, C1

Table 24: List of important butterfly species for Aladağlar Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	ÖDA Kriteri
Archon apollinus - Anatolia	No	No	_	EN	B1, C1
Coenonympha leander dierli	Yes	No	_	_	B2, C1
Glaucopsyche alexis - Anatolia	No	No	_	VU	B1
Muschampia proteides - Anatolia	No	No	_	EN	B1, C1
Nymphalis xanthomelas - Anatolia	No	No	_	VU	B1
Parnassius apollo	No	No	VU	VU	A1
Polyommatus poseidon - Anatolia	No	No	_	EN	B1, C1
Pseudophilotes bavius - Anatolia	No	No	_	EN	B1, C1
Pseudophilotes vicrama - Anatolia	No	No	_	VU	B1
Pyrgus aladaghensis	Yes	No	_	_	A2, A4, C1
Tomares nogelli - Anatolia	No	No	_	EN	B1, C1

Table 25: List of important bird species for Aladağlar Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	ÖDA Kriteri
Aquila chrysaetos	No	No	LC	LC	C1
Bubo bubo	No	No	LC	LC	C1
Dendrocopos syriacus	No	No	LC	LC	C1
Emberiza hortulana	No	No	LC	LC	C1
Falco peregrinus	No	No	LC	LC	C1
Gypaetus barbatus - Mediterranean and Anatolia	No	No	LC	VU	B1, C1
Gyps fulvus	No	No	LC	LC	C1
Hieraaetus pennatus - Europe	No	No	LC	LC	C1
Lanius collurio	No	No	LC	LC	C1
Lanius minor	No	No	LC	LC	C1
Lullula arborea	No	No	LC	LC	C1
Neophron percnopterus - Europe	No	No	LC	EN	B1, C1
Pyrrhocorax pyrrhocorax	No	No	LC	LC	C1
Tetraogallus caspius - Anatolia and Caucasus	No	No	LC	VU	B1, C1

Table 26: List of important mammal species for Aladağlar Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	ÖDA Kriteri
Capra aegagrus	No	No	VU	_	A1, C1
Chionomys nivalis - Middle Tauruses	No	No	NT	LC	B2, C1
Felis chaus - Middle East	No	No	LC	(EN)	B1, C1
Lutra lutra	No	No	NT	_	C1
Neomys teres - Aladağlar	No	No	LC	LC	B2, C1

Table 27: List of important reptile species for Aladağlar Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	ÖDA Kriteri
Eirenis barani	Yes	No	_	LC	A2, A4, C1

Seyhan Delta KBA

Map 19: Seyhan Delta Key Biodiversity Area (Eken *et al.* 2006)

Criteria for KBA Designation:
A1: 17 species that are threatened either globally, regionally or nationally

A2: 14 species that have a total home range of 50.000 km2 or less around the globe

A3: The site is host to at least 1% of 3 species global population during a specific period of the year.

A4: the site is home to at least 5% of the global population of 1 species that are endemic to the biomes in this KBA

B1: the site is home to 17 subspecies or subpopulations that are regionally threatened

B2: 4 subspecies whose home range is less than 20.000 km2 or whose local populations have been separated from the main populations

B3: The major part of 22 species global population is concentrated in the site

C1: important site for 44 species threatened in the EU

C3: The site is home to at least 1% of the EU population for 18 species

A total of 19 plant taxa fulfil the KBA criteria. The majority have a narrow distribution and are globally threatened.

The Tuzla and Akyatan lakes are important for birds year-round.

The area is also important for birds wintering, breeding and migrating birds. Some important species of the KBA are marbled teal (*Marmaronetta angustirostris)*, white-headed duck (*Oxyura leucocephala*), kentish plover(*Charadrius alexandrinus*) and greater flamingo(*Phoenicopterus roseus*).

Important wildlife such the jungle cat (*Felis chaus*), green sea turtle (*Chelonia mydas*), and a small number of loggerhead sea turtles (*Caretta caretta*). A snake (*Eirenis aurolienatus*) which is a national endemic and a species restricted to the Mediterranean biome lives in this KBA. A globally threatened species of dragonfly *Brachythemis fuscopalliata* is also found in this KBA.

Ecosystem Use:

Animal husbandry, agriculture and fisheries are the main activities in the area.

Some tourism including birding tourism is done in the area.

Threats:

The major threat in the area is the manipulation of the natural water regime by State Hydraulic Works (DSI). The 4th and final stage of the Lower Seyhan Irrigation Project consists of draining the land close to Tuzla and Akyatan lakes, which have high levels of underground water. The aim is to drain 35.000 ha of Treasury land and to make it available for private ownership. Some small marshes and ephemeral wetlands have already been drained in the delta. Summer housing developments and afforestation efforts also threaten the integrity of the KBA.

The important species found in the Seyhan Delta KBA are:

Table 28: List of important plant species for Seyhan Delta Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Alhagi mannifera - Mediterranean	No	No	_	VU	B1
Alkanna pinardii	Yes	No	_	EN	A1, A2
Allium gayi	Yes	No	_	NT	A2
Ambrosia maritima - Eastern Mediterranean	No	No	_	EN	B1
Anthemis halophila	Yes	No	_	EN	A1, A2

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Astragalus suberosus ssp. mersinensis	Yes	No	_	VU	B1, B2
Bellevalia modesta	Yes	No	_	CD	A2
Beta adanensis	Yes	No	_	VU	A1, A2
Bromus psammophilus	Yes	No	_	CR	A1, A2
Bupleurum polyactis	Yes	No	_	VU	A1, A2
Bupleurum zoharii	Yes	No	_	VU	A1, A2
Cyprinia gracilis	No	No	_	EN	A2, B1
Heptaptera cilicica	Yes	No	_	EN	A1, A2
Hypericum polyphyllum ssp. polyphyllum	Yes	No	_	NT	B2
Linum anisocalyx	Yes	No	_	EN	A1, A2
Centaurea calcitrapa ssp. cilicica	Yes	No	_	CD	B2
Centaurea solstitialis ssp. carneola	Yes	No	_	NT	B2
Glycyrrhiza flavescens	Yes	No	_	NT	A2
Silene pompeipolitana	Yes	No	_	VU	A1, A2

Table 29: List of important freshwater fish species for Seyhan Delta Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Alosa fallax nilotica	No	No	DD	_	C1
Aphanius fasciatus	No	No	DD	LC	C1

Table 30: List of important dragonfly species for Seyhan Delta Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Brachythemis fuscopalliata	No	No	VU	VU	A1, C1
Coenagrion ornatum	No	No	_	_	C1

Table 31: List of important bird species for Seyhan Delta Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Acrocephalus melanopogon	No	No	LC	LC	C1
Anas crecca - Mediterranean and Black Sea	No	No	LC	LC	B3, C3
Anas penelope - Mediterranean and Black Sea	No	No	LC	LC	B3, C3
Anthus campestris	No	No	LC	LC	C1
Aythya ferina - Europe and Mediterranean	No	No	LC	LC	B3, C3
Burchinus oedicnemus - Eastern Europe	No	No	LC	VU	B1, C1
Calandrella brachydactyla	No	No	LC	LC	C1
Calidris minuta - Europe and Western Africa	No	No	LC	LC	B3, C3
Casmerodius albus - Europe and Mediterranean	No	No	LC	LC	C1
Charadrius alexandrinus - Mediterranean and Black Sea	No	No	LC	LC	B3, C1, C3
Charadrius alexandrinus - Mediterranean and Black Sea	No	No	LC	LC	B3, C1, C3
Charadrius alexandrinus - Mediterranean and Black Sea	No	No	LC	LC	A3, B3, C1, C3
Ciconia ciconia - Eastern Europe	No	No	LC	LC	B3, C1, C3
Fulica atra - Mediterranean and Black Sea	No	No	LC	LC	B3, C3
Glareola pratincola - D. Mediterranean and Black Sea	No	No	LC	LC	B3, C1, C3
Grus grus - Anatolia and Black Sea	No	No	LC	(EN)	B1, B3, C1, C3
Halcyon smyrnensis - Anatolia	No	No	LC	EN	B1, C1
Himantopus himantopus - E. Europe and E.	No	No	LC	LC	C1

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Mediterranean					
Himantopus himantopus - E. Europe and E. Mediterranean	No	No	LC	LC	B3, C1, C3
Ixobrychus minutus	No	No	LC	LC	C1
Marmonetta angustirostris - E. Mediterranean	No	No	VU	VU	A1, B1, B3, C1, C3
Melanocorypha calandra	No	No	LC	LC	C1
Oxyura leucocephala - Eastern Mediterranean and İran	No	No	EN	VU	A1, A3, B1, B3, C1, C3
Phalacrocorax pygmeus - SE. Europe and Turkey	No	No	LC	LC	C1
Phoenicopterus roseus - E. Mediterranean	No	No	LC	LC	A3, B3, C1, C3
Porphyrio porphyrio caspius	No	No	LC	LC	C1
Prinia gracilis akyildizi	No	No	LC	VU	B1, C1
Recurvirosta avosetta - Mediterranean and GD. Europe	No	No	LC	LC	B3, C1, C3
Recurvirosta avosetta - Mediterranean SE. Europe	No	No	LC	LC	C1
Sterna albifrons - D. Europe	No	No	LC	LC	B3, C1, C3
Sterna caspia - Europe	No	No	LC	LC	C1
Tadorna tadorna - Mediterranean and Black Sea	No	No	LC	LC	B3, C3
Vanellus spinosus – Balkans and Anatolia	No	No	LC	VU	B1, C1

Table 32: List of important mammal species for Seyhan Delta Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Felis chaus - Middle East	No	No	LC	(EN)	B1, C1

Table 33: List of important reptile species for Seyhan Delta Key Biodiversity Area

Taxon	Endemic	Local Endemic	Global Red List Category	National or Regional Red List Category	KBA Criteria
Caretta caretta	No	No	EN	(EN)	A1, C1
Caretta caretta - Mediterranean	No	No	EN	(EN)	B1, B3, C1
Chelonia mydas	No	No	EN	(CR)	A1, C1
Chelonia mydas	No	No	EN	(CR)	A1, C1
Chelonia mydas	No	No	EN	(CR)	A1, C1
Chelonia mydas - Mediterranean	No	No	EN	(CR)	B1, B3, C1
Chelonia mydas - Mediterranean	No	No	EN	(CR)	B1, B3, C1
Chelonia mydas - Mediterranean	No	No	EN	(CR)	B1, B3, C1
Eirenis aurolineatus	Yes	No	_	LC	A2, A4, C1
Emys orbicularis	No	No	NT	NT	C1
Testudo graeca	No	No	VU	NT	A1, C1
Trionyx triunguis - Eastern Mediterranean	No	No	CR	CR	B1, C1

4.2.4. Anatolian Diagonal Biodiversity (SCP) Project

Anatolian Diagonal Project is a biodiversity assessment study carried following the Systematic Conservation Principles (Margules and Pressey 2000) in 8.5 million hectares of area extending from Adana to Erzurum.

The approach uses the distribution of actual vegetation types (mapped from satellite imagery), vertebrate and butterfly species (plus other taxa, if data are available), ecological and evolutionary processes as surrogates for over all biodiversity. It includes socio-economic data as cost for conservation, threats and opportunities.

In the final analysis biological and socio-economic features are optimized to identify the conservation portfolio for a study area. Optimization processes stress the following criteria for the final conservation portfolio;

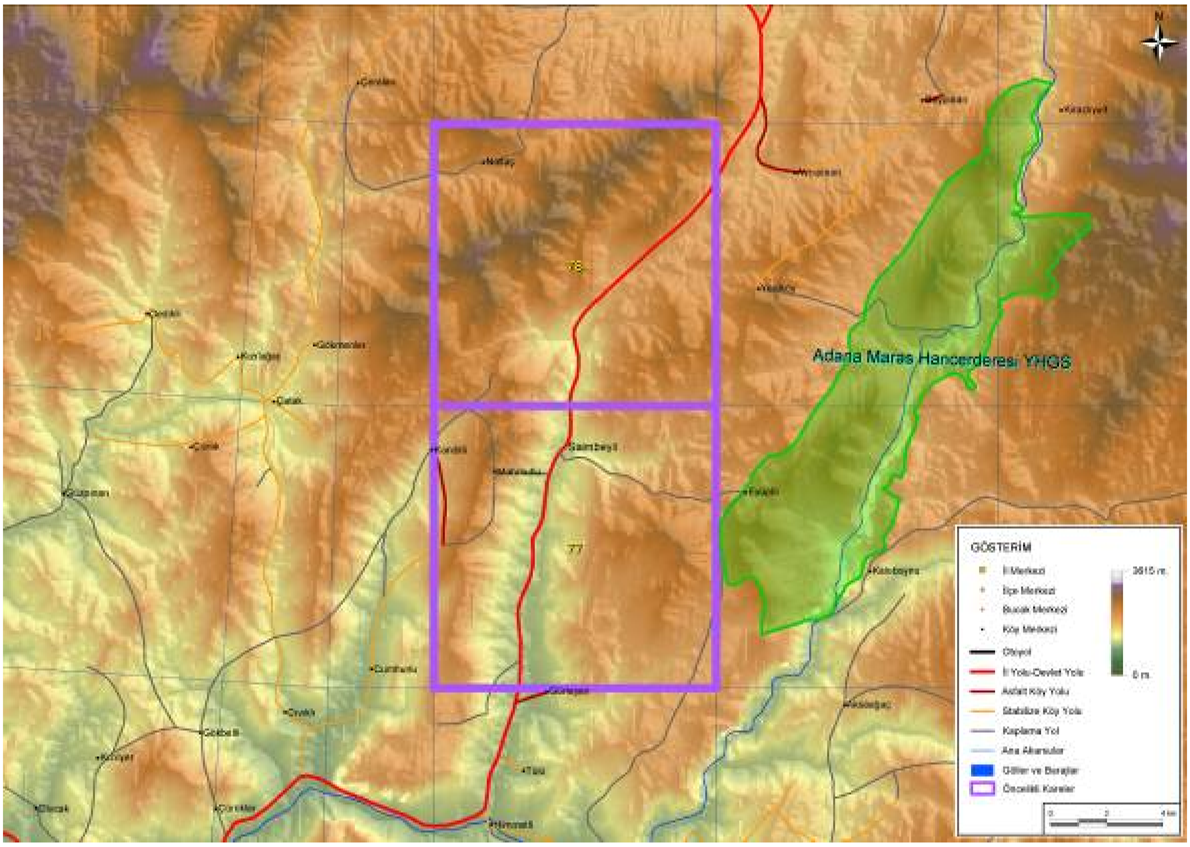
- Highest representation of biodiversity,
- Minimum number of sites,
- Minimum conservation cost,
- Maximum conservation opportunities

Computer based optimization processes can be iterated many times according to comments of stakeholders to reach the most implementable conservation portfolio. Unlike many other site prioritization (reserve selection) tools, SCP does not give prescriptions but provides a procedure that can integrate regional and local priorities and stakeholders' demands.

