European Environment Agency

Europe's biodiversity

– biogeographical regions and seas

Biogeographical regions in Europe

The Continental biogeographical region

– agriculture, fragmentation and big rivers

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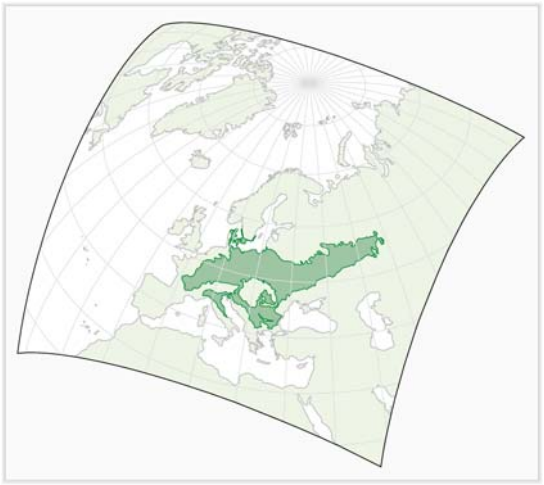


Summary

- The Continental biogeographical region is the second largest biogeographical region in Europe, nearly as big as the Boreal region
- The climate is continental with warm summers and cold winters, especially in the central and eastern parts
- The soils have naturally high fertility and the region is a main crop-producing area, mostly through intensive agriculture, but alternative farming is increasing
- Permanent grasslands are still widespread, but the area is decreasing due to intensification of agriculture and afforestation
- The forested area is increasing. The natural forest cover in much of the region is deciduous, but coniferous forests now dominate in several countries
- Only little remains of natural old forests. Substial areas of forests with little or no management are still found in the eastern parts. In many areas the forest condition is still seriously affected by long-range air pollution
- The urban areas are among the largest and most extensive in Europe, with a dense and increasing infrastructure leading to continuously increasing fragmentation of habitats
- A large proportion of the population lives in the vicinity of forests. Some new afforestation occurs around big cities for recreational purposes
- Most of Europe's large rivers cross the region; often they are highly regulated and the floodplains drained. Many rivers are interconnected by canals
- Wetlands have been much reduced, but some large remaining bogs and mires still occur in the central and eastern parts
- The number of indigenous species is high, but few are endemic to the region; forests and grasslands contain the largest number of species
- All big carnivores exist in the region, which also hosts a reconstituted population of the largest wild European herbivore, the bison
- This is a most important region for birds, including migratory species

1. What are the main characteristics and trends of the Continental biogeographical region?

1.1 General characteristics

The area treated in this chapter is the Continental biogeographical region as defined by the European Commission and the Council of Europe for evaluation and assessment of nature conservation. It is a region that connects to most other biogeographical regions of Europe. The Continental region extends in a central east-west band over most of Europe. A relatively narrow fringe of land separates it from the Atlantic Ocean in the west; in the east it reaches as far as the border of Asia, just south of the Ural Mountains. It reaches Denmark and Sweden in the north, Italy and the Balkan Peninsula in the south. The

region includes or borders to several of the European Alpine biogeographical sub-regions. The region is not entirely contiguous: the Alps act as a barrier, isolating the part of the region on the Apennine Peninsula. The Continental region entirely surrounds the Pannonian region as well as the Carpathian Mountains, which belong to the Alpine region. In countries such as Slovenia, Croatia, Serbia and Bosnia-Herzegovina the shifts from one region to another occur over short distances. The Czech Republic is fully within the region except for a small area in southeast. Luxembourg is wholly within the region.

