

# European Environment Agency

## Europe's biodiversity — biogeographical regions and seas

### Biogeographical regions in Europe

## The Black Sea Region

### — shores and delta

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## Summary

- This chapter covers southern shore areas of the Black Sea.
- Climatic transfer from Mediterranean to continental Europe.
- Coastal cliffs and the Danube delta hosts a highly diverse fauna.
- Originally mostly covered by forests.
- Agriculture, afforestation, salinisation and coastal erosion are major threats to the biodiversity in region.

## 1. What are the main characteristics and trends of the Black Sea biogeographical region?

### 1.1 General characteristics

#### 1.1.1 Extent and limitations

The region consists of two coastal bands encompassing the southern half of the Black Sea. The western part stretches from the delta of the Danube, through the Dobrouja plateau, across low mountains extending east towards the Bosphorus outlet. This stretch is 530 km long and its width varies between 20 and 60 km. The other part — 1 400 km long and between 10 and 160 km wide — stretches from east of the Bosphorus over the various mountain ranges along the southern coast of the Black Sea and as far as the Caucasus mountains in the east.

#### 1.1.2 Geomorphological and topography

The Danube delta, a maze of marshes, lakes and islands are constituents of a low coastal area. It is a comparatively young formation. About 6 500 years ago the delta was a shallow cove of the Black Sea coast, but it has gradually been filled by river-borne silt. The delta continues to grow seaward at the rate of approximately 30 m per year. The Dobrouja Plateau consists of Sarmatian limestone covered by loess deposits. Several cliff segments are cut by short, enlarged valleys with limans and lagoons, divided from the sea by sandy levees. The folded zone south of the Black Sea consists of a series of mountain ridges, increasing in elevation toward the east. High ridges trending east-west rise abruptly from the Black Sea coast and the coastal plain is thus narrow, opening out only in the deltas of the Kisil and Yesil rivers. In the western section, between the Sakarya and Kizil rivers, there are four main ridges, the Küre, the Bolu, the Ilgaz, and the Köroglu mountains, with maximum elevations of 1 950, 2 524 and 2 338 m respectively. East of the Yesil the system is higher, narrower, and steeper, with a maximum elevation of 3 932 m in the Kaçkar range.

Three rivers with total catchment areas of more than 50 000 km<sup>2</sup> drain into the Black Sea through the region: the Danube, the Kizilirmak and the Sakarya rivers. Furthermore, the smaller Yesilirmak and Coruh rivers also drain to the Black Sea through the south of the region. Other rivers reaching the Black Sea through Turkey are short, torrential streams originating from the northern face of the mountains.

**Table 1. Statistics for the Black Sea biogeographical region**

Surface area (km <sup>2</sup> )	Number of countries in region	National composition by area	Population (inhabitants/km <sup>2</sup> )
120 000	4	Turkey 83 %	77
		Georgia 8 %	77
		Bulgaria 6 %	71
		Romania 3 %	94

**Sources:** various sources by ETC/NPB and EEA.

### 1.1.3 Soils

Undeveloped soils are present in the Danube Delta. Elsewhere in Romania a mollisol type of soil is present. Brown forest soils dominate in the southern part of the region. Acidic brown soils, rendzina and alluvial soils are other main soil types occurring in the Turkish part of the region.

**Map 1. Physiography of the Black Sea biogeographical region**

### 1.1.4 Climate

The climate of the region can be described as 'Danubian', with warm and relatively dry summers. Similarly to the Mediterranean climate, precipitation reaches its maximum in spring and autumn. However, in some areas precipitation is higher in summer than in winter, which is a characteristic of continental climates. The annual precipitation average shows a significant increase from the west towards the east. In Romania, it is relatively low with 370 mm, in western Turkey 600–1 200 mm, and in the east up to 2 500 mm. In the west, there are relatively large differences between the average summer and winter temperatures. On the coast of Bulgaria the average winter temperature is  $-1\text{ }^{\circ}\text{C}$  and the average summer temperature is about  $21\text{ }^{\circ}\text{C}$ . On the north coast of Turkey it is generally warmer particularly in winter, and the differences between summer and winter temperatures is not so marked. The city of Samsun has average temperatures of  $6\text{ }^{\circ}\text{C}$  in January and  $24\text{ }^{\circ}\text{C}$  in July.