Table 34: List of Priority Biodiversity Areas selected in Anatolian Diagonal Project

Name of the Area	Province	Area Code (AD Bio. Project)	Total Biodiversity Priority Score (over 1000)
Saimbeyli (North) – Naltaş	Adana	78	752,048696
İmamkulu, Develi-Tomarza	Kayseri	1096	687,622207
Çukurbağ, Çamardı	Niğde	930	620,387296
Gülek	Mersin	904	585,367355
Bolkar Dağları	Niğde	892, 899	581,280142
Göksun'un (North), Keklikoluk	K.Maraş	110	560,804499
Yaylacık, Develi	Kayseri	1085	553,614334
Yahyalı	Kayseri	1057	523,154227
Pınarbaşı (Nortwest)	Kayseri	155	493,522809
Pınarbaşı (South)	Kayseri	115	470,758076
Akyatan Lake	Adana	951	457,958299
Sarız (South)	Kayseri	121	406,295195
Ulupınar, Yahyalı	Kayseri	994	358,106667
Orhaniye, Çamardı	Niğde	945	324,479167

1. Saimbeyli (North), Naltaş / ADANA (78)

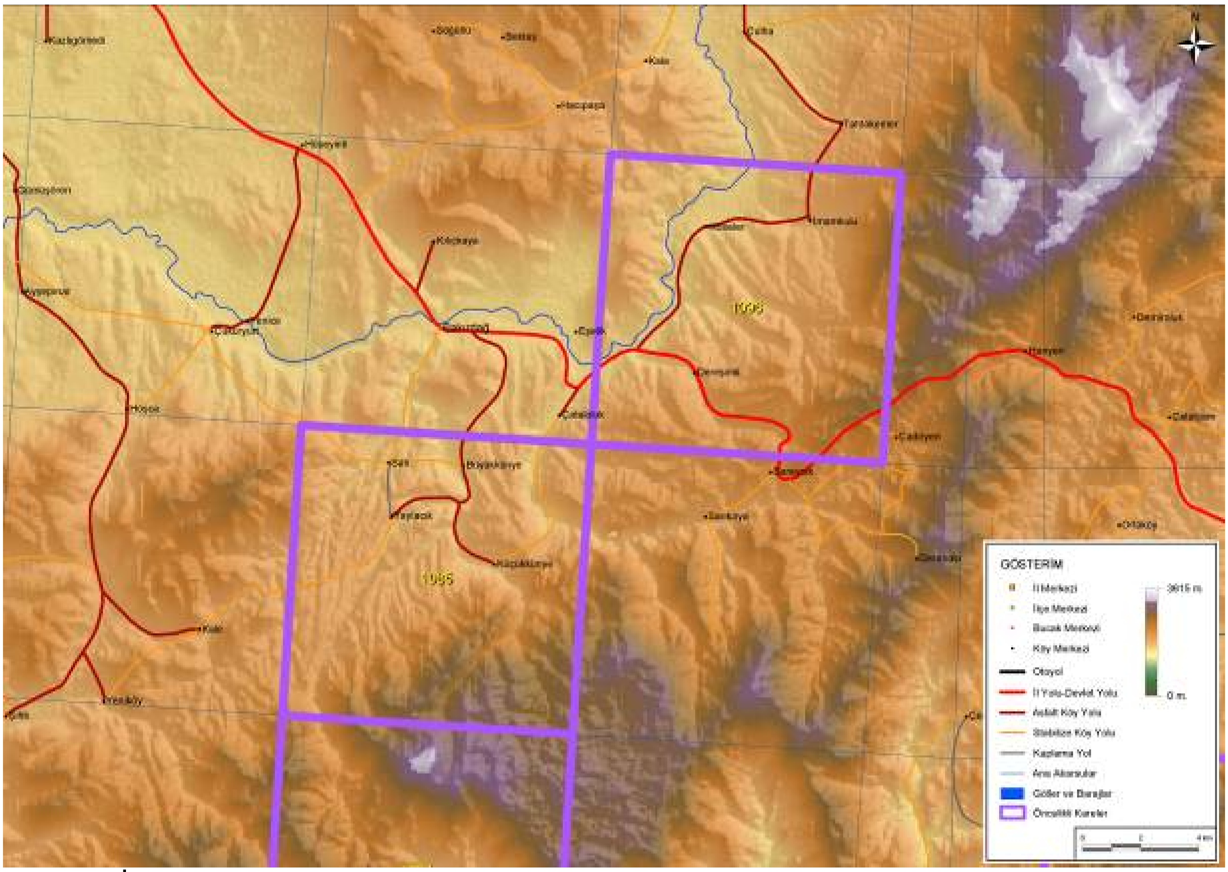


Map 20: Saimbeyli (North), Naltaş Priority Biodiversity Area (DKM 2009)

Table 35: Criticial species for Saimbeyli (North), Naltaş Priority Biodiversity Area

Taxa	Name	Biodiversity Priority
Plant	Anthemis antitaurica	8.50
Plant	Verbascum hadschinense	8.50
Butterfly	Polyommatus theresiae	7.00
Butterfly	Melanargia syriaca syriaca	5.43
Butterfly	Satyrus ferula	5.33
Butterfly	Pseudochazara lydia obscura	5.26
Butterfly	Argynnis adippe taurica	4.38
Reptile	Rana macrocnemis	4.27
Butterfly	Polyommatus syriacus burak	4.24
Butterfly	Muschampia poggei poggei	4.19
Butterfly	Hipparchia mersina	3.79
Butterfly	Melitaea arduinna	3.58
Butterfly	Thymelicus hyrax	3.50
Butterfly	Satyrus favonius favonius	3.46
Butterfly	Polyommatus menalcas	3.30
Butterfly	Polyommatus carmon carmon	3.26

2. İmamkulu, Develi-Tomarza / Kayseri (1096)

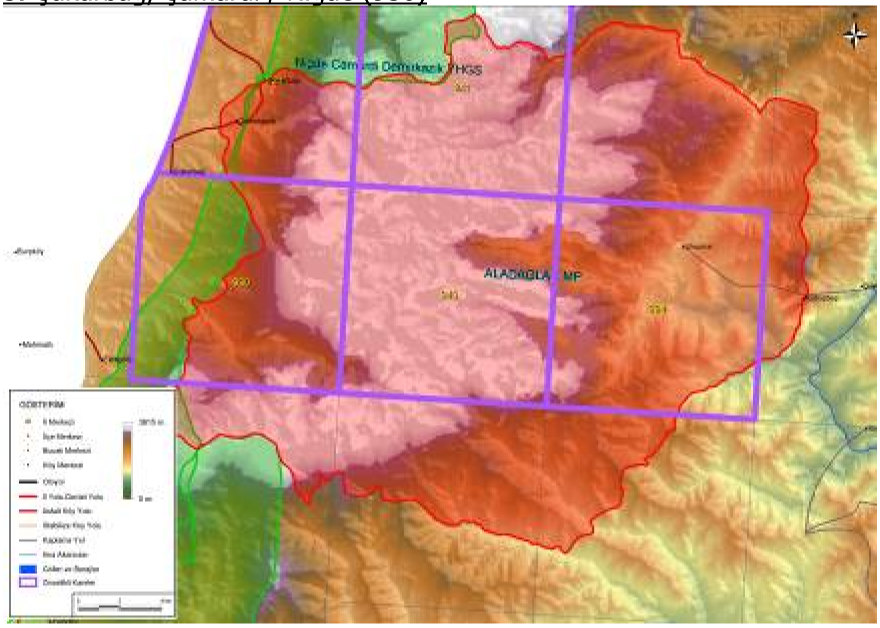


Map 21: İmamkulu-Develi-Tomarza Priority Biodiversity Area (DKM 2009)

Table 36: Criticial species for İmamkulu-Develi-Tomarza Priority Biodiversity Area

Taxa	Name	Amount in the Area	Biodiversity Priority
Community	2_1_13 Tahtali Mountain Black Pine Forest	663.1614	12.45
Plant	Cirsium aytachii		8.50
Plant	Geranium cinereum var elatius		5.34
Butterfly	Polyommatus menalcas		3.30
Butterfly	Glaucopsyche astraea astraea		3.12

3. Çukurbağ, Çamardı / Niğde (930)

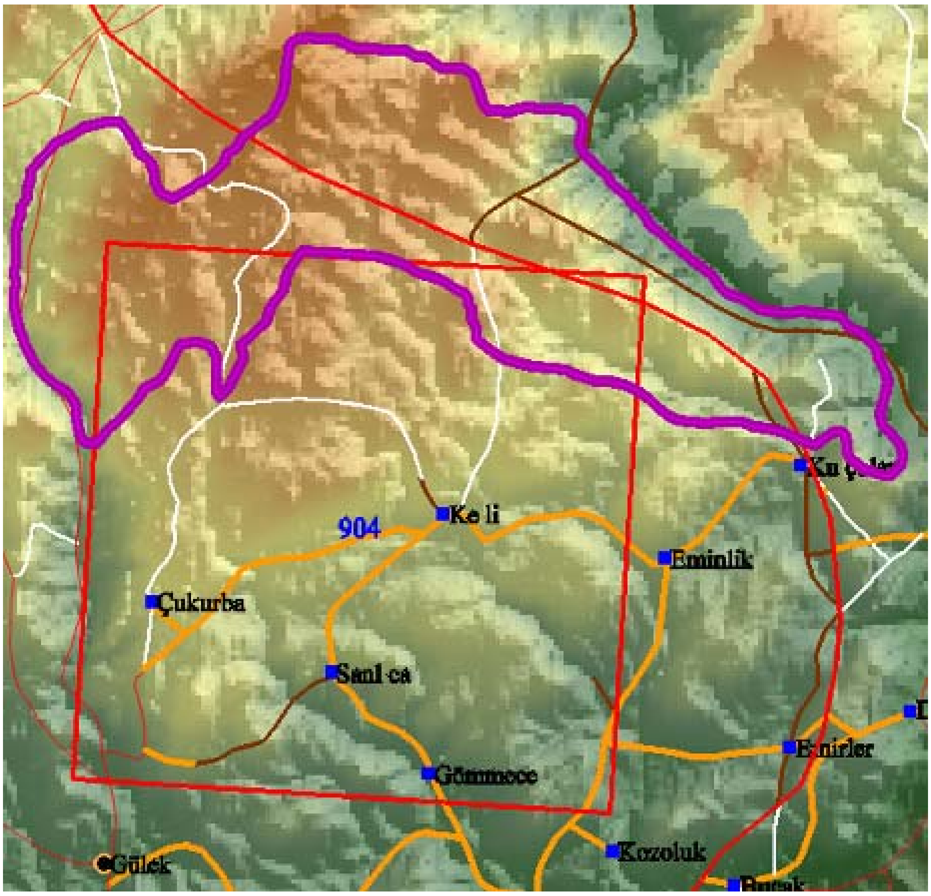


Map 22: Çukurbağ-Çamardı Priority Biodiversity Area (DKM 2009)

Table 37: Criticial species for Çukurbağ-Çamardı Priority Biodiversity Area

Taxa	Name	Biodiversity Priority
Butterfly	Pyrgus aladaghensis	8.50
Plant	Astragalus stridii	8.50
Plant	Sedum inceii	8.50
Plant	Allium stenopetalum	7.00
Plant	Alyssum trapeziforme	7.00
Plant	Centaurea chrysantha	7.00
Plant	Draba acaulis	7.00
Plant	Galium aladaghense	7.00
Plant	Alchemilla rivularis	6.50
Plant	Verbascum adenocaulon	6.50
Plant	Dianthus goerkii	6.25
Plant	Sideritis phlomoides	6.00
Plant	Ferulago pachyloba	5.50
Butterfly	Polyommatus sigberti(actis)	5.48
Butterfly	Argynnis aglaja ottomana	5.43
Butterfly	Satyrus ferula	5.33
Plant	Hypericum crenulatum	5.33
Butterfly	Lycaena virgaureae aureomicans	4.67
Small Mammal	Crocidura arispa	4.41
Butterfly	Hipparchia aristaeus senthes	4.00
Butterfly	Colias chlorocoma	3.82
Butterfly	Chilades trochylus trochylus	3.72
Reptile	Vipera xanthina	3.52
Butterfly	Satyrus favonius favonius	3.46
Butterfly	Plebeius pyrenaicus dardanus	3.45
Butterfly	Polyommatus carmon carmon	3.26
Butterfly	Polyommatus mithridates	3.13
Butterfly	Glaucopsyche astraea astraea	3.12
Butterfly	Polyommatus ossmar ossmar	2.99

4. Gülek/MERSİN (904)

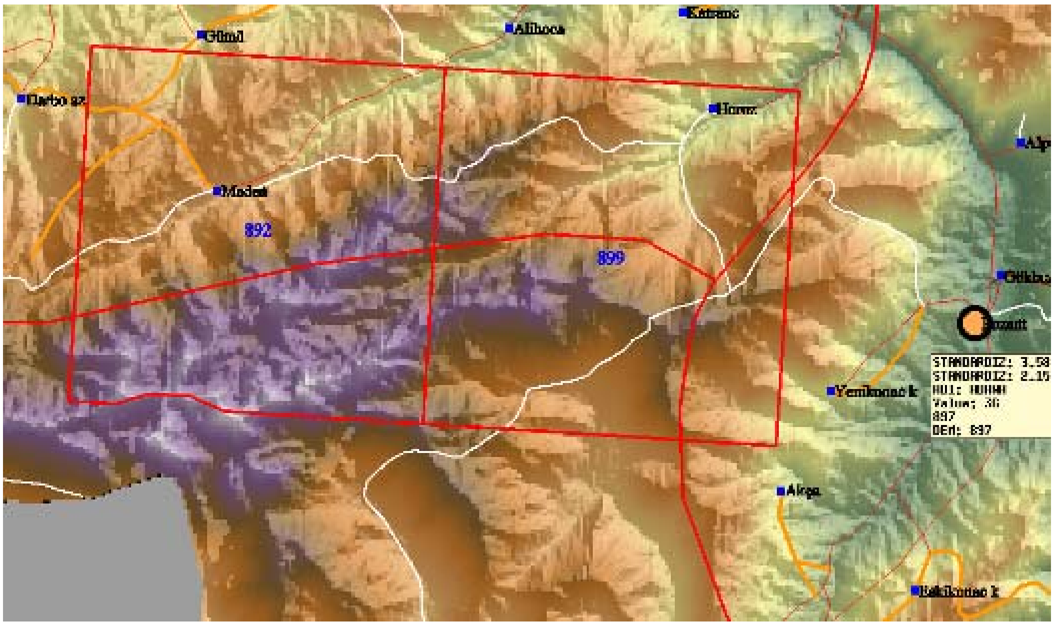


Map 23: Gülek Priority Biodiversity Area (DKM 2009)

Table 38: Criticial species for Gülek Priority Biodiversity Area

Taxa	Latin Name	Amount in the Area	Biodiversity Priority
Plant	Micromeria_cilicica		8,50
Plant	Tordylium_elegans		5,93
Community	1_2_26_Aladaglar_Low_Mountain_Maquis	1482,87	4,13
Butterfly	Hipparchia_mersina		3,79
Riverine System	Midbasin_Mediterranean_Lowland_fast_rivertype	33,45143	3,63
Reptile	Vipera_xanthina		3,52
Community	1_2_19_Aladaglar_Taurus_Cedar_Taurus_Fir_Forest_Aladaglar_High_Mountain_Mixed_Needle-leaved_Forest	1045,635	3,08
Community	1_1_20_Cukurova_Low_Mountain_Red_Pine_Forest	55,47413	3,05
Amphibia	Rana_ceyhanensis		2,97