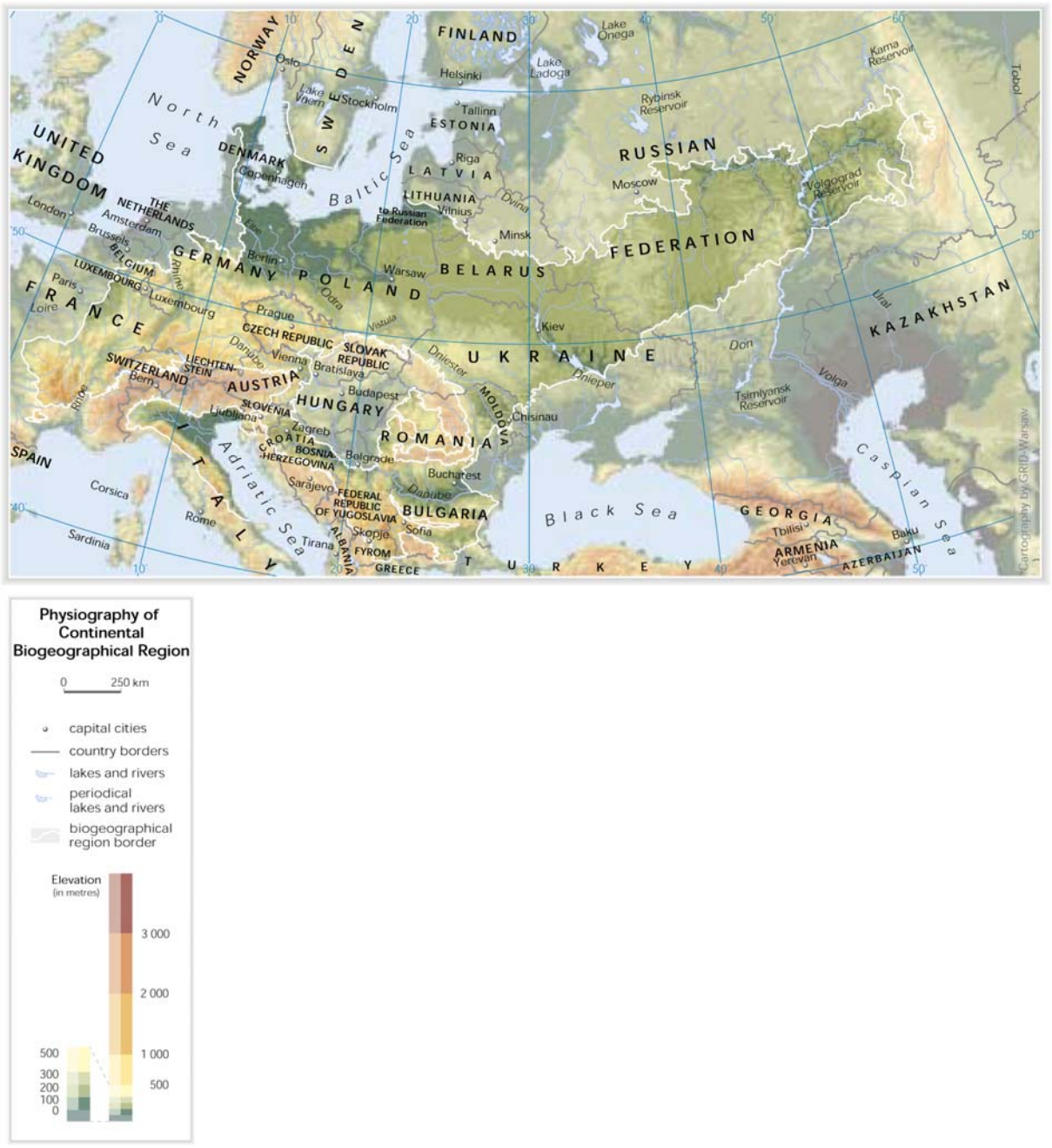
Table 1. Statistics for the Continental biogeographical region.

Surface area (km^2)	Number of countries in region	National composition by area	Population (inhabitants/km^2)	Main habitat types
2 700 000 (ca 25 % of Europe)	23	RU 32 % DE, PL, UA 11 % FR 7 % RO 5% BG, BY, CZ, IT 3 % YU 2 % AT, BA, BE, CH, DK, HR, LU, MD, MK, SE, SK, SL (<1 %)	Around 150 but varies substantially	Agriculture 52 % Grasslands 14 % Forests 27 %

Sources: EEA/ETC BD, compilation from various sources (EEA Corine Land Cover database and ETC/CME);BfN, 1996.