## 1.2 Present biodiversity status and trends: habitats, fauna and flora

### 1.2.1 Habitats

**Table 2. Main habitat types in the Black Sea biogeographical region, as defined by EUNIS (European Nature Information System) habitat classification**

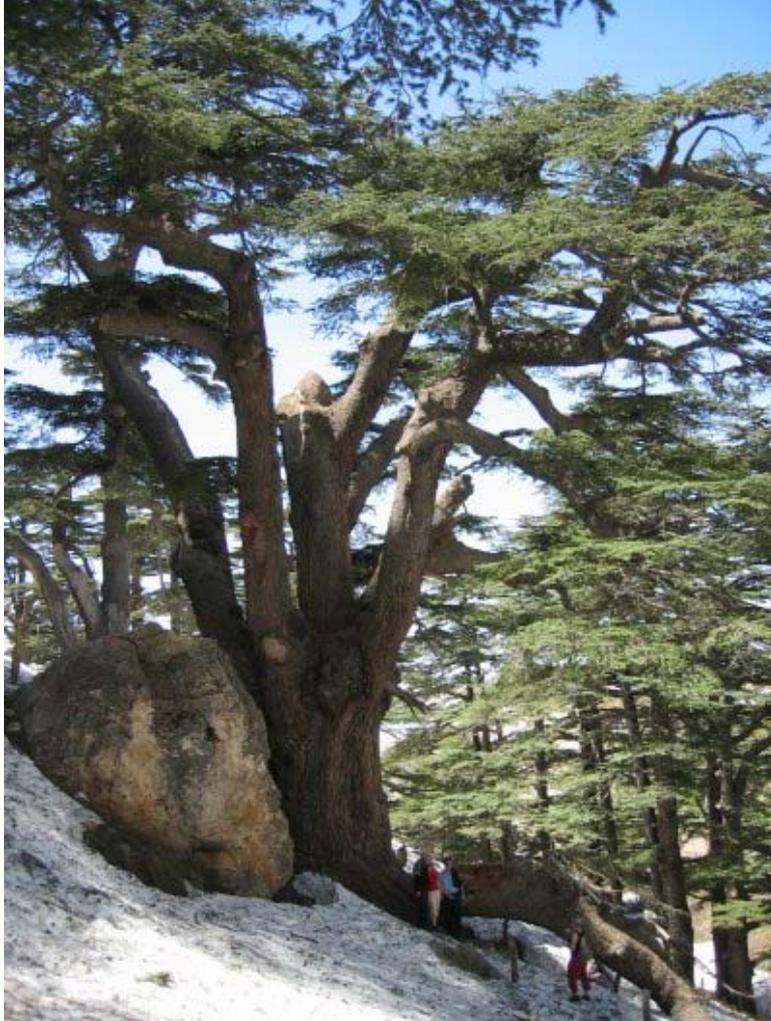
Habitat type	Proportion
Grassland habitats	34 %
Woodland and forest habitats and other wooded lands	29 %
Heathland and scrub habitats	20 %
Regularly or recently cultivated habitats and gardens	14 %
Bogs, fens and mires habitats	1 %
Freshwater aquatic habitats	< 1 %
Constructed industrial and other artificial habitats	< 1 %
Coastal and halophytic habitats	< 1 %
Inland sparsely vegetated or unvegetated habitats	< 1 %