<u>5. Bolkar Mountains/Mersin-Niğde (892,899)</u>



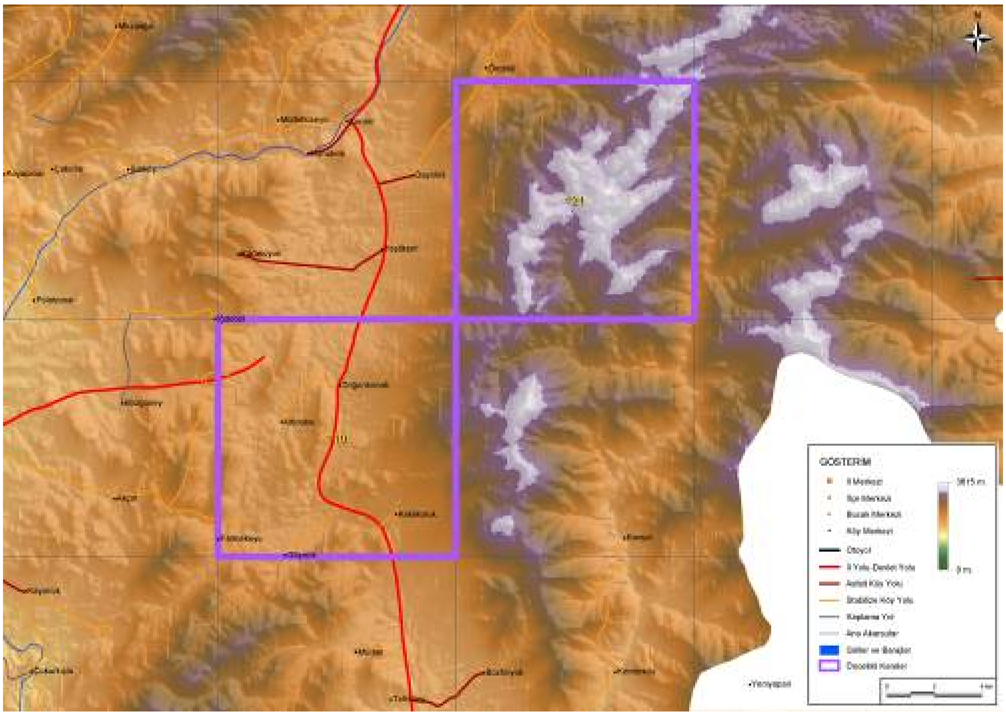
Map 24: Bolkar Moutains Priority Biodiversity Area (DKM 2009)

Table 39: Criticial species for Bolkar Moutains Priority Biodiversity Area

Taxa	Latin Name	Biodiversity Priority
Butterfly	Pyrgus_bolkariensis	8,50
Plant	Anthemis_oxylepis	8,50
Plant	Asperula_cilicica	8,50
Plant	Gentiana_boissieri	8,50
Plant	Centaurea_anthemifolia	8,50
Plant	Gentianella_holosteoides	8,00
Plant	Helianthemum_strickeri	8,00
Plant	Centaurea_sieheana	7,00
Plant	Euphorbia_schottiana	7,00
Plant	Johrenia_alpina	7,00
Plant	Silene_fenzlii	7,00
Plant	Thurya_capitata	7,00
Plant	Centaurea_sieheana	7,00
Plant	Euphorbia_schottiana	7,00
Plant	Linum_empetrifolium	6,50
Plant	Verbascum_lyratifolium	6,50
Plant	Verbascum_lyratifolium	6,50
Plant	Veronica_surculosa	6,50
Plant	Linum_empetrifolium	6,50
Plant	Verbascum_lyratifolium	6,50
Plant	Veronica_surculosa	6,50
Plant	Lactuca_glaerosa	6,17
Plant	Lactuca_glaerosa	6,17
Plant	Thesium_cilicicum	6,00
Plant	Achillea_spinulifolia	5,75
Plant	Campanula_trachyphylla	5,75
Plant	Veronica_kotschyana	5,75
Plant	Achillea_spinulifolia	5,75
Plant	Campanula_trachyphylla	5,75

Taxa	Latin Name	Biodiversity Priority
Plant	Veronica_kotschyana	5,75
Plant	Ferulago_pachyloba	5,50
Plant	Hypericum_crenulatum	5,33
Plant	Hypericum_crenulatum	5,33
Plant	Verbascum_cilicicum	5,21
Plant	Verbascum_cilicicum	5,21
Plant	Potentilla_pulvinaris_ssp_argentea	4,93
Plant	Potentilla_pulvinaris_ssp_argentea	4,93
Butterfly	Lycaena_virgaureae_aureomicans	4,67
Small Mammal	Crocidura_arispa	4,41
Butterfly	Pieris_krueperi_krueperi	3,93
Large Mammal	Hyaena_hyaena	3,63
Butterfly	Melitaea_arduinna	3,58
Reptile	Vipera_xanthina	3,52
Reptile	Vipera_xanthina	3,52
Butterfly	Glaucopsyche_iolas_lessei	3,48

6. Göksun (North), Keklikoluk/ K.Maraş (110)

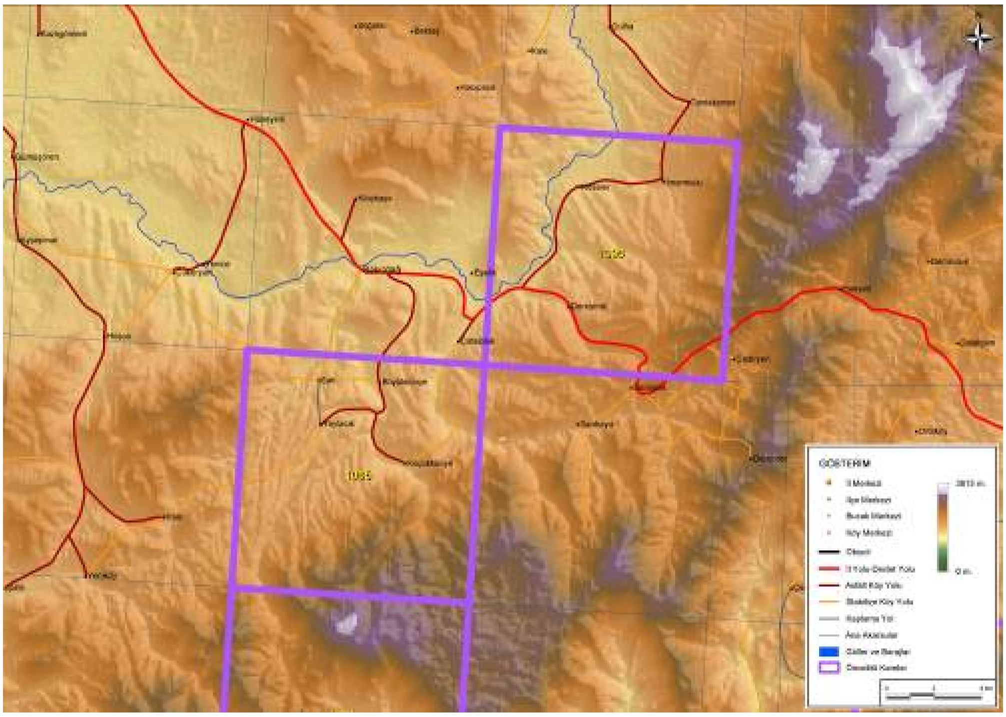


Map 25: Göksun (North), Keklikoluk Priority Biodiversity Area (DKM 2009)

Table 40: Criticial species for Göksun (North), Keklikoluk Priority Biodiversity Area

Taxa	Latin Name	Biodiversity Priority
Plant	Centaurea goeksunense	8.50
Plant	Seseli marashica	8.50
Plant	Ferula longipedunculata	6.25
Plant	Silene caryophylloides ssp binbogaense	6.18
Plant	Geranium cinereum var elatius	5.34

7. Yaylacık, Develi / Kayseri (1085)



Map 26: Yaylacık, Develi Priority Biodiversity Area (DKM 2009)

Table 41: Criticial species for Yaylacık, Develi Priority Biodiversity Area

Taxa	Latin Name	Amount in the Area	Biodiversity Priority
Plant	Paronychia kayseriana		8.50
Community	2_1_13 Tahtali Mountain Black Pine Forest	76.94037	3.77

8. Yahyalı / Kayseri (1057)

Map 27: Yahyalı Priority Biodiversity Area (DKM 2009)

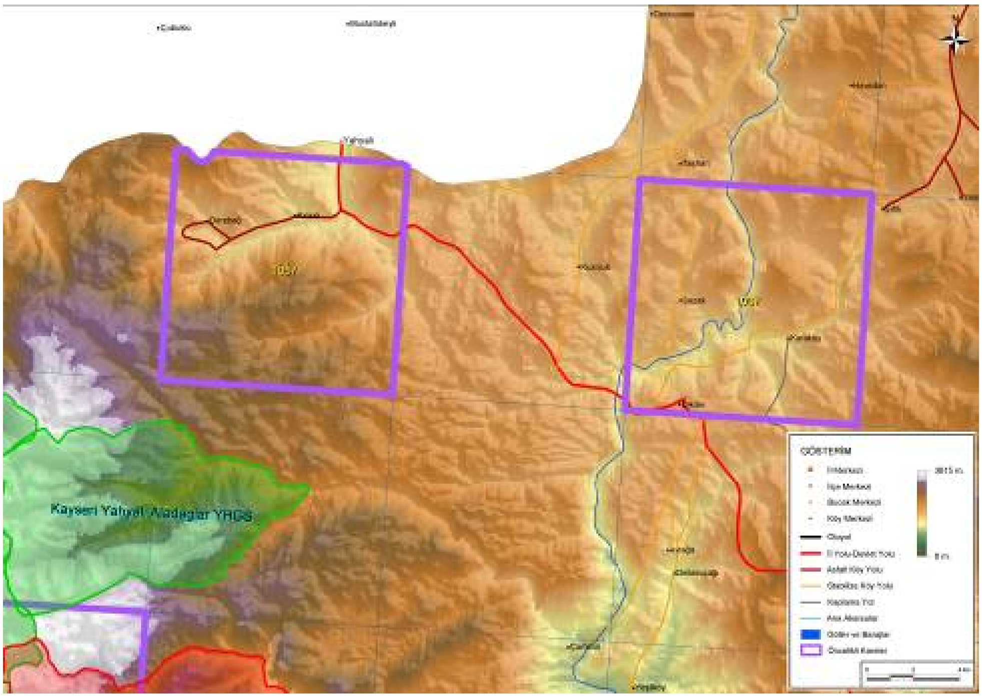
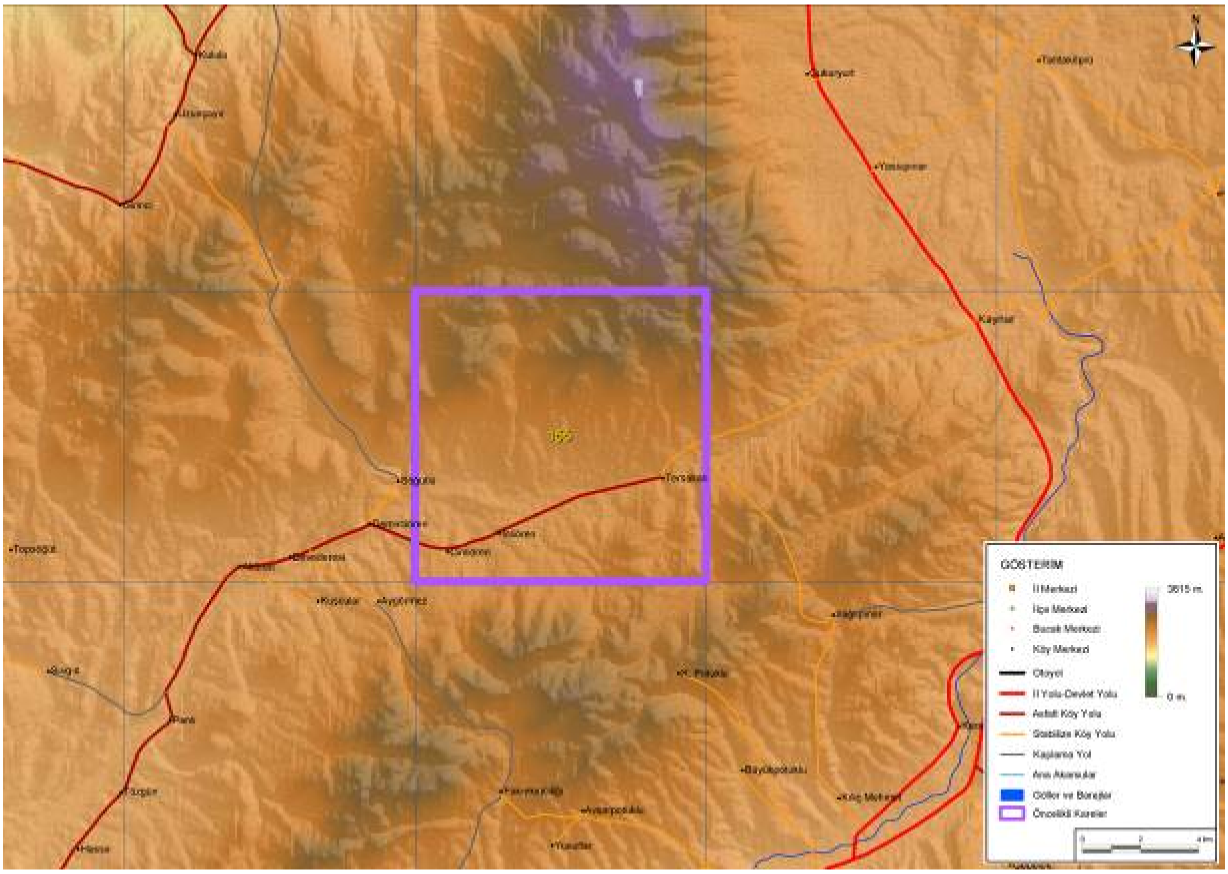


Table 42: Criticial species for Yahyalı Priority Biodiversity Area

Taxa	Latin Name	Biodiversity Priority
Plant	Crocus adanensis	8.50
Small Mammal	Crocidura arispa	4.41
Reptile	Vipera xanthina	3.52
Butterfly	Glaucopsyche iolas lessei	3.48
Butterfly	Glaucopsyche astraea astraea	3.12