Note: AT: Austria; BA: Bosnia and Herzegovina; BE: Belgium; BY: Belarus; BG: Bulgaria; CH: Switzerland; CZ: Czech Republic; DE: Germany; DK: Denmark; FR: France; MK: Former Yugoslav Republic of Macedonia; HR: Croatia; IT: Italy; LU: Luxembourg; MD: Moldova; PL: Poland; RO: Romania; RU: Russian Federation; SE: Sweden; SK: Slovakia; SL: Slovenia; UA: Ukraine; YU: Federal Republic of Yugoslavia (now: Serbia and Montenegro). Since 2003 Lithuania is considered to be fully within the Boreal biogeographical region.

Map 1. The Continental biogeographical region.



Source: EEA, UNEP/GRID Warsaw final map production.

Note: Lithuania is since 2003 considered to belong to the Boreal biogeographical region.

1.1.1 Topography and geomorphology

The landscape is generally flat in the north and hilly further south. Huge floodplains surround rivers like the Danube and the Po. The north European plain, stretching from Germany into the Russian Federation and extending northwards into Denmark, was formed during the ice ages. At its southern limit in Germany and Poland a belt with several thousands of shallow lakes was formed. Large inland areas with dunes have been formed in the melting phase of the ice or on flood plains such as in Germany, Poland and Denmark.

Further south between central France and the heart of central Europe a series of low blocks of mountains are interspersed with lowland plains and plateaus, with associated ancient and recent volcanic activity, for example in Auvergne in the Massif Central. To the east lies the extensive Russian Plateau.

The Continental region includes the middle courses of a large number of Europe's most important rivers: the Danube, Desna, Dnepr, Dnestr, Elbe, Loire, Oder, Pripyat, Rhine, Vistula and Volga. These rivers have played a determining role in the formation of the landscape and its subsequent biodiversity. They have also been decisive for important parts of the basic settlement structure and infrastructure.

1.1.2 Soils

Soils show a north-south gradation. As the moisture surplus diminishes to the south-east, leaching becomes less intense and true podzols give way to grey and brown forest soils, which are less acidic, have a much greater organic content and higher natural fertility. Peaty swamp soils found in the lake area and in poorly drained valleys are of importance in the north. The foothills of the Alps in the south of the region contain sedimentary material from intensive erosion on the steep alpine slopes.

Much of the most fertile soil in the region was developed on loess, an unstratified, homogeneous, fine-grained earth, blown south from glacial and fluvio-glacial deposits. This type of soil is dependent on climatic conditions as well as on the geological nature of the substrata. Black earth chernozem, for example, has developed under particularly favourable conditions, producing high natural fertility, which combines low acidity and high humus content. The chernozems of central Ukraine are among the most fertile soils in the world. They occupy about two-thirds of the country's area and a significant part lies in the Continental region. Soils developed on alluvial sediments are common in the floodplains of the region's various large rivers.

1.1.3 Continental climate

The climate in the region can be defined as truly continental in the eastern parts where there are strong contrasts in seasonal temperatures, with generally warm summers and cold winters.

Rainfall is most abundant during summer. Precipitation in the region varies mainly according to altitude and exposition. Towards the west, these characteristics become less and less marked due to oceanic influences.

The western slopes of mountains receive the highest precipitation: around 1 700 mm/year in the German Black Forest. In the lowland plains, precipitation can be less than 600 mm/year: Warsaw, for example, receives an average of 500 mm/year. Rainfall patterns have changed in the last decades.

Winter temperatures rise steadily from east to west. The average January temperature is –15 °C at the foot of the Ural Mountains, –3 °C in Warsaw and 0.6 °C in Strasbourg. Winter temperatures do not vary as much between north and south.

At equivalent altitudes the south is warmer than the north in summer. This is largely compensated for by the fact that areas in the north is mainly made up of wide lowland plains, and the south is mainly mountainous. Therefore similar summer temperatures are found throughout the region. The floodplains of the Danube and the Po are exceptions to this: they are generally warmer throughout the year. In the Russian Federation both winters and summers are relatively long and pass very quickly from one to the other. Further west, spring and autumn last much longer.