**Source:** ETC/NPB, estimation based on 90 % of the region.

#### 1.2.1.1 Forests

Much of the region was originally covered by forests. Today woodland and forest habitats cover 29 % of the region. Willow and poplar *Salix* spp., *Populus* spp. and alder and ash (*Alnus* spp., *Fraxinus* spp.) woods extend on floodplains while the Mediterranean oak and poplar forests cover periodically flooded dunes. Associations of tree species in forests vary significantly between the western and eastern part of Turkey. Beech *Fagus* spp. and oak *Quercus* spp. forests in the west are replaced by two conifers, *Pinus sylvestris* and *Abies bornmuelleriana*, at higher altitudes. Coniferous species become dominant above 1 000 m, giving way to alpine grassland above 2 000 m. The richest type of woodland is the Colchian forest, confined to the eastern part of the Black Sea coastlands where rainfall is heavy with no summer drought, and winters are mild. Hornbeam *Carpinus* spp., sweet chestnut *Castanea sativa*, oriental spruce *Picea orientalis*, and alder *Alnus glutinosa* are the most common species, and there is a rich shrub layer of rhododendron *Rhododendron* spp., laurel *Laurus* spp., holly *Ilex aquifolium*, myrtle *Myrtus* spp., filbert *Corylus maxima* and walnut *Juglans regia*. The mountain range in the east also includes relict stands of Mediterranean forests along the mild and humid coastline and in the highly isolated gorges of the Yesilirmak, Kelkit and Coruh rivers. Strawberry tree *Arbutus* spp., olive *Olea* spp., Turkish pine, *Pinus brutia*, Greek juniper, *Juniperus excelsa* and cedar of Lebanon, *Cedrus libani*, are some species of note forming these Mediterranean relict communities. Forest dominated by oak *Quercus* spp., black pine *Pinus nigra* and Scots pine *Pinus sylvestris*, the latter at higher altitudes, extends in the transition zone between the Black Sea and Anatolian regions.

A traditional forestry technique, coppice forestry, is a common practice in Turkey, west of the Bosphorus. The maintenance of this technique is still of great value for the rural community and is from a biodiversity point of view of value to conserve several rare plants associated with coppice forests.



*Cedrus libani*, one of the species forming the Black Sea relict plant communities.

**Source:**

<<http://en.wikipedia.org>>.

#### **1.2.1.2 Alpine zone**

The alpine biome within the region extends above 2 000 m. The Koroglu and Ilgaz mountains in the west and the Kackar mountains in the east support alpine elements from the Anatolian and Caucasian alpine regions as well as many endemic taxa confined to the Black Sea region.

#### **1.2.1.3 Heathland**

In the peninsulas of the Istanbul province, along the transition zone between this region and the Mediterranean, there are large stands of heathland, which are among the rarest habitat types in Europe. This unusual distribution pattern of heathlands results from the unique geographical location of the area affected both by the Black Sea and Mediterranean climates. 95 % of heathlands in the region have already been lost due to urbanisation and afforestation. The remaining 5 % covering an area of more than 20 000 ha still support substantial wildlife.

#### 1.2.1.4 Cliffs

Cliffs with specific vegetation occur along the coastline, in Bulgaria, on the western part of the Turkish coast and at some locations in the east. There are a few small islands located in the south. Dunes are other coastal habitats of note. More than 80 % of the dunes have been lost during the late 20<sup>th</sup> century because of afforestation and urbanisation.

#### 1.2.1.5 Wetlands

The second largest wetland of Europe — after the Volga Delta — is the Danube Delta and the adjacent Razim-Sinoe complex of lagoons, located in Romania and Ukraine. The Danube River splits into three channels: the Chilia, the Sulina and the Sfântu Gheorghe, carrying 63 %, 16 % and 21 % of the total runoff respectively. Navigation is possible only through the Sulina Channel, which has been straightened and dredged along its 60 km length.



*Satellite image of the Danube Delta. The Razim-Sinoe lagoons are visible in the south.*

**Source:**  
<<http://en.wikipedia.org>,  
image from NASA>.

The Danube Delta is made up of reed swamps, lakes and an extensive network of canals, and as well as high ground forests, meadows, sandy grasslands and dunes forming a complex and unique mosaic of terrestrial and aquatic habitats, supporting a rich flora and fauna. A total of 300 bird species and almost 3 400 species of insects have been registered in the area.