9. Pınarbaşı (Northwest) / Kayseri (155)

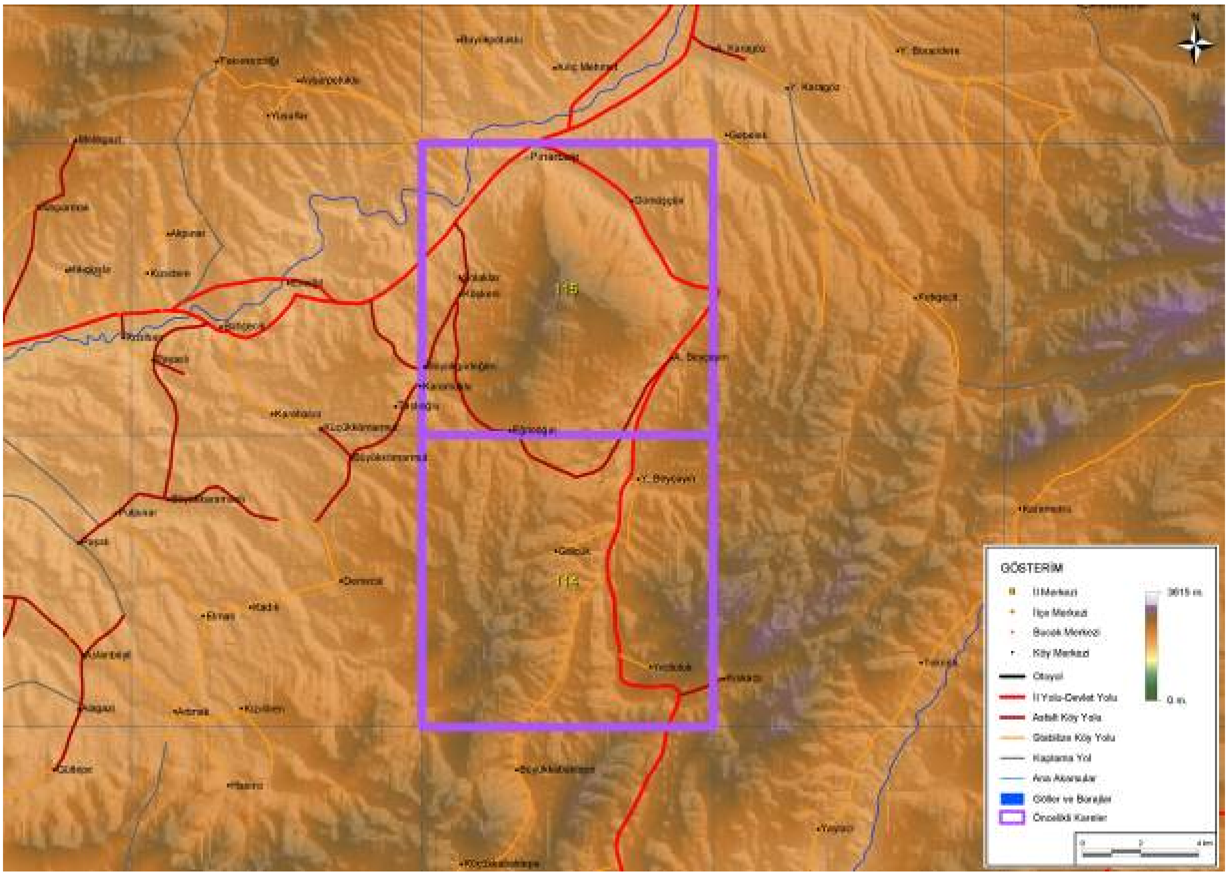


Map 28: Pınarbaşı (Northeast) Priority Biodiversity Area (DKM 2009)

Table 43: Criticial species for Pınarbaşı (Northeast) Priority Biodiversity Area

Taxa	Latin Name	Biodiversity Priority
Plant	Asyneuma trichostegium	8.50
Butterfly	Glaucopsyche iolas lessei	3.48
Butterfly	Glaucopsyche astraea astraea	3.12

10. Pınarbaşı (South) / Kayseri (114, 115)



Map 29: Pınarbaşı (South) Priority Biodiversity Area (DKM 2009)

Table 44: Criticial species for Pınarbaşı (South) Priority Biodiversity Area

Taxa	Latin Name	Amount in the Area (he)	Biodiversity Priority
Plant	Isatis huber-morathii		8.50
Bird	Emberiza cirlus		3.92
Community	2_1_23_Tahtali Mountain and High Mountain Oak Juniper Woodland and Shrubland	241.0015	3.35
Plant	Verbascum subserratum		8.50
Bird	Emberiza cirlus		3.92
Butterfly	Glaucopsyche astraea astraea		3.12
Butterfly	Tomares nesimachus		3.06

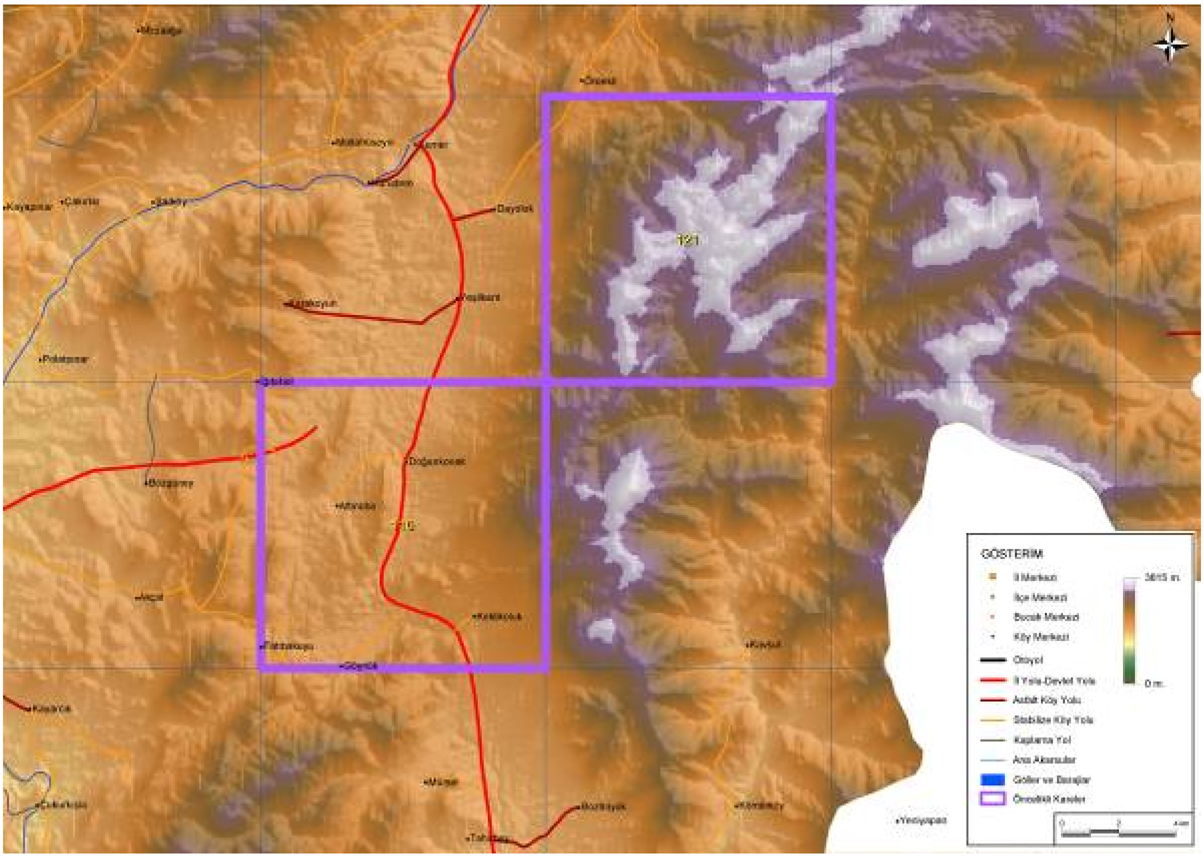
11. Akyatan Lake (951 ve 950)

Map 30: Akyatan Lake Priority Biodiversity Area (DKM 2009)

Table 45: Criticial species for Akyatan Lake Priority Biodiversity Area

Taxa	Latin Name	Amount in the Area (he)	Biodiversity Priority
Community	1_1_09_Cukurova_Plain_Coastal_Stone_Pine_Forest	1044,033	10,03
Reptile	Caretta_caretta		5,10
Large Mammal	Felis_chaus (Saz kedisi)		4,92
Reptile	Chelonia_mydas		4,88
Bird	Burhinus_oedicnemus		4,35
Bird	Charadrius_alexandrinus		4,25
Bird	Glareola_pratincola		4,18
Bird	Ixobrychus_minutus		4,00
Bird	Prinia_gracilis		3,78
Bird	Acrocephalus_melanopogon		3,68
Reptile	Eirenis_levantinus		3,57
Bird	Anas_platyrhynchos		3,44
Bird	Sterna_hirundo		3,33
Bird	Capoeta_angorae		3,23
Bird	Anas_querquedula		3,08
Reptile	Eirenis_lineomaculatus		3,04
Reptile	Rhynchocalamus_melanocephalus		3,03
Plant	Bromus_psammophilus		6,10
Reptile	Eirenis_levantinus		3,57
Freshwater Fish	Capoeta_angorae		3,23
Reptile	Eirenis_lineomaculatus		3,04

12. Sarız (South) / Kayseri (121)

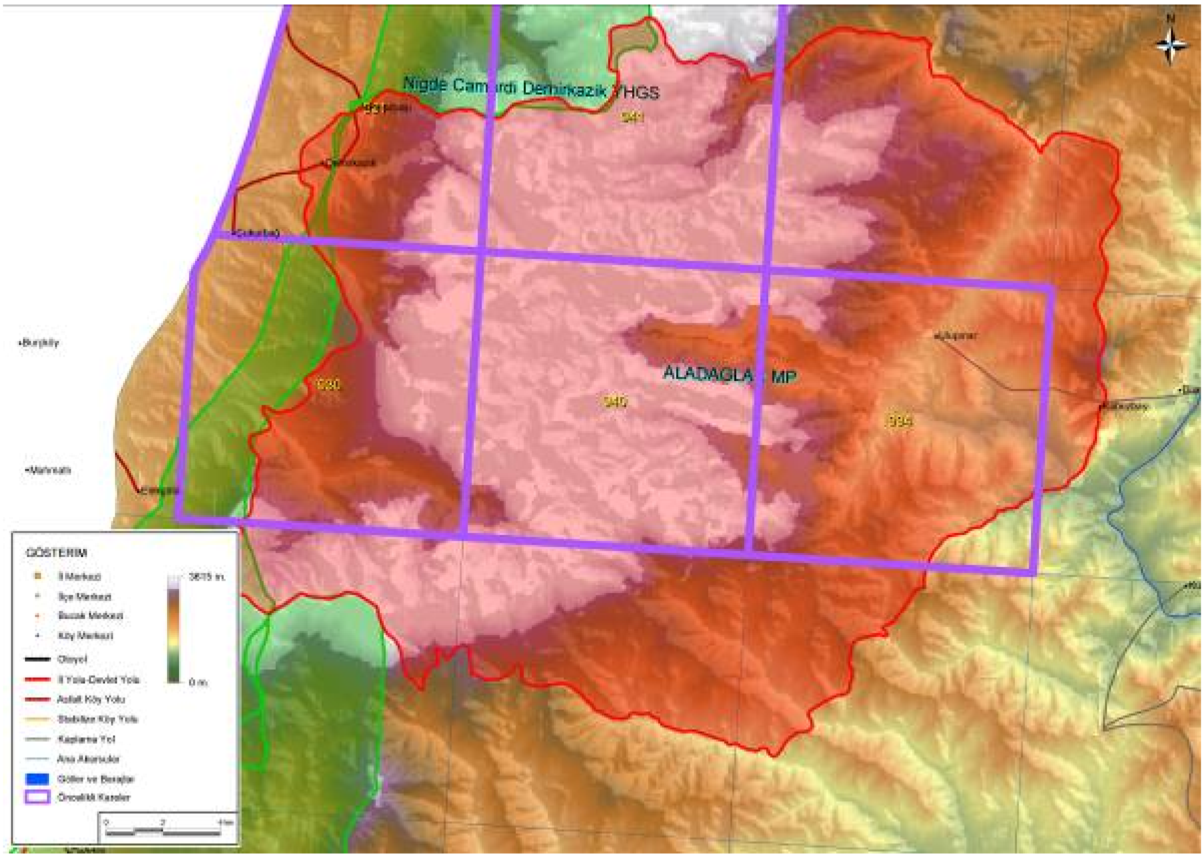


Map 31: Sarız (South) Priority Biodiversity Area (DKM 2009)

Table 46: Criticial species for Sarız (South) Priority Biodiversity Area

Taxa	Latin Name	Amount in the Area	Biodiversity Priority
Plant	Aethionema huetii		8.50
Plant	Graellsia davisiana		7.00
Community	2_2_25_Binbogalar High Mountain Juniper Woodland and Shrubland	693.8644	4.52
Evo&Eco Processes	Transition Aladaglar Binbogalar		3.50
Freshwater	Midbasin Mediterranean Highland rivertype	15.67531	3.32
Butterfly	Glaucopsyche Astraea astraea		3.12
Community	2_2_34_Binbogalar Mountain Steppe	3440.83	3.02

13. Ulupınar, Yahyalı / Kayseri (994)

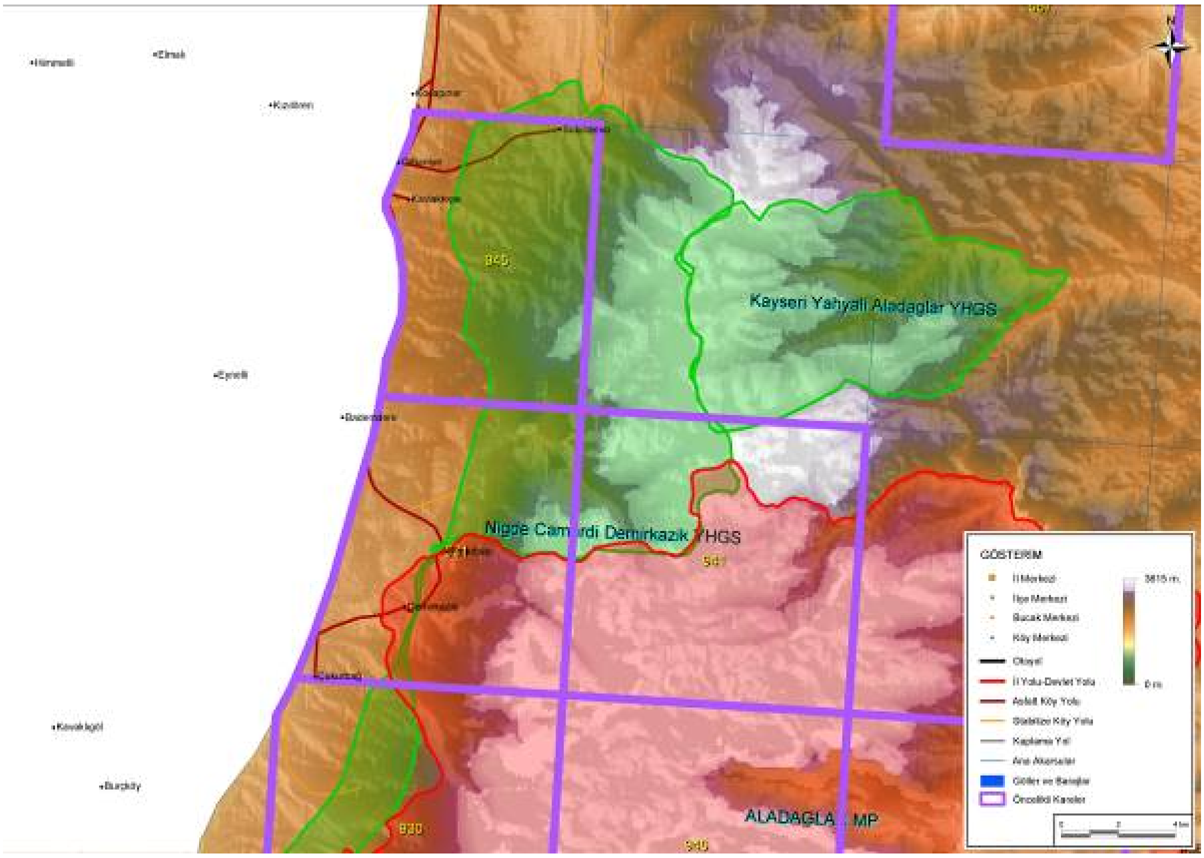


Map 32: Ulupınar-Yahyalı Priority Biodiversity Area (DKM 2009)