The region is climatically favourable for vegetation growth and is responsible for the bulk of European agricultural production. In some areas, however, large variability in precipitation can lead to relatively long periods of drought or, alternatively, excessive humidity. Crops can fail either by too much or too little rain. One of the most important limiting factors for vegetation growth in the central east European lowlands is the occurrence of very cold winters and long-lasting periods of frost. Any changes in this climate pattern in the region may have a significant impact on agricultural production, and on the many forest areas.

1.1.4 Population and settlement – fragmentation

The north-western parts of the region are among the most densely populated areas in the world. Further east and south, population is less dense with the exception of some important industrial zones in Poland and Ukraine. The urban population has increased throughout the region, the most striking change being in the former Czechoslovakia where 76 % of the population was urban in 1990 against 41 % in 1950. The expansion of settlements, industry and infrastructure has increased rapidly over the last 10 years, especially in central European countries.

This trend in combination with the intensification of agriculture with greater distances between habitats interspersed in the agriculture area and in the intensive forestry has made this region the most fragmented in Europe.

1.2 Main influences

Main influences

The main influences on biodiversity are:

- climate change
- economic use of species
    - agriculture, including wineyards
    - forestry
    - freshwater fishing
    - hunting

Other important influences are:

- infrastructure
- intensive use of rivers
- contaminants
- alien species

Economic use of species is an important influence on biodiversity in the Continental region. Photo: Linus Svensson.

1.3 Main political instruments

Main political instruments

The main political instruments of direct importance for biodiversity in the region are:

- the UN Convention on Biological Diversity (CBD)
- the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention)
- the Convention on Migratory Species (Bonn Convention)
- the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)
- the UN Economic Commission for Europe (UNECE) Convention on Long-range Transboundary Air Pollution (CLRTAP)
- the Ministerial Conference on Protection of Forests in Europe (MCPFE)
- the pan-European Biological and Landscape Diversity Strategy (PEBLDS)
- the Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention)
- the European Landscape Convention
- the Convention on Protection of the Alps (Alpine Convention)
- the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (UNECE Water Convention)

European Community legislation and policy, in particular:

- EU Birds and Habitats Directives
- EU Biodiversity action plans
- EU Environmental action plan
- the Common Agricultural Policy and its accompanying measures
- the Forest Action Plan and its accompanying measures
- the EU Water Framework Directive

1.4 Biodiversity status

1.4.1 Ecosystems and habitat types

The Continental biogeographical region has some of the continent's most productive ecosystems. It is the transition zone on the N–S axis between the woodland-dominated coniferous Boreal region and the open Steppic region. Agriculture covers more than half the area, in addition to which there is a significant proportion of grasslands, mostly semi-natural. Forests are much less prominent than in the Boreal region, but still cover around 27 % of the area. Former widespread heathlands on sandy soil in the northern part have been cultivated or afforested. Large bog and mire areas have been drained and cultivated (Table 2). Only 4 % of the region is urban or constructed, but the area is spreading. The infrastructure is dense, especially in the western part, and is expanding all over the

region. With growing economic activity in the east, urbanisation and infrastructure are expected to increase significantly. The change in land use is leading to an increasing fragmentation of habitats and the creation of barriers, which isolate species populations.

Increasing infrastructure projects are causing fragmentation of ecosystems in the Continental region. Photo: Perry Nordeng, Citytunneln.

Table 2. Main habitat types of the Continental biogeographicalal region.

Agriculture and gardens	Grass-land	Forest and other wooded land	Heath-land and scrubs	Wetlands (bogs and mires)	Rivers and lakes	Coastal and halophytic habitats
52 %	14 %	27 %	Less than 2 %	ca 1 %	ca 1 %	less than 1 %

Sources: Compiled by ETC/NC and EEA from Corine Land Cover (EEA) and PELCOM map (Pan-European Land Cover Monitoring, 1999, NL), June 2000. EUNIS Habitats Classification, ETC/NPB.

Note: Estimate based on only 83 % of western part of the region.

In the EU-27 part of the region, 149 habitat types of Community importance are identified in the EU Habitats Directive (Annex I), out of which 46 are of priority concern.