Similar associations of habitats are present in the southern Black Sea region in coastal wetlands. The most important are Kizilirmak Delta, Sakarya Delta, Terkos Lake, Igneada and Yesilirmak Delta. The largest of these is the Kizilirmak Delta formed by the river Kizilirmak. The Kizilirmak riverbed is shallow and the amount of water fluctuates greatly

with the seasons, with a minimum in summer and a maximum in spring. The Kizilirmak Delta is intensively used for agricultural production. Main crops are wheat, vegetables and rice. There are several inland water-bodies worthy of note such as the lakes Sapanca, Yenicaga, Ladik and Yedikir.



*The Danube Delta hosts over 1 200 varieties of plants, 300 species of birds as well as 45 freshwater fish species in its numerous lakes and marshes. The Delta is on the UNESCO list of World Heritage Sites and Biosphere reserves. Around 2 733 km<sup>2</sup> of it are strictly protected areas.*

**Source:**

<<http://en.wikipedia.org>>.

### 1.2.2 Fauna

The aquatic environment in the northwest and in some deltas in the south is rich in fauna especially so in insects, fish and birds. Marine levees are rich in psammophile and halophile fauna. Many species of invertebrate in the region are considered as endemic.

The fish fauna of running and stagnant water ecosystems are represented by, among others, *Alosa pontica*, *Acipenser ruthenus*, *Cyprinus carpio*, *Lucioperca lucioperca*, *Silurus glanis*, *Tinca tinca*, *Vimba vimba carinata*.



*Forested wetland areas in the Danube Delta offers excellent breeding grounds for the black stork, Ciconia nigra.*

**Source:**

<[www.wikipedia.org](http://www.wikipedia.org)>.

The most interesting examples of birds diversity in the region are: mallard *Anas platyrhynchos*, grey heron *Ardea cinerea*, red-breasted goose *Branta ruficollis*, great

white egret *Egretta alba*, night heron *Nycticorax nycticorax* and Dalmatian pelican *Pelecanus crispus*. In the Danube Delta, there are 280 species of birds, 10 of them are protected. It is also an important nesting area and stop-over place for migratory species. The composition of the avifauna of the smaller deltas in the south of the region is very similar to that of the Danube Delta. Squacco heron *Ardeola ralloides*, black stork *Ciconia nigra*, white-headed duck *Oxyura leucocephala* and lesser spotted eagle *Aquila pomarina* are other bird species of note occurring in significant numbers in these wetlands.



*The shag (Phalacrocorax aristotelis) occurs along the coast of Turkey.*

**Photo:**  
Arthur  
Grosset.

Coastal cliffs and islands along the coast of Turkey also host internationally important birds, in particular the shag *Phalacrocorax aristotelis*. The Coruh gorge is a significant bottleneck area for migrating storks and birds of prey. The alpine zone and forests in the region are also of global importance for birds. Eastern Black Sea Mountains constitute the western-most part of the Caucasian Endemic Bird Area (EBA) being one of the two EBA's in Europe. Rare birds occurring here are: bearded vulture *Gypaetus barbatus*, black vulture *Aegypius monachus*, and Caucasian chiffchaff *Phylloscopus lorenzii*. The Ilgaz Mountains in the west hosts an endemic sub-species of the bullfinch *Pyrrhula pyrrhula paphlagoniae*.



*One of the endangered reptile species in the area is the Caucasus viper (Vipera kaznakovi).*

**Photo:** Mike Pingleton.

Mammals are represented by 47 species. Wolf *Canis lupus*, lynx *Lynx lynx*, brown bear *Ursus arctos*, alpine chamois *Rupicapra rupicapra*, wild goat *Capra aegagrus* are large mammals of note occurring in the south. The ranges of the two latter species are confined to the eastern part of the region. In total, the area has 56 species of reptiles and amphibians. Of these, Caucasian salamander *Mertensiella caucasica*, Caucasian parsley frog *Pelydotes causicus*, and Caucasus viper *Vipera kaznakovi* are among the endemic species, they are mainly distributed in the mountain ranges in the east.