Table 47: Criticial species for Ulupınar-Yahyalı Priority Biodiversity Area

Taxa	Latin Name	Amount in the Area	Biodiversity Priority
Plant	Hesperis anatolica	1	5.93
Bird	Dryocopus martius	1	4.25
Bird	Dendrocopos leucotos	1	3.85
Community	1_2_16 Aladaglar Low Mountain Red Pine Black Pine Forest	250.4052	3.65
Reptile	Vipera xanthina	1	3.52
Evo&Eco Processes	Mature Habitats	13.88	3.26
Community	1_2_01 Aladaglar Coastal Red Pine Forest	59.81674	3.09

14. Orhaniye, Çamardı / Niğde (945)



Map 33: Orhaniye-Çamardı Priority Biodiversity Area (DKM 2009)

Table 48: Criticial species for Orhaniye-Çamardı Priority Biodiversity Area

Taxa	Latin Name	Biodiversity Priority
Plant	Crocus sieheanus	8.50
Small Mammal	Crocidura arispa	4.41
Butterfly	Nymphalis polychloros polychloros	3.93
Reptile	Vipera xanthina	3.52
Butterfly	Polyommatus menalcas	3.30
Butterfly	Plebeius alcedo	3.21
Butterfly	Polyommatus mithridates	3.13
Butterfly	Polyommatus ossmar ossmar	2.99

4.3. Ecosystem Services

Intact or natural ecosystems generate a variety of goods and services important for human wellbeing, collectively called ecosystem services*.* These can be anything from fresh water, soil, biological and genetic diversity to crop pollination, carbon sequestration, climate stabilization, and recreation. The United Nations' Millennium Development Goals and the Millennium Ecosystem Assessment highlight the enormous value of the goods and services people obtain from ecosystems and the crucial role these services play in sustaining economic viability (MA 2005). Ecosystem services are categorized into four types (MA 2005):

- provisioning services (e.g., food, timber, medicines, water and fuels)
- regulating services (e.g., water purification and carbon sequestration)
- supporting services (e.g., climate regulation and nutrient cycling)
- cultural services (e.g., aesthetic values and sense of place)

These ecosystem goods and services generate value when they are enjoyed directly by people (e.g., eating fish) or indirectly when they support the production and quality of other things people enjoy (e.g., instream flows support fish).

Scientists agree that ecosystem services are essential to civilization. Ecosystem services operate on such a grand scale and in such intricate and little-explored ways that most could not be replaced by technology. However, human activities are already impairing the flow of ecosystem services on a large scale. If current trends continue, humanity will dramatically alter virtually all of Earth's remaining natural ecosystems within a few decades.

Scientific data analyzed by Daily *et al.* (1997) show that:
Many of the human activities that modify or destroy natural ecosystems may cause deterioration of ecological services whose value, in the long term, dwarfs the short-term economic benefits society gains from those activities.

- Considered globally, very large numbers of species and populations are required to sustain ecosystem services.
- The functioning of many ecosystems could be restored if appropriate actions were taken in time.

In this section, we will overview the ecosystem services generally associated with the biomes or ecosystems found in the Seyhan Basin.

4.3.1. Grassland Ecosystem Services

Grasslands produce a variety of goods and services for humans, though only a few of them have market value. Meat, milk, wool and leather are the most important products currently produced in grasslands that have a market value. On the other hand, grassland ecosystems confer many other vital and often unrecognized services such as maintenance of the composition of the atmosphere, maintenance of the genetic library, amelioration of weather, and conservation of soils.

In many cases, the value of services provided by grasslands in terms of production inputs and sustenance of plant and animal life may be larger than the sum of the products with current market value (Sala and Paruelo 1997).

Carbon Sequestration

Grasslands sequester large quantities of carbon as soil organic matter, which are rapidly transferred into the atmosphere when ploughed and converted into agricultural land. In comparison with other ecosystems such as forests, grasslands store most of their carbon belowground.

Genetic Library

As in other ecosystems, the grasslands also contain a large amount of genetic material. The grasslands in the Mediterranean ecoregion are especially important for this service as they are the native homelands of many domesticated crop species such as wheat, barley, and legumes such as peas, onions etc. Grasslands are also the centre of origin of many domesticated animals such as goats, sheep and cattle.

Therefore the genetic resources of grasslands have a disproportionately large conservation value for humans, who depend on a limited number of grassland species for nutrition, medicine, fibre and shelter.

Grasslands represent the natural ecosystem from where a large proportion of domesticated species originated, and where wild populations related to the domesticated species and their associated pests and pathogens still thrive. These areas are most likely to provide new strains that are resistant to diseases or contain new features important for humankind.

Weather Control

There is research that suggests that healthy grasslands, as compared with degraded grasslands have a positive effect on climate. They buffer ambient temperatures and limit excessive warmth to a certain degree. Healthy grasslands' community structure and vegetation cover translate in a lower albedo, which is the amount of energy reflected by the land surface.

Soil conservation

Healthy grassland ecosystems are very efficient at protecting soil against erosion. Soil erosion on the site translates in losses in production potential, infiltration, water availability and nutrient availability. Off-site erosion costs include expenditures such as the increased costs of obtaining a suitable water supply, increased drainage problems, increases in flood damage, and a decreased potential for water power. This service is critical for Turkey which faces soil erosion on 90% of its territory, of which 63% is at very severe levels. In fact, the amount of soil transported by rivers in Turkey is 7 times higher than that transported in the US, 17 times than in Europe and 22 times than in Africa (TEMA 2009).

Forage Production

Forage production is a provisioning service in the grasslands that supports both native herbivores and domestic livestock. This service is all the more important in the Seyhan Basin as it supports the traditional lifestyles of the Yörük nomads, a group that practice animal husbandry.

4.3.2. Wetland Ecosystem Services

Mediterranean wetlands supply an important flow of ecosystem services, such as food, freshwater supply, water purification, erosion control, natural hazard regulation such as flood control, climate change mitigation, recreational or tourism opportunities, as well as aesthetic values, and finally act as a reservoir of biodiversity (Ramsar Bureau 2009, MedWet 2009).

Prevention of Saline Water Intrusion

Coastal freshwater wetlands can help to maintain supplies of drinking, and irrigation water to local communities and prevent salinization of the soil. In low-lying coastal wetlands where the underlying substrate is permeable, a wedge of freshwater frequently overlies deeper saline water, preventing it from moving to the surface.

Removal or reduction of this freshwater wedge through degradation (e.g. through groundwater abstraction) or removal of a wetland can allow the deeper saline water to penetrate the land surface, causing water quality problems

Water Purification

Plants and soils in wetlands play a significant role in purifying water. High levels of nutrients such as phosphorous and nitrogen, commonly associated with agricultural run-off, are effectively removed by wetlands. This is important in preventing high concentrations of these nutrients reaching groundwater supplies or other water sources that may be used for drinking water. This service is all the more important for the wetlands in the Seyhan Delta as the Seyhan Basin is intensively used for agriculture.

Flood Control

Wetlands hold on to heavy rainfalls, preventing possible flooding. By storing the water in the soil or retaining it in the surface waters of lakes, marshes, etc., wetlands reduce the need for expensive engineered structures. Wetland vegetation also plays a role in slowing down the flow of flood water.

Shoreline Stabilization and Storm Protection

Coastal wetlands can help prevent or reduce erosion of coastlines by acting as a physical barrier to seawater intrusion. Plant roots can bind and stabilise soil/sediment and vegetative matter, reducing erosion. In addition, wetland vegetation can shield from damage caused to farmland or buildings by strong salt-laden wind. This can be a sustainable and highly cost effective method of sea defence. Deltas like the Seyhan delta are formed from sediment brought down and deposited by the river. As sediment arrives the delta expands naturally outwards into the sea.

Climate Change Mitigation

Wetlands play at least two critical roles in mitigating the effects of climate change: one in the management of greenhouse gases, especially carbon dioxide, and the other in physically buffering climate change impacts. Wetlands will play a further role as the frontline defenders of coastal and inland areas as we deal with the full effects of climate change: increasing frequency of storms, changing rainfall patterns, rising sea-levels and sea surface temperatures.

Reservoirs of Biodiversity

Many species of animals and plants and their habitats depend on wetlands for their continued existence. Some species live permanently in wetlands and others depend on them for key aspects of their life cycles (such as resting points on routes for migratory birds, spawning grounds for fish). Many rare or threatened species depend on wetlands and people value their continued presence in their own right and not as a source of food or other direct use.

The Tuzla and Akyatan Lagoons in the Seyhan Delta are very important locations for birds. Many species of birds use the area for wintering or even for breeding, including some globally threatened species. The site is also important in terms being a final resting place before the long journey towards Africa for many migratory species.

Chelonia mydas, the green sea turtle is listed as globally endangered by IUCN, and the Mediterranean population is regarded as critically endangered. Only 200–300 nesting females remain. Whilst 99 percent of all recorded nesting in the Mediterranean occurs in Turkey, Cyprus and Syria, 80 percent of all nests are concentrated at only seven key nesting beaches, thus making the population highly vulnerable. Turkey has by far the largest share of the Mediterranean population, and nesting is mostly concentrated on four beaches: Akyatan in the Seyhan delta, Kazanli, Yumurtalik and Samandag (MEDASSET, 2005)

Wetland Products

Wetlands also provide benefits to humans in the form of products that can be exploited for human use. The range is enormous: fruit, fish, shellfish, game meat, reeds for thatching and weaving, fodder for animals, etc. The average annual fish production in the Tuzla nursery reaches 40 tonnes a year, while production in the Akyatan nursery surpasses 250 tonnes a year.

Recreation

The natural beauty as well as the diversity of animal and plant life in many wetlands makes them very good locations for local tourists and a very important site for the growing number of Turkish bird watchers.

4.3.3. Forest Ecosystem Services

Forests are one of the world's most important renewable natural resources, supplying timber for fuel, building materials, paper, and other goods, including non-wood products, such as fruit, herbs and other food sources.

Forests also provide non-market amenity services. These include cleaning and preserving the natural environment, filtering water, cleaning the air, soil formation, preventing erosion, preserving biodiversity, nutrient recycling, pollination, reducing the threat of climate change, and providing flood control services. There is also an increasing understanding in Turkey of the economic value of forests for recreation and tourism purposes.

Carbon Sequestration

Trees absorb CO_2 from the air during photosynthesis and store them in their branches, root and leaves, effectively becoming carbon sinks. This carbon sequestration function is vital in the defence against climate change. Forests are known to be the most effective carbon storing ecosystem.

Biodiversity Reservoir

The forests of Seyhan Basin hold very valuable biodiversity. Placed in one of the 35 biodiversity hotspots in the world they are home to a large number of endemic and threatened fauna and flora species.

Soil formation and conservation

Soils are a renewable resource, but our uses of soil are not sustainable if erosion or other disturbances exceed formation or recovery. It is possible to maintain or improve soil conditions on a site by maintaining or increasing organic matter, nutrients and soil organism diversity. A simple slogan about soil conservation is: keep it in place, keep it porous and keep it organically rich. Forests do just that.

Flood control and water purification

Rain water running off trees gets trapped in the porous soil of the forest where it is retained for trees and plants as a water source. This also serves to limit water run-off into streams and filters various minerals and impurities from the water before it hits streams and rivers.

Providing Services

Forests form the basis of a variety of industries including timber, processed wood and paper, fruits etc. However, they also contain products that are necessary to the viability of rural agricultural communities. These products include fuel and fodder, game, fruits, building materials, medicines and herbs.

Pollination

The variety of bees and insects living in the forest not only help the regeneration of forest plant communities, but also serve to pollinate the nearby agricultural fields, effectively increasing yields (Ülgen and Zeydanlı 2008).

5. Vulnerabilities and Recommendations for adaptation and further studies

5.1. Critical areas

Particularly the southern part of the Seyhan Basin is a well known part of Turkey in terms of its rich biodiversity. Many organizations such as Doğa Derneği, WWF Turkey, Turkish Society for the Conservation of Nature (DHKD), Nature Conservation Centre and Ministry of Environment and Forestry have carried out biodiversity surveys in the area (Özhatay *et al.* 2005, Eken *et al*. 2006, Kılıç and Eken 2004, Zeydanlı *et al*. 2005, DKM 2009). All of them pinpoint to three areas in the southern part of the Basin: Seyhan Delta, Bolkar Mountains and Aladağlar. These areas are well known endemism centers and biodiversity hotspots since 1970s (Zohary 1971, 1973, Davis 1971).

Among these studies we recommend the use of outcomes of the Anatolian Diagonal Biodiversity Project due to following reasons;

- It covers all the areas highlighted by other studies,
- Uses many different taxa in analysis,
- Is based on extensive field surveys,
- Uses vegetation as a data layer,
- Includes ecological and evolutionary processes,
- Includes socio-economical data,
- Gives more detailed (in 10x10 km^2 grids) priority area list,
- Identifies priority sites in the northern part of the Basin as well.

These areas are listed in the Table 34. However, it should be noted that these are only the most irreplaceable areas. Should there be an opportunity to include more sites in the conservation and sustainable development plans, the priority area list can be extended.

5.2. Critical Flora Species

Seyhan Basin is situated in one of the well known global plant endemism centres (Davis 1971, Boulos and Miller 1994). Consequently there are many local endemics that are known only from one or two locations. Aladağlar and Bolkar Mountains is home to a bulk of these species as these areas appear important in all of the prioritization studies.

It is known that rare species will be effected the most from the global climate change and we recommends that their persistence be included in the regional actions plans. Plant species listed in Table 49 have to be considered in that respect.