1.4.1.1 Continental forests

Forests cover around 27 % of the region. The climatic conditions and the soils are in many places best suited for deciduous forest, with different species being predominant according to geographical location. As a whole, however, conifer forests dominate in several countries of the region, having to a considerable extent replaced local deciduous species in managed forests.

The concentration of urbanisation and the development of agriculture in the plains and

the large river valleys have resulted in almost total deforestation or to very fragmented forest remnants, particularly in the western part of the region. Large lowland areas are still covered by forest in the east, particularly in the north of Ukraine and southern Belarus. Forests are intensively managed in the western parts, while forests in the eastern parts have been under much less management until now.

The forests contain a large proportion of all the species present in the region. In Germany for instance 50 % of all indigenous vascular plants grow in forests or other wooded land. Deciduous forests on alkaline soils may house around 340 vascular plant species, second only to the dry grasslands with 382 species. The beech forests are rich in animals closely connected to forests: two thirds of all Continental region beetles occur in forests, 20 % of them being dependent on dead or rotten wood (TBFRA, 2000).

Lowland beech forest is one of the most important forest categories in the Continental region. Photo: Tor-Bjorn Larsson

Deciduous forests – Most of the deciduous forest is managed. The beech (*Fagus sylvatica*) is especially characteristic of the southern and western part of the region. Further east, the beech becomes more and more scarce: it cannot survive the prolonged periods of frosts east of Poland and is also susceptible to dry climates. The natural

distribution of hornbeam (*Carpinus betulus*) stretches further east. Oaks (several *Quercus* species) occur in around half of the area and penetrates deeply into the Russian territory. The limits of the distribution of elm (*Ulmus glabra*), lime (*Tilia cordata*) and ash (*Fraxinus excelsior*) correspond in general to the eastern border of the Continental region, the Ural Mountains, and in the southeast reach the borders of the Russian steppes via a belt of forest steppe. Deciduous trees become more and more sporadic going north towards the transition zone to the boreal forest.

The black locust tree (*Robinia pseudoacacia*) was introduced around 1600 from North America and has since then been widely planted on mesic to dry, sunny and often disturbed mineral rich soils. It is extremely hardy to frost, and a very good bee plant, important for beekeepers in southern parts of the region. It has, however, also locally become a problematic species invading dry grasslands in large areas and mixing into young forests. Moldova is an example of a country where the formerly fully dominant deciduous trees (mostly oak) are now competing strongly with the black locust (more than 38 % of the forest area) and with box elder (*Acer negundo*, another North American introduction).

Deciduous floodplain forests – Rivers of continental Europe are naturally bordered by riverine forests. However, most of these wet forests have disappeared along the major rivers, due both to channelisation of rivers, build-up of riverbanks and to conversion to agriculture or urbanisation. The forest belt at the river's edge is often referred to as riparian forest.

An example of the reduction of riverine forests along the Rhine can be given: Forests used to cover about 2 000 km² but is nowadays fragmented and covers a total of 150 km², of which less than 1.5 km² is still semi-natural.

The riverine and alluvial forests occur on soils, which have over time been deposited by rivers during flooding. They are among the richest and most complex ecosystems of Europe. They are decidous with widespread European oak (*Quercus robur*), elm (*Ulmus campestris*), poplars (*Populus* spp.) and ash (*Fraxinus* spp.), but they also contain a high diversity of other tree species. The forests along the Rhine contain 24 tree species, 24 shrubs and 3 climbers belonging to 21 families and 34 genera. The wealth of species is due to the richness of the soil and the abundance of light in the undergrowth, which allows a complex stratification. Alluvial forests are the home of numerous animal species. In the Rhine forests, 38 bird species have been recorded, with about 200 pairs per ha of forests, which is twice the number of pairs to be found in temperate oak-beech forests.

All over the region, vast stretches of riverine forests were first use for grazing and hay-making. With growing intensification many areas were turned into arable land or plantations of poplar and other deciduous trees with short generation times. However, where these activities are abandoned, riverine forests may return naturally: it will, however, take 50–100 years and will probably not result in the same species composition. Restoration success normally depends on access to active flooding processes. In the region relic stands of riverine forests are partly protected in national parks and nature reserves in Austria (Danube near Vienna), Belarus and Ukraine (Upper Dnepr), Croatia (Sava lowland), Germany (Upper Rhine valley, Middle Elbe, Lower Oder) and the Russian Federation (the Volga west of Kazan, the floodplains of the Oka, Don and Vorona rivers).