### 1.2.3 Flora

In the Black Sea region a relatively high number of species are concentrated in a small area. It is rich in endemic species such as bellflower *Campanula romanica*, knapweed *Centaurea pontica* and campion *Silene caliacrae*. Plants adapted to wetlands and plants adapted to dry habitats are of particular significance in the region.

Sites with importance to rare plants in the south of the region are mainly associated with the coastal dunes, the coppice forests, the heathlands of the Istanbul province, the alpine zone, river gorges in the east and the peatlands extending around some wetlands in the west. In particular, the coastal dunes and the alpine zone hold several narrow endemic plants. Examples of dune species of special importance include mustard species *Alyssum borzaeanum*, *Astrodaucus littoralis*, blue hound's tongue *Cynoglossum creticum*, poppy *Hypecoum ponticum*, and one rye-grass *Lolium loliaceum*. Other species of note in the region listed in the Annex I of the Bern Convention are for example, mustard species *Aurinia uechritziana*, knapweed *Centaurea hermannii*, cyclamen *Cyclamen coum*, and the orchid *Himantoglossum caprinum*. The mountains in the east of the region are particularly rich in plants: ca 2 500 species of vascular plants occur, including 160 endemics to this part of the region.

## 2. Main issues of biodiversity in relation to human activities

### 2.1 Main pressures on biodiversity



*Falconry is a traditional practise in part of the Black Sea biogeographic region. It may however have negative impact on many species of raptors.*

**Photo:** Stephen Eric Wood/DHD Multimedia Gallery.

Biodiversity in the region is highly threatened. Many rare species of plants are to become extinct in the near future unless the countries in the region take conservation action. Agriculture, tourism and water management significantly influence the ecological

diversity of the region. Dominant lowland vegetation belt is characterised primarily by the replacement of climazonal vegetation in large areas and its transformation into arable land, fishponds and pastures.



*Agriculture and tourism are major threats to biodiversity in the Black Sea region.*

**Photo:**  
*Linus Svensson,  
ZooBoTech.*

### 2.1.1 Agriculture and forestry

Afforestation of dune ecosystems and heathlands for commercial timber production with alien *Pinus* species, construction of highways and urbanisation along the coast constitute the main pressures on biodiversity in the south of the region. Wetlands, both in the northwest and in the south, suffer from reclamation schemes.

On the coastal fringes of Turkey, most of the higher-value crops are grown. The relative warmth and dampness of the Black Sea coastlands make this region one of the most intensively cultivated despite its limited lowlands. The building of enclosures for agriculture, forest plantations and pisciculture in the Danube Delta, have damaged the ecosystems of stagnant waters, reed plots and riverbanks. Large quantities of reeds that grow in shallow water in the Danube Delta are used in the manufacture of paper and textile fibres. The parcelling and the controlled hydrographic conditions have put pressure on natural ecosystems. In some cases, these have been proved to be economically inefficient and the natural hydrographic conditions have been restored.

Traditionally, Istanbul heathlands are used for bee farming and grazing. Heathers are also used for broom production, an important element of the rural economy in the Istanbul region.

### 2.1.2 Irrigation, salinisation and waterlogging

Huge irrigation schemes were introduced in Romania 25 years ago (about 3.2 million ha), it is estimated that 200 000 ha have been salinised through irrigation, which represents about 6 % of total irrigated land. Part of this area is in the Black Sea region. Salinisation has direct negative effects on soil biology and crop productivity. It also has indirect effects in that it leads to loss of soil stability through changes in soil structure (alkalinisation). Salinisation is reversible but reclamation of saline/alkaline soils is expensive, as it requires complex amelioration techniques.

Waterlogging occurs in the lower Danube valley and along the Black Sea coast. It is the result of flooding due to the raising of water table by irrigation and an increase in the amount of rain run-off. This leads to decline in soil structure.

### 2.1.3 Coastal erosion

The damming of the Danube and other major rivers, particularly in the former USSR over the last 30 years, has resulted in an estimated decrease of freshwater input to the Black Sea of up to 20 %. This reduction in freshwater and associated sediments load has resulted in an increase in salinity and coastal erosion, particularly in Romania. Some beaches have been eroded at a rate of 12 m per year. Extensive coastal engineering work has been carried out along the Romanian coast to protect the shoreline and to enlarge the Constanta harbour. Large amount of material has been dumped in the coastal waters, deteriorating the quality of the water. The most severely affected biota has been filter feeding organisms and rocky zone microflora.