Table 49: List of critical plant secies

Source	Taxa	Conservation feature name	Endemism	IUCN Threat Category	Priority Score
AD	Plant	Aethionema huetii	Endemic	CR	8,50
AD	Plant	Anthemis antitaurica	Endemic	CR	8,50
AD	Plant	Anthemis oxylepis	Endemic	DD	8,50
AD	Plant	Asperula cilicica	Endemic	CR	8,50
AD	Plant	Astragalus stridii	Endemic	EN	8,50
AD	Plant	Asyneuma trichostegium	Endemic	CR	8,50
AD	Plant	Centaurea anthemifolia	Endemic	EN	8,50
AD	Plant	Centaurea goeksunense	Endemic	CR	8,50
AD	Plant	Cirsium aytachii	Endemic	CR	8,50
AD	Plant	Crocus adanensis	Endemic	CR	8,50
AD	Plant	Crocus sieheanus	Endemic	EN	8,50
AD	Plant	Gentiana boissieri	Endemic	EN	8,50
AD	Plant	Micromeria cilicica	Endemic	CR	Yok
AD	Plant	Paronychia kayseriana	Endemic	EN	8,50
AD	Plant	Sedum inceii	Endemic	CR	8,50
AD	Plant	Seseli marashica	Endemic	CR	Yok
AD	Plant	Verbascum hadschinense	Endemic	CR	8,50
AD	Plant	Gentianella holosteoides	Endemic	DD	8,00
AD	Plant	Helianthemum strickeri	Endemic	DD	8,00
AD	Plant	Allium stenopetalum	Endemic	EN	7,00
AD	Plant	Alyssum trapeziforme	Endemic	EN	7,00
AD	Plant	Centaurea chrysantha	Endemic	EN	7,00
AD	Plant	Centaurea sieheana	Endemic	CR	7,00
AD	Plant	Draba acaulis	Endemic	CR	7,00
AD	Plant	Euphorbia schottiana	Endemic	DD	7,00
AD	Plant	Galium aladaghense	Endemic	EN	7,00
AD	Plant	Graellsia davisiana	Endemic	EN	Yok
AD	Plant	Johrenia alpina	Endemic	EN	Yok
AD	Plant	Silene fenzlii	Endemic	EN	7,00
AD	Plant	Thurya capitata	Endemic	EN	Yok
AD	Plant	Alchemilla rivularis	Endemic	DD	6,50
AD	Plant	Linum empetrifolium	Endemic	DD	6,50
AD	Plant	Verbascum lyratifolium	Endemic	LC	6,50
AD	Plant	Veronica surculosa	Endemic	DD	6,50
AD	Plant	Dianthus goerkii	Endemic	EN	6,25
AD	Plant	Ferula longipedunculata	Endemic	EN	6,25
AD	Plant	Silene caryophylloides ssp binbogaense	Endemic	CR	6,18
AD	Plant	Lactuca glaerosa	Endemic	EN	6,17
AD	Plant	Verbascum adenocaulon	Endemic	CR	6,17
AD	Plant	Thesium cilicicum	Endemic	NT	6,00
AD	Plant	Achillea spinulifolia	Endemic	NT	5,92
AD	Plant	Veronica kotschyana	Endemic	NT	5,92
AD	Plant	Ferulago pachyloba	Endemic	EN	5,80
AD	Plant	Campanula trachyphylla	Endemic	NT	5,75
AD	Plant	Hypericum crenulatum	Endemic	NT	5,73
AD	Plant	Sideritis phlomoides	Endemic	VU	5,73
AD	Plant	Hesperis anatolica	Endemic	VU	5,47
AD	Plant	Potentilla pulvinaris ssp argentea	Endemic	CR	5,43
AD	Plant	Geranium cinereum var elatius	Endemic	EN	5,34
AD	Plant	Tordylium elegans	Endemic	NT	5,21

AD	Plant	Verbascum cilicicum	Endemic	EN	5,17
KBA	Plant	Achillea monocephala	Endemic	EN	Yok
KBA	Plant	Aethionema demirizii	Endemic	EN	Yok
KBA	Plant	Alchemilla paracompactilis	Endemic	DD	Yok
KBA	Plant	Alkanna pinardii	Endemic	EN	Yok
KBA	Plant	Ambrosia maritima	Non-endemic	EN	Yok
KBA	Plant	Anthemis adonidifolia	Endemic	CR	Yok
KBA	Plant	Anthemis halophila	Endemic	EN	Yok
KBA	Plant	Asperula cilicica	Endemic	CR	Yok
KBA	Plant	Astragalus bakirdaghensis	Endemic	EN	Yok
KBA	Plant	Astragalus goeznensis	Endemic	EN	Yok
KBA	Plant	Astragalus stenosemioides	Endemic	EN	Yok
KBA	Plant	Bromus psammophilus	Endemic	CR	Yok
KBA	Plant	Campanula bluemelii	Endemic	EN	Yok
KBA	Plant	Crocus paschei	Endemic	EN	Yok
KBA	Plant	Cyclamen pseud-ibericum	Endemic	EN	Yok
KBA	Plant	Cyprinia gracilis	Non-endemic	EN	Yok
KBA	Plant	Delphinium nydeggeri	Endemic	EN	Yok
KBA	Plant	Dianthus nihatii	Endemic	CR	Yok
KBA	Plant	Draba elegans	Endemic	CR	Yok
KBA	Plant	Echinops mersinensis	Endemic	CR	Yok
KBA	Plant	Erodium leucanthum	Endemic	EN	Yok
KBA	Plant	Ferula drudeana	Endemic	CR	Yok
KBA	Plant	Flueggea anatolica	Endemic	CR	Yok
KBA	Plant	Galanthus nivalis ssp. cilicicus	Non-endemic	EN	Yok
KBA	Plant	Galium membranaceum	Endemic	DD	Yok
KBA	Plant	Hedysarum antitauricum	Endemic	EN	Yok
KBA	Plant	Helichrysum peshmenianum	Endemic	EN	Yok
KBA	Plant	Heptaptera cilicica	Endemic	EN	Yok
KBA	Plant	Hieracium argaeum	Endemic	EN	Yok
KBA	Plant	Hyacinthella lazulina	Endemic	EN	Yok
KBA	Plant	Hypericum rupestre	Endemic	EN	Yok
KBA	Plant	Kitaibelia balansae	Endemic	EN	Yok
KBA	Plant	Limonium tamaricoides	Endemic	EN	Yok
KBA	Plant	Linum anisocalyx	Endemic	EN	Yok
KBA	Plant	Linum ciliatum	Endemic	DD	Yok
KBA	Plant	Myosotis diminuta - Anadolu	Non-endemic	EN	Yok
KBA	Plant	Myosotis ramosissima ssp. uncata	Endemic	EN	Yok
KBA	Plant	Onosma papillosum	Endemic	EN	Yok
KBA	Plant	Origanum boissieri	Endemic	CR	Yok
KBA	Plant	Papaver arachnoideum	Endemic	EN	Yok
KBA	Plant	Pastinaca zozimioides	Endemic	DD	Yok
KBA	Plant	Poa speluncarum	Endemic	EN	Yok
KBA	Plant	Polygala inexpectata	Endemic	EN	Yok
KBA	Plant	Potentilla pulvinaris ssp. pulvinaris	Endemic	EN	Yok
KBA	Plant	Reseda balansae	Endemic	EN	Yok
KBA	Plant	Rosularia sempervivum ssp. glaucophylla	Endemic	EN	Yok
KBA	Plant	Rosularia tauricola	Endemic	EN	Yok
KBA	Plant	Salvia quezelii	Endemic	EN	Yok
KBA	Plant	Scutellaria rubincunda ssp.	Endemic	CR	Yok

		pannosula			
KBA	Plant	Thlaspi crassum	Endemic	EN	Yok
KBA	Plant	Thlaspi rosulare	Endemic	CR	Yok
KBA	Plant	Trigonella cilicica	Endemic	EN	Yok
KBA	Plant	Verbascum linearilobum	Endemic	EN	Yok
KBA	Plant	Viola sandrasea ssp. cilicica	Endemic	EN	Yok

AD : Anatolian Diagonal Biodiversity Project
KBA : Key Biodiversity Areas

5.3. Critical Fauna Species

Seyhan Basin is host to many rare fauna species varying from reptiles to butterflies. As for plants, Aladağlar and Bolkar Mountains contain the bulk of these species (DKM 2009). On the other hand, Seyhan Delta system provides a sanctuary for many important reptile and fish species.

Table 50: List of critical fauna secies

Source	Taxa	Taxa Name	End	Threat Category	Priority Score
AD	Butterfly	Pyrgus aladaghensis	Endemic	Less Important (1)	8,50
AD	Butterfly	Polyommatus theresiae	Endemic	Less Important (1)	7,00
AD	Butterfly	Argynnis aglaja ottomana	Endemic	Less Important (1)	5,43
AD	Butterfly	Satyrus ferula	Non-endemic	Very Important (5)	5,33
AD	Butterfly	Pseudochazara lydia obscura	Endemic	Less Important (1)	5,26
AD	Butterfly	Melanargia syriaca syriaca	Endemic	Medium Important (2)	4,93
AD	Butterfly	Polyommatus sigberti(actis)	Endemic	Medium Important (2)	4,88
AD	Butterfly	Lycaena virgaureae aureomicans	Endemic	Medium Important (2)	4,67
AD	Mammal	Felis chaus	Non-endemic	EN	4,58
AD	Reptile	Caretta caretta	Non-endemic	EN	4,50
AD	Small Mammal	Crocidura arispa	Non-endemic	LC	4,47
AD	Butterfly	Colias chlorocoma	Non-endemic	Very Important (7)	4,15
AD	Reptile	Chelonia mydas	Non-endemic	EN	4,13
AD	Butterfly	Hipparchia aristaeus senthes	Non-endemic	Less Important (1)	4,00
AD	Bird	Dryocopus martius	Non-endemic	LC	3,92
AD	Bird	Emberiza cirlus	Non-endemic	LC	3,92
AD	Reptile	Vipera xanthina	Endemic	LC	3,78
AD	Bird	Burhinus oedicnemus	Non-endemic	LC	3,75
AD	Butterfly	Hipparchia mersina	Endemic	Very Important (7)	3,70
AD	Butterfly	Satyrus favonius favonius	Endemic	Very Important (7)	3,70
AD	Butterfly	Muschampia poggei poggei	Non-endemic	Important (3)	3,65
AD	Butterfly	Thymelicus hyrax	Non-endemic	Very Important (5)	3,65
AD	Butterfly	Argynnis adippe taurica	Endemic	Medium Important (2)	3,63
AD	Butterfly	Plebeius pyrenaicus dardanus	Non-endemic	Very Important (5)	3,63
AD	Bird	Charadrius alexandrinus	Non-endemic	LC	3,58
AD	Butterfly	Melitaea arduinna	Non-endemic	Important (3)	3,58
AD	Bird	Dendrocopos leucotos	Non-endemic	LC	3,55
AD	Mammal	Hyaena hyaena	Non-endemic	NT	3,54
AD	Bird	Glareola pratincola	Non-endemic	LC	3,54
KBA	Freshwater Fish	Alosa fallax nilotica	Non-endemic	DD	Yok
KBA	Butterfly	Archon apollinus	Non-endemic	EN	Yok

KBA	Freshwater Fish	Barbatula seyhanensis	Endemic	EN	Yok
KBA	Mammal	Felis chaus	Non-endemic	EN	Yok
KBA	Bird	Grus grus	Non-endemic	EN	Yok
KBA	Bird	Halcyon smyrnensis	Non-endemic	EN	Yok
KBA	Butterfly	Melanargia titea	Non-endemic	EN	Yok
KBA	Reptile	Montivipera xanthina	Non-endemic	CR	Yok
KBA	Butterfly	Muschampia proteides	Non-endemic	EN	Yok
KBA	Bird	Neophron percnopterus	Non-endemic	EN	Yok
KBA	Butterfly	Polyommatus poseidon	Non-endemic	EN	Yok
KBA	Butterfly	Pseudophilotes baviu	Non-endemic	EN	Yok
KBA	Butterfly	Tomares nogelli	Non-endemic	EN	Yok
KBA	Reptile	Trionyx triunguis	Non-endemic	CR	Yok

AD : Anatolian Diagonal Biodiversity Project
KBA : Key Biodiversity Areas

5.4. Continuity of the Ecosystem Services

Climate change is likely to substantially alter or even eliminate certain ecosystem services. To better understand the consequences of climate change and to develop effective means of adapting, it is critical that we improve our understanding of the links between climate, ecosystems, and the economic value of ecosystem services. Shaw *et al.* (2009) report that under most scenarios of climate change, the provision of all the ecosystem services they studied will decline, leading to a decline in the economic output and well-being.

Projections show that this change on ecosystems may be all the more important in the Mediterranean region. For example, areas suitable for forage production to support cattle grazing in natural areas could shift as some parts of the Basin become too dry to support forage and others become wetter. The ability of the forests to sequester carbon and support climate stabilization could be hindered as productivity decreases and fires increase. And increased salinity and water temperatures in wetlands and streams due to a decrease in provision of fresh water could seriously alter fish reproduction. All of these ecosystem services have economic value and that value and its distribution is likely to changes under a changing climate.

Our scientific understanding of the links between climate, ecosystems, and economic value is still poorly developed. A comprehensive research program focused on developing models and estimating the impacts of climate change on ecosystem services will be an important tool for reversing current and future losses in the economic value of our natural ecosystems.

To investigate ecosystem service supply during the 21st century, Schroter *et al.* (2005) used a range of ecosystem models and scenarios of climate and land-use change to conduct a Europe-wide assessment. The models suggested that among all European regions, the Mediterranean was most vulnerable to global change. The impacts to Mediterranean regions included water shortages, increased risk of forest fires, northward shifts in the distribution of typical tree species, and losses of agricultural potential. Mountain regions also seemed vulnerable because of a rise in the elevation of snow cover and altered river runoff regimes.

5.4.1. Effects of Climate Change on the Ecosystem Services Provided by Grasslands

Carbon stocks in grasslands are largely determined by factors such as precipitation and temperature. Carbon stocks in the soil of grasslands increase with precipitation, mainly as a result of increased primary production. On the other hand, stocks decrease with increasing temperatures as a result of increased decomposition. As temperature are expected to increase and precipitation decrease with climate change, the very important service of ***carbon sequestration*** provided by grasslands will be impaired (Sala and Paruelo 1997).

The effect of climate change on carbon sequestration is compounded by the ploughing and tilling activities that come with agricultural practices in the Basin. Tillage is an activity that releases large amounts of carbon into the atmosphere. The majority of the grassland areas that have a permitting slope and are adequately productive are converted to agriculture. However carbon losses as a result of cultivation are very large. At a global scale, agriculture has made a significant contribution to the observed increase in atmospheric CO_2. Analysis of tree rings in the US, which are indicative of the CO_2 concentration of the atmosphere in the past, showed that the rapid transformation of native ecosystems into croplands that occurred between 1960 and 1890 contributed one and a half times the amount of CO_2 produced by all the fossil fuel emissions through 1950 (Sala and Paruelo 1997).

The current status of grasslands in the Basin is already dire due to overgrazing. The effect of overgrazing will be increasingly compounded by the effects of climate change. Due to the expected shortage of water and humidity, grassland composition will start to shift more in favour of small woody plants, or so called chamaeophytic species, which have a higher capacity of effectively using water. As most chamaeophytic species are unpalatable for livestock, this in turn will further decrease the range of grasslands available for ***forage production***.

The domination of these small woody species will consequently alter the species composition of grasslands and will put in peril the important ***genetic library*** in these ecosystems, especially the parent species of today's domesticated crops, and their associated communities.