Lessons learned from the floodings experienced in the central parts of the region during 2002 indicate that future flooding-incidents may be mitigated by de-regulation of some river stretches to allow water to spread temporarily. Such management could also be directed towards restoring or allowing for new riverine forests

Coniferous forests – Conifers become naturally more abundant towards the east and are

also in many areas favoured for forestry, especially on sandy soil or at higher elevations. Poland is noted for Scots pine (*Pinus sylvestris*) and the eastern slopes of the Vosges in France and the Black Forest in Germany for Norway spruce (*Picea abies*), which is also generally present in the limited sub-alpine belts of the mountains. European silver fir (*Abies alba*) becomes more and more important towards the east (from Belarus to the Russian Federation and Ukraine).

In Germany 72 % of the forests are coniferous, mainly Scots pine (*Pinus sylvestris*) and Norway spruce (*Picea abies*); the remaining 28 % are deciduous with 20 % beech. In Poland 88 % of the forests are coniferous, 76 % of which are Scots pine and larch. In Belarus pines (especially the European silver fir *Abies alba*) dominate (55 %), and occur mostly in the north, while other species are much less frequent, for example birch (12 %), spruce (10 %) and black alder (8 %).

Very few remaining natural forests – In the eastern part of the region there are large extensively or little managed forests. The largest area of old lowland continental forest in Europe, Bialowieza (Box 1), is found on the border between Poland and Belarus.

Box 1. The Bialowieza Forest

Foto: Tor-Bjorn Larsson

The Bialowieza Forest is the largest area of old mixed forest in Europe. Preserved for centuries as the private hunting forest of first the Polish kings and later the Russian tsars, it was designated a national park in 1932, a UNESCO biosphere reserve in 1976 and a UNESCO World Heritage site in 1979. It is situated in a vast forest complex (125 000 ha) and covers 10 500 ha. The rich forest vegetation that once covered much of Europe survives here, dominated by trees that have grown to exceptional heights. The dominant forest type is the eastern European Tilio-Carpinetum (lime and hornbeam) and the central European Querco-Carpinetum (oak and hornbeam). There are more than 630 vascular plant species recorded, with at least 11 tree and 35 shrub species. Beech, larch and yew are absent.

The forest is contiguous to the east to the Belovezhskaya Pushcha National Park in Belarus, which also has a long history of protection and which became a World Heritage site in 1992 (87 000 ha) and a biosphere reserve in 1993 (177 000 ha). Here the Tilio-

Carpinetum is dominant. The forest here contains 26 tree species and 138 shrub species, in all more than 900 vascular plant species.

The forests are designated in various zones from core areas to buffer zones. Both reserves house the European bison (*Bison bonasus*), also called the visent, together with a rich fauna of mammals, birds and also fish. Some 95 000 visitors visit the Polish reserve annually, mostly for strictly guided tours, while far fewer visit the Belarus park at present (Lapinski, W. 2000).

More information is available at the UNESCO World Heritage and Biosphere Reserve web sites http://tinyurl.com/5fjf8q.

Photo: Gunilla Andersson

1.4.1.2 Rivers and lakes

The region is crossed by most of Europe's largest rivers and has distinct areas rich in lakes.

Rivers – The Continental region is characterised by large rivers and river systems, which connect it with all European seas except the Arctic. The river flows are moderate in speed, but the volumes of water carried are enormous because the catchment areas are large. Based on river flow data (EEA, 1995) it is estimated that about 20 % (approximately 600 km³) of the total average annual run-off for Europe (approximately 3 100 km³) is carried to the seas by rivers originating in this region. Including the Volga River in the estimate brings the percentage to 27 %. This means that the quantity and quality of the water in this region has a major influence on virtually all sea areas around Europe.

The Rhine, Danube and Volga and most of the other large rivers in the region have been considerably regulated. Dams, dikes and