### 2.1.4 Tourism

The favourable climate has made the region a major recreational and recuperative centre. The sandy beaches attract an increasing number of tourists. Today, much of the Black Sea coastal zone is densely populated.

#### The Danube Delta under pressure

Draining a basin of 805 300 km<sup>2</sup>, and flowing 2 860 km to its delta on the edge of the Black Sea, the Danube is the second largest river in Europe after the Volga. In its lower reaches in Romania, the Danube formerly flooded over 11 000 km<sup>2</sup> of wetlands. These vast wetlands yielded a variety of benefits and played an especially important role in reducing the risk of floods, being able to retain up to 9 km<sup>3</sup> of water, and serve as a filter between the basin and the Black Sea. A number of islands in the lower Danube carry seasonally flooded forests and marsh habitats. The delta covers 5 200 km<sup>2</sup>. It supports a rich diversity of plant and animal species, many of which are seriously threatened or have disappeared elsewhere in Europe. The buffer coastal zone has a very rich dune vegetation, represented by halophyte plants including: seablite *Sueda maritima*, glasswort *Salicornia herbacea*, sea-lavender *Limonium gmelini* etc. Bird populations are exceptionally rich, with some 280 species nesting, resting and feeding in the area. The Danube Delta ecosystem holds the majority of the world's population of two endangered species — the pygmy cormorant *Phalacrocorax pygmaeus* and the red breasted goose *Branta ruficollis*. There are also significant populations of several water-bird species, whose populations have recently declined drastically in Europe.

Like most large European rivers, the Danube has suffered from pollution, modification of the hydrological system and drainage of its wetlands. Over 4 000 km<sup>2</sup> — 69 % of the floodplains of the lower Danube, and 800 km<sup>2</sup> — 15 % of the delta — have been drained, while dredging of canals within the delta have reduced its capacity to retain and filter water. After World War II industry, agriculture, livestock and urban settlements have all increased the input of sewage, agricultural and industrial waste and pesticides into the Danube's water. Up until the 1980's this has increased substantially the nutrient load of the river, by up to three times in the case of dissolved nitrogen, and up to 12 times in the case of phosphorus. Over the past 20 years nutrient loads into the Danube have decreased significantly, but they are still above the levels of 1955. The Danube acts as a huge trade artery for the Balkan countries. The building of the Danube Black Sea Canal, passing through Lake Agigea before reaching the sea, destroyed a nature reserve. The ecological and economic (fishery) system as a whole is under threat, and continued decline can be expected unless urgent measures are taken.

## 2.3 Some initiatives for biodiversity

### 2.3.1 International cooperation on establishment of protected areas

The Danube Delta Biosphere Reserve, shared with Romania and Ukraine, was established in 1998. The total area is 623 000 ha while the core area is 73 000 ha (of which 1 300 ha is marine). A number of internationally important wetland areas have been designated as Ramsar sites: a part of the Danube Delta and Razim-Sinoe lagoon complex (within the Danube Delta Biosphere Reserve) in Romania, Durunkulak (350 ha) and Shabla lakes (404 ha) in Bulgaria as well as the Kizilirmak Delta (16 110 ha) in Turkey.

### 2.3.2 A 'Green corridor' for the Danube

A 'Green corridor' of natural wetlands along the lower Danube has been launched by Romania, in co-operation with Bulgaria, Moldova and Ukraine. This is the largest international cross-bordered wetland restoration and protection initiative in Europe. It includes wetlands, lakes, flooded areas, floodplain forests and meadows. The aim is to expand the Danube's natural capacity for pollution reduction, flood retention and nature conservation. An existing pilot project covering 3 680 ha has demonstrated the restoration potential of damaged wetland areas. Initiated and carried out by the Danube Delta Biosphere Reserve Authority, the Danube Delta Institute and WWF, and supported by the World Bank, the project restored floodplain habitat, unsuccessfully drained for agriculture, back to natural conditions. This has benefited local communities in many ways, including livelihood improvement from increased fish stocks.