The ability of grasslands to ***conserve soil*** may be compromised as with increasing temperatures and lower levels of precipitation, especially compounded with unsustainable grazing, more and more barren patches of soil will be present. The most important type of soil erosion is caused by water overflow. Even though we predict rainfall will decrease, and consequently the associated soil erosion on barren terrain with slope, the risk of loosing fertile soil will still be very high due to the expected increase in flash floods and increasing amount of barren soil.

Recommendations

In order to safeguard many of the ecosystem services that grasslands provide such as carbon sequestration, genetic library, weather control and soil conservation, we recommend that:

- A study be started with the Ministry of Agriculture and Rural Affairs, looking more specifically into the combined effects of current grazing and agriculture policies and climate change on grasslands. Economic comparisons should be drawn for the potential scenarios, and a suitable policy should be developed.
- Because the global carbon market exchange only values carbon sequestered above ground, as in trees, it may not seem important to assess real economic gain from the carbon sequestered by grasslands. However, it is still important to quantify and bestow a value to this service as it affects the climate change itself and local weather patterns.

5.4.2. Effects Of Climate Change on the Ecosystem Services Provided by Wetlands

On a global scale, wetlands are amongst the most threatened ecosystems as a result of drainage, land reclamation and pollution; in the Mediterranean Basin alone half of the wetlands and salt marshes have been lost over the past three decades.

Unfortunately many ecosystem components and services lie outside conventional markets, and so their real value is difficult to capture in terms of the costs of climate change. For example, biodiversity is a key factor in ecosystem resilience: biodiversity loss does not only mean loss of species, but also loss and degradation of ecosystem functions and capacity to deliver services.

According to a report published by the European Environment Agency, climate change will have profound impacts on the coastal environment such as desertification along the Mediterranean coasts; sea level rise affecting low lying areas; increased erosion of coastlines and deltas. Climate change will impact coastal wetlands as a result of the interactive effects of sea level rise, warming, and decrease in precipitation.

In all models run by Shaw *et al.* (2009) rivers in Mediterranean type climate show an increase in average flows in the winter as a result of more precipitation falling as rain instead of snow. Consequently, all model-scenario combinations show a significant decrease in average flow in the dry months, with the greatest drop in June and July.

Coastal ecosystems, and particularly coastal lagoons along the shores of semi-enclosed seas, could be severely reduced or even disappear during this century. This is particularly so in areas with low tidal ranges backed by intense human use, which limits the scope for onshore migration and coastal subsidence. More flooding events are also expected because of both climate change and reduced natural retention capacity of the land following its sealing or conversion from, for example, coastal wetlands. (EEA, 2007). In other words, the ***flood control service*** of coastal wetlands such as the Akyatan lagoons will be severely compromised.

Deltas like the Seyhan Delta depend on sediment deposition to exist and to keep providing all the services listed above. However dams upstream of the wetlands hold the sediments that the delta so critically depends on. For example The Nile delta in Egypt, has seen a reduction in silt load as a result of sediment trapped upstream in the Aswan damn. This has contributed to a retreat of the delta by two kilometres between 1971 and 1988. The effects of dams, combined with the effects of climate change create a fatal risk for the continued existence of the Seyhan Delta.
Evaporation rates will increase and regional water tables will continue to lower as a result of climate change (EEA, 2007). This will impair the ***freshwater supplying service*** of wetlands.
As wetlands start to dry, the enormous amounts of carbon dioxide previously stored in them will be released to the atmosphere. Wetlands will not only loose their efficiency in ***storing carbon dioxide***, but be actual contributors to climate change.

We should also keep in mind that a non-negligible amount of agriculture is practiced in the Seyhan Basin. More water will need to be drawn from the Seyhan River as precipitation levels diminish. This means lesser and lesser freshwater input to the coastal wetlands. This also implies a change in the salinity of the lagoons, and therefore a change in the composition of ***resident biodiversity***. Some species whose life cycles require the less saline waters will start to disappear. Similarly, the economic implications in terms of decreased ***fish production*** may be disastrous.

An additional complication caused by the loss of wetlands, and therefore the diminishing surface of aggregation for birds is that wild birds become more concentrated on the remaining wet areas where they increasingly come into contact with the poultry kept for domestic food production, so increasing the risks of transmission of bird flu. This affects both the ***food provision service*** of wetlands, by actually endangering the domestically raised poultry, and creates an enormous ***human health risk*** by laying the grounds for epidemics.

Recommendations:

- It is of utmost urgency that the farmers adopt drastically more efficient ways of irrigation in their agriculture practices in order to conserve water and therefore wetlands. State policies should immediately devise incentive policies to drive this kind of change in behaviour.
- Though all wetlands are threatened in Turkey, the Ministry of Forestry and Agriculture should give priority to the conservation of Mediterranean Wetlands as without exception, all the models predict that they are the most vulnerable under global climatic change.
- A minimum amount of flooding and release of water with silts from the upstream dams should be calculated and allowed to take place for the continued existence of the Delta.

- Even to date, vast areas of coastal wetlands are being drained at an incredibly fast rate in favour of the tourism industry, especially in the Antalya region. The loss of these wetlands increases the burden on the remaining ones and makes them even more valuable service assets for the well-being people in the region. It is imperative to keep our options living, so we can keep receiving all the above-mentioned free services. The income generated by tourism will no doubt fall vastly short of covering the financial burden of the services no-longer provided by wetlands. We recommend that the Ministries of Environment and Forestry and the Ministries of Tourism and Culture plan a sustainable way for tourism to develop concerning wetlands.

5.4.3. Effects of Climate Change on the Ecosystem Services Provided by Forests

The very service that keeps climate change from happening even faster than it does is threatened by climate change itself. Carbon sequestration is a service that most ecosystems provide at various degrees, whether the carbon is stored above or below ground, in living or dead organic matter.

However models suggest that the capacity of Mediterranean forests to ***sequester carbon*** will be lowered by climate change (Shaw et. al. 2009). The two important reasons for this are:

1. The projected decline in the total area of conifer forests due to water stress. Although higher amounts of CO_2 captured from the atmosphere make it possible for the trees to use the available water more efficiently, the trees will nevertheless feel the effects of the lowering amount of available water.
2. Fire losses will be significant as temperatures rise and humidity drops. This has a two-fold effect: more CO_2 will be released to the atmosphere with burning organic matter, and there will be fewer trees to capture the atmospheric CO_2.

Most ecosystems are able to store carbon and, in many instances, may cost less per ton of carbon stored than other means of reducing atmospheric carbon or emissions. Climate change, however, could substantially change the ability of natural ecosystems to store carbon. Using market prices for carbon emissions, which have emerged from cap and trade systems and voluntary markets, Shaw *et al.* 2009 estimate that the impacts of climate change between 2005 and 2034 could result in a potential loss in carbon storage that would otherwise have had a market value of $325 million and $3 billion.

Changing climate will influence forests through impacts on other biotic factors such as pests and diseases. Climate change in some areas of Turkey and the world is already providing insect species with increasingly hospitable habitats, while their movement is further facilitated by wider global commerce. Climate change will have an impact on ***forest health*** (FAO).

Forest fires will have a different effect under climate change. Not only will they be more frequent and more severe, the vegetation that will colonize the area after the fire will tend to be different than the original cover, even in the longer term, once the system is closer to climax. Smaller, more water resistant species will dominate over conifers which already show water stress in many semi-arid climates around the world.

The same would hold true after a forest clear cut. Even if the area is re-forested, the chances of a forest type similar to the former one growing is getting slimmer. Regeneration failures are increasing in semi-arid regions of the world. Silvicultural interventions are not always done taking forest health and all forest ecosystem services into consideration. They are mostly geared towards economic profit. However, with changing climatic conditions, forests will respond differently to the traditional silvicultural practices.

The changing forest type will see a change in its ***biodiversity composition***, possibly losing many species dependent on the former forest type and unable to migrate to better suited habitats for lack of connecting corridors. Even though close to one quarter of Turkey's surface is covered by forests Turkish forests are among the most fragmented in the world. Connecting corridors will become of utmost importance for saving critical biodiversity that will need to migrate with changing climatic conditions.

Recommendations:

Forests are among the two major ecosystems to capture ambient CO2. It is important, for climate control and to mitigate many effects of climate change to keep healthy forest ecosystems in the Seyhan Basin.

We recommend that:

- An economic analysis be done comparing the gain obtained by forestry practices and the potential loss of the carbon sequestration service. This will be all the more significant once Turkey enters the carbon exchange market. The potential economical gains that will be obtained by these forests' carbon sequestration service, coupled with other services will likely outweigh the gains from timber production, especially as the timber value seems to be on a decline.
- That a study be conducted to identify the changes the forestry sector needs to adopt in its practices in light of the current knowledge concerning forests and climate change. One example is the ploughing of the cleared forest land to be re-forested as ploughing releases a considerable amount of carbon into the atmosphere.
- A study be conducted on the responses of forests to current management practices under current and future climatic conditions and fine tune both management and silvicultural practices so that the forests keep on being economically productive, and retain their ecosystem services.
- A study be performed showing the current and possible future locations of forests, the migration needs of critical species, and the necessary connecting corridors that need to be formed to ensure the survival of these species.

- Planted forests increasingly fulfil 2010 biodiversity objectives also pledged by Turkey. One good way of achieving this is to bestow a corridor function on them and plan them accordingly.

5.4.4. Effects of Climate Change on Terrestrial Biodiversity

Without always being totally clear about the specific processes, scientists believe that most of the services ecosystems provide depend on the biodiversity living in these ecosystems. Micro-organisms that aerate the soil and increase the soils capacity to retain water and prevent floods, reeds in wetlands that capture pollutants in the water and thus purify the water, chlorophyll containing trees and plants that capture CO_2 and release O_2 are just some obvious examples of how the diversity of life plays an important role in providing for ecosystem services.

In healthy ecosystems, the role played by one species may be overtaken by another species should the former species become extinct for a reason. The complexity of the web of life usually allows for such back-up plans. The problem arises when there are too many threats on too many species, for too long of a time-span as the situation is today for global biodiversity. The cumulative effect of the stated conditions is that today we are facing a rate of extinction unrivalled by any other period in Earth's history. Therefore, aside from the intrinsic value every single life form holds, they are now all the more valuable as we need to keep our options alive if we want to keep receiving the ecosystem services we so desperately depend on.

Unfortunately, across all broad taxonomic groups surveyed by Shaw *et al.* 2009 projections suggest increasing atmospheric greenhouse gases substantially increases negative biodiversity impacts. Forecasts of large-scale migrations, range contractions, and losses of historical refugia are common and widespread. It is unclear how climate impacts may affect current community composition, but some future assemblages may be entirely novel (Williams and Jackson 2007).

A Europe wide assessment of climate change's impact on biodiversity found that the Mediterranean region will be among the most affected, along with the Arctic and mountain areas (EEA, 2007)

Recommendations

- Species habitat modelling should be carried out for species of particular concern. Results from the rare and threatened terrestrial species distribution model runs performed by Shaw *et al.* 2009 suggest species will migrate towards the poles, towards the coast and upslope. The more severe climate change will be, the bigger migrations will become. A map of potential future refugia will greatly benefit these species (Loarie *et al.* 2008)
- Similarly, ecosystem modelling should also be carried out. We should aim to foresee the shifts in ecosystems and habitats, even though our modelling tools are still not capable to predict the changes that will occur to a certainty. Chan *et al.* 2006 also suggests the mapping of ecosystem services.

- Corridor networks and speciation processes would add value to these mapping endeavours (Davis *et al.* 2008)
- Conservation policies should incorporate the conservation of the potential ranges of species of particular concern, or habitats, or ecosystems and the necessary corridors to get to their potential new ranges.

5.4.5. Other Recommendations on Ecosystem Services

In this section, we have tried to describe the probable general impacts that climate change will have on a subset of Seyhan Basin's existing ecosystem services. However, in order to come closer to understanding the effects of climate change of the ecosystem services of the Basin we recommend that a number of ecosystem services should be selected and their continuity, market and non-market values under changing climatic conditions should be determined.

Even though models indicate that species and habitats will migrate to more suitable locations under changing climatic conditions, this has very little probability in real life, unless very serious measures are taken. For example, it will not be easy to change the boundaries of protected areas that are home to species and ecosystems of high conservation concern. There will be stakeholder issues, land ownership and land use issues to be dealt with. We therefore recommend that the government start making the projections and start adapting policies accordingly.

Another example for why species or ecosystems may not be able to migrate as predicted by models is as follows: let's imagine that a forest in mountainous area will loose its edge lying in the lower altitude. But our model predicts that the forest will expand upslope. However, seasonal grazing is practiced in the alpine meadows starting from the tree line, upslope of the current forest. Even if the forest tries to extend upslope, the young shoots and seedlings will be one of the preferred forage for grazing livestock, thereby preventing the upslope expansion of the forest.

It is therefore very important to pay special attention to the transition zones between different habitats and ecosystems.

Though scientists are doing their best at trying to predict the potential scenarios, they all agree that their models fall short of showing the real dimensions of the effects of climate change. It is therefore essential to start monitoring species and ecosystems to understand the change that is going on. Although many countries in the world have started monitoring the bio-physical effects of climate change, it is important to understand the situation for different regions of Turkey as Turkey is home to 3 out of 35 global biodiversity hotspots defined by Conservation International.

Decision makers are more easily convinced with hard figures. Economic valuation of different ecosystems will show, in no uncertain terms, that many activities humans are undertaking for economic development's sake actually impoverish the same society in the medium to long-term. The cost to ecosystems and the services they provide are externalized in the feasibility studies of economic activities. It is crucial to come up with some figures for values of intact, or at least healthily functioning ecosystems to be able to perform real economic feasibility studies of development activities. Though some countries have done valuation studies, Turkish economists and scientist should perform valuation studies of important ecosystems for Turkey itself. As Troy and Wilson 2006 state, to simply assume that the economic value of a freshwater wetland in one ecological region is going to be the same for a freshwater wetland in a wholly different region would be inappropriate.

With developing technology, the spatial dimension to economic valuation becomes all the more important. The adoption of a spatial approach to economic valuation is recommended in terms of producing more accurate economic valuation figures, for examining spatial sustainability, and facilitating the introduction of natural capital concepts into environmental decision-making processes (Eade and Moran 1996).

Spatial dimension will keep in consideration similarity in the level of scarcity of the service. Systems with an abundance of a given land cover type are more likely to have redundancy in the services it provides. Where there is a scarcity of a natural resource type that provides a given type of service for which no substitute exists, even a small marginal loss of that resource could be devastating and, thus, the value would increase accordingly. For instance, the marginal ecosystem cost of losing a single hectare in a region with 10.000 ha coastal wetlands is likely to be relatively low compared to the cost of losing a hectare in a region where the last remaining 50 ha of coastal wetlands provide critical services.

By mapping ecosystems at higher levels of spatial and categorical precision and accuracy and linking them to reliable ecosystem service flow estimates, we can assist decision makers in the Ministries of Environment and Forestry, Agriculture and Rural Affairs, and Tourism and Culture as they seek to identify their investment portfolios so they do not overlap with critical areas in the delivery of ecosystem services. Since any given location in the landscape can yield a bundle of ecosystem services, the challenge will be determining how to manage landscapes in a manner that maximizes the delivery of value to society while minimizing forgone market opportunities.