### 2.3.3 The Black Sea Environmental Programme

The Bucharest 'Convention on the Protection of the Black Sea Against Pollution', signed in 1992, was designed to initiate a regional approach for nature conservation of the Black Sea. The Black Sea Environmental Programme was officially established in 1993 by UNDP/GEF. The programme is funded by GEF with additional cost sharing contributions from CEC's PHARE and TACIS programmes as well as bilateral contributions from Canada, the Netherlands, Switzerland and France. In 1994, a programme coordination unit was established in Istanbul and a plan was established by its national coordinators.

The programme has three main objectives:

- To strengthen and create regional capacities for the management of the Black Sea ecosystem;
- To develop and implement an appropriate policy and legal framework for the assessment, control and prevention of pollution as well as the maintenance and enhancement of biodiversity;
- To facilitate the preparation of environmentally sound investments.

Each of these objectives has enormous scope and concerns a broad range of sectors. The BSEP steering committee incorporates the national coordinators, donor representatives and representatives of NGOs. The working parties themselves include at least one expert from each of the Black Sea countries, together with additional expertise where appropriate.

The activity centres and their working parties are as follows:

1. Emergency response (Varna-Bulgaria);
2. Routine pollution monitoring (i.e., the assessment of land based sources, water quality (Istanbul-Turkey);
3. Special monitoring programmes, biological and human health effects and environment quality standards (Odessa-Ukraine);
4. Protection of biodiversity (Batumi-Georgia);
5. Development of common methodologies for integrated coastal zone management (Novorossisk-Russia);
6. Fisheries (Constanta-Romania).

### 2.3.4 Research, monitoring and nature management projects

The Scientific and Technical Research Council of Turkey (TUBITAK) is the main governmental body in Turkey facilitating the research on the biodiversity and natural resources. The main institutions carrying out research and monitoring programmes in the region are the 'Danube Delta Biosphere Reserve Authority (DDBRA)' and the 'Danube Delta Research Institute (DDRI)' in Tulcea (Romania). These institutions initiated a project concerning 'Management Objectives for Biodiversity Conservation and Sustainable Development in the Danube Delta Biosphere Reserve, Romania (1995)'. The European Bank provided the support for the preparation of these objectives for Reconstruction and Development, with financing from the European Union PHARE programme. Another important institution is the 'National Institute of Marine Geology and Geo-ecology' in Constanta (Romania). This institute has organised international workshops based on research regarding Danube Delta-Black Sea System under Global Changes Impact (1995) and 'Fluvial-Marine Interactions' (1997).

The Society for the Protection of Nature (DHKD) and The Turkish Foundation for Combating Soil Erosion, for Reforestation and for Protection of Natural Habitats (TEMA) are the main organisations promoting nature conservation. DHKD operates a number of projects to create pilot management plans for the Black Sea wetlands in Turkey. TEMA effectively promotes the implementation of the Pasture Land Law and implements reforestation projects in several localities of the Black Sea region, e.g. large-scale oak seeding campaigns.

#### **A project for sustainable development**

The Turkish Foundation for Combating Soil Erosion, for Reforestation and for Protection of Natural Habitats (TEMA) is running a rural development project aiming to conserve one of Turkey's few remaining pristine forests. The forest, with all its original fauna and flora intact, is in the mountains of Artvin province bordering the state of Georgia. The area, known in Georgian as Macahel and in Turkish as Camili and Karagöl, is under threat from the 3 000 people and 2 000 farm animals living in six villages in the vicinity. It is clear that the villagers have to make a living and will eventually turn to what is left of the region's forests for sustenance. The solution lies in offering the local people a choice, ways of earning a living without destroying the forest and its unique ecosystem. As a part of the project, a local company was set up for farming and honey production of the Caucasian bee, which thrives naturally in the area. Nature tourism is also promoted to people visiting the forest and stay in traditional village homes.

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