Carpenter (2009) report that: "The Millennium Ecosystem Assessment (MA) introduced a new framework for analyzing social–ecological systems that has had wide influence in the policy and scientific communities. Our recommendations coincide with the necessary studies that should be performed after the MA. Our new challenge in the basic science is the need to assess, project, and manage flows of ecosystem services and effects on human well-being.

5.5. Ecological and Evolutionary Processes

Conservation held onto a single species approach for a very long time. Since 1990's, with the advancement of conservation science and availability of spatial tools it has broadened its area of concentration from species to communities, ecosystems and ecological-evolutionary features. Ecological and evolutionary processes *(will be called as processes in short)* are the most critical feature for the endurance of the species, communities and ecosystems (Erwin 1991, Vane-Wright *et al*. 1991, Brooks et al. 1992). Although their importance is well respected, processes are rarely considered in conservation planning as it is not easy to quantify and map them (Spector 2002). After the recognition of the global climate change and its possible impact scenarios for the ecosystems, scientists have started to pay more attention to these processes as it is not possible to develop a long term conservation plan without understanding the ecological and evolutionary systems and processes driving them. It has to be mentioned that this efforts is not only crucial for conservation but essential for natural resource management and sustainable development.

If we are to plan for an evolutionary future, then evolutionary processes—those that maintain genetic diversity and promote diversification—must be explicitly considered, and represented, in the conservation plan (Mortiz 1999, Cowling *et al.* 1999,)" (Cowling and Pressey 2001).

However, there are very few studies trying to quantify and map the ecological and evolutionary processes. These attempts can be classified into four groups based on the literature (Rouget *et al.* 2003, Gaston *et al*. 2001, Spector 2002, Araujo 2002):

<u>1. Landscape Design Criteria (Generic Design Criteria) Components:</u>

Rouget *et al.* 2003 states that the most common approach for addressing processes in conservation planning is generic design criteria such as the size, shape and connectivity of conservation areas (Shafer 1990, Noss *et al.* 1997). These criteria are for the insurance of maintenance of the effective population sizes of species in conservation areas. Therefore demographic, genetic and evolutionary processes important for the maintenance of the minimum viable populations of these species and their adaptation to changing environments (Caughley & Gunn 1996).

<u>2. Species Specific Components:</u>

Identifying the processes according to specific requirements of selected species (i.e. umbrella species, indicator species, focal species) (Lambeck 1997, Carroll *et al*., 2001, Rouget *et al.* 2003). Processes are incorporated into the conservation plans in relation to requirements of these selected species or plans are specifically produced for these species. As it is easier to address processes for a single species and species are the most common conservation targets (eg. Charismatic fauna species) this is the most common means of use of processes.

3. Particular Spatial Components:

The persistence of other biodiversity processes also requires more than generic design criteria. Although it is generally true that more natural processes will continue in larger conservation areas (Cowling *et a*l. 1999, Pressey *et al*. 2003), the persistence of other processes will hinge on conservation of their particular spatial components (Cowling *et al*. 1999, 2003; Cowling & Pressey, 2001, Desmet *et al*. 2002, Moritz 2002). Rouget *et al*. (2003) define spatial components here as the physical features of a region with which particular ecological and evolutionary processes are associated.

4. Heterogeneity Areas:

Intersections of biogeographic regions, ecoregions etc. create regions of rapid turnover (or high beta diversity) of species and habitats, leading to exceptionally high levels of species richness. Consequently, crossroads maybe evolutionarily active zones, the origination sites of new taxa or adaptations in existing taxa (Spector 2002, Smith *et al.* 1997, Araujo 2002).

However, there is an important debate about heterogeneity areas as conservation target and their support to speciation and long term existence of species. Classical evolutionary theory maintains that gene flow between populations effectively counters the effects of divergent selection on connected populations (Mayr 1963). Recent studies claims that "ecological heterogeneity and strongly differing selection pressures across ecotones may drive rapid evolutionary changes in populations even in the face of gene flow, perhaps driving evolution and speciation at the edges of habitats and enriching biotas (Enserink 1997; Smith et al. 1997; Schneider et al. 1999). Araujo (2002) claims that although the conservation planners are right to stress the importance of ecological transition zones to preserving species' adaptive responses to future challenges, they disregard some important questions.

5. Phylogenetic Features:

There are many new attempts to consider different source of classification than taxonomical classification of species and evaluation source different than the threat categories of species (IUCN 2001). One of the main reasons behind this attempt is; "Species that are taxonomically distinct will be expected to make a large contribution to some overall measure of diversity of any subset of the total set of species. This is apparent if species are replaced as the basic units (or attributes) of biological diversity by *features* of species. Taxonomically distinct species then contribute more to the diversity of a given subset because they contribute different features" (Faith 1992).

Species differ substantially in the amount of unique genetic information they embody (May 1990, Vanewright *et al*. 1991, Faith 1992, Crozier 1997) and those species with higher amount of unique genetic information have to have higher conservation value than the ones with many close relatives.

If we are to plan for a future in a changing world (i.e. climate change, natural disturbances, human induced disturbances) evolutionary and ecological processes have to be two of the key features to include in biodiversity conservation and natural resource management plans. Based on the above theoretical background proposed scheme for the inclusion of the processes in the Seyhan Basin is formulated as follows:

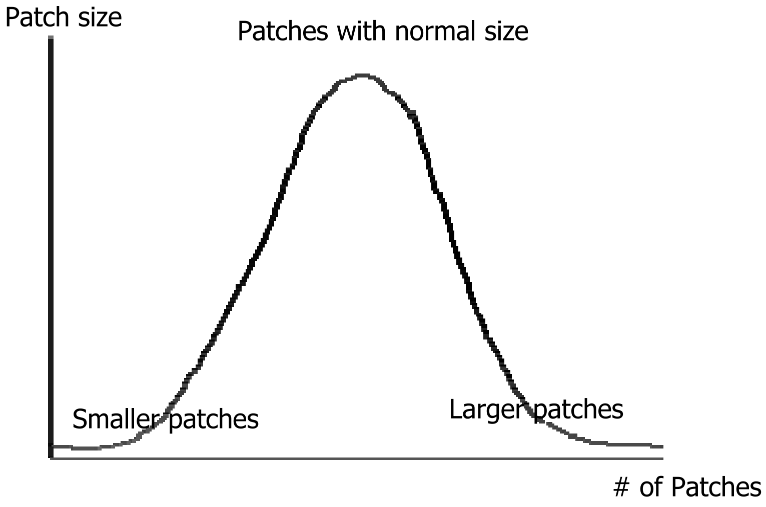
5.5.1. Landscape Design Criteria

This item includes generic design criteria based on the Island Biogeography theory. It deals with the shape, size, connectivity of the natural areas and protected areas. However, these are necessary for the sustainable use of the natural resources, especially forests.

a. Large habitat blocks of natural areas:

Large habitat blocks are important for the long term existence of the many species. As size of the patches increases survival rate of species living in these habitats increases (MacArthur and Wilson 1967). These large blocks may act as refugia in front of impacts of the climate change.

Forested areas regardless of the forest types have to be considered together to identify the large habitat blocks. Steppe areas have to be considered in the same manner regardless of the type of the steppe. Large habitat blocks have to be identified and mapped and referred as conservation target and/or considered for the sustainable use of them. Patch number/size curve can be used to identify critical size for the identification of the large habitat blocks



b. Habitat blocks serves to connectivity purpose

<u>Riverine Corridors:</u>

We defined interbasin riverine corridors as those that breach the Taurus Mountain Belt, thereby linking interior basins and the coasts. Riverine corridors facilitate animal movement and plant dispersal. There is evidence that migration of plant species along riverine corridors has resulted in species diversification (Bayer, 1999). Riverine corridors also act as refuge from drought and fire and have provided refuge for mesic species during major climatic events in the past (Geldenhuys, 1997).

It can be assumed that a buffer area of 250 m on either sides of the river would be sufficient for species dispersal, and untransformed sections 500 m long (25 ha) to be minimal to serve as refuge areas for conservation planning (Rouget et al. 2003).

Upland-Lowland Interfaces:

Rouget *et al.* (2003) defined upland–lowland interfaces as short gradients for diversification and range adjustment in response to climate change (Midgley *et al.*, 2002, 2003). Because of differences in elevation, climate, parent material and age of the surfaces between upland and lowland habitats, these interfaces are associated with ecological diversification of plant (Goldblatt 1979, Kurzweil *et al.* 1991) and possibly animal lineages.

The interfaces also facilitate seasonal movements between uplands and lowlands (Kruger 1977).
It can be assumed that a 1-km-wide buffer along the upland–lowland boundary would accommodate range adjustment and will be considering each unique boundary between upland and lowland habitat types (Rouget *et al.* 2003).

Habitat connecting patches:

Connectedness is one of the most important generic design criteria. According to island biogeography and landscape ecology principles isolated patches without any connection will be lost (Noss and Cooperrider 1994). Connectedness is also critical for the marginal patches of the habitats to survive against the impact of the global climate change. Connectedness has to be considered primarily for the forest habitats but grasslands have to be considered too.

Connectedness has to be considered according to following items:

- Patches in the critical areas (areas will be dramatically effected from the global climate change),
- Patches connecting large habitat blocks,
- Marginal patches of the habitats
- In the fragmented areas,

Upland-Lowland Gradients:

Upland–lowland gradients are important for seasonal movements of animals (Kruger, 1977; Fraser *et al.*, 1989), and local-scale adjustment of species distributions to climate change (Midgley *et al.*, 2002, 2003). Due to strong climatic and edaphic differences between the upland and lowland environments, they are also associated with ecological diversification of plant (Rourke 1972, Cowling 1983, Bruyns & Linder 1991, Linder & Vlok 1991, Bakker *et al*. 1999, Reeves 2001) and animal (Enrödy-Younga 1988, Coe & Skinner 1993) lineages.

5.5.2. Ecological Heterogeneity Areas

Ecologically heterogeneous, transition areas attract the attention of the conservation planners and resource mangers in two reasons:

1. Biogeographic crossroads present conservationists with opportunities to represent significant amount of species in small number of areas (Spector 2002, Williams and Araujo 2000, Gaston *et al.* 2001).
2. These areas provide sets of different ecological conditions in a relatively small distances that this would provides species opportunities to adapt or survive changing conditions (e.g. global climate change, natural disturbances) (Araujo 2002).

Identification of these areas would provide set of sites that could support species for adapting and surviving the changing ecological conditions, induced by the global climate change.

These areas can be identified according to following items:

a. Transition Zones

- Transition zones between macro climatic regions
- Transition zones between main soil components
- Transition zones between major geological formations
- Transition zones between major ecoregions
- Transition zones between subecoregions

b. Richness and Rarity of the Ecological Formations

- Richness of the main vegetation types
- Uniqueness of the main vegetation types (dissimilarity value per planning unit)
- Number of main community types
- Uniqueness of the main community types (dissimilarity value per planning unit)

5.5.3. Species Heterogeneity Areas

A diversity of living things of any region is adaptive diversification of a taxonomically constrained biota that should be reflected in patterns of attributes that represent the outcomes of a combination of ecological, biogeographical, and evolutionary processes (Brown and Maurer 1987).

"At one extreme, variation on large spatial and long temporal scales determines the biogeographical and evolutionary processes that shape the composition of the pool of species that historically have had access to a geographical region" (Brown and Maurer 1987). This feature has been already outlined in the above heading "Ecological Heterogeneity Areas". "At the other extreme, variation on small spatial scales and short time scales influences the dynamics of local populations of interacting species and determines the combinations of species that constitute local communities" (Brown and Maurer 1987).

Species change by adapting to changing conditions in the space they exist, competing with the other species and by random events in different scales. Until the recent times species-species interactions were accepted as one of the main driving force in identification of the community features and evolutionary processes (Stanley 1975, 1979; Vrba 1980, 1983; Fowler and MacMahon 1982; Gould 1982; Vrba and Eldredge 1984; Damuth 1985; Eldredge 1985). Although its strong vigour as an ecological paradigm, it lost some ground against the importance of random events and natural disturbances (Hubbel 2001).

Hence it is still worth considering species-species interactions as one of the important means for the explanation of the community level events such as adaptation, resilience, resistance. Consequently it is crucial to consider the species assemblages to study the adaptation of species into changing conditions.

Based on this theoretical background species assemblages have to be considered in analyses of possible sustainable natural resources use and biodiversity conservation scenarios for adapting to climate change in Seyhan Basin.

Areas with different species compositions can be accepted as areas that have genetic, species and ecological diversities that can provide opportunities for adapting to the impacts of the global climate change.

a. Species dissimilarity

- Total
- Birds
- Plants
- Butterflies
- Mammals

b. Richness hotspots

- Total
- Birds
- Plants
- Butterflies
- Mammals

5.5.4. Rare Interactions

Some evolutionary and ecological processes lead to a differentiation of an area or ecosystem from its surrounding with features acquired during these processes. Relict ecosystems, evolutionary enclaves, mature ecosystems, old-growth forests, undisturbed areas (human induced disturbances) can be given as examples of these features.

There are no relict or enclave formations in the Seyhan Basin. However, some of the forests in the Taurus arc have old-growth forest features. These forests have to be identified and considered as a conservation target and source of ecological information for analysis of the impacts of the global climate change.

5.5.5. Phylogenetic Features

It is accepted that species gene pools are the main sources or the outcome of the long evolutionary processes (May 1990, Vanewright *et al.* 1991, Faith 1992, Crozier 1997). Thus, their survival is merit to the conservation efforts and solutions to environmental problems (Faith 1992, Posadas *et al.* 2000). Consequently, there are different attempts to use phylogenetic information as an alternative source of evaluation criteria to threat categories (e.g. IUCN, Bird and Habitat Directives, national red lists etc.) (see Redding and Mooers 2006). Species that are taxonomically different are expected to have different features and gene set that will make a large contribution to some overall measure of diversity of any subset of the total set of species (Faith 1992, Redding and Mooers 2006).

One of the paradigms is use of "Evolutionary Significant Units" instead of species in conservation and sustainable use plans (Ryder 1986, Moritz 1994). The ESU concept was developed to provide a rational basis for prioritizing taxa for conservation effort (e.g. captive breeding), given that resources are limited and that existing taxonomy may not adequately reflect underlying genetic diversity (Avise 1989). However, lack of common conceptual definition of ESU creates operational problems. Some definitions suggest that an ESU should be geographically discrete, others highlight significant divergence of allele frequencies, level of genetic distance' to congruently structured phylogenies or divergence of non-molecular traits.

However, regarding theoretical and operational problems it is not practical to produce such information for the species in the Seyhan Basin; we do not recommend use of Evolutionary Significant Units. Easier way of considering phylogenetic information is the consideration of higher taxa diversity and endemism. In that respect we recommend the identification of endemic genus or families if there exist in the study area. Also if there are already well known species, genus that have taxonomical distinctiveness from the rest of the taxa in their group, they can be considered as conservation target due to their different genetic material.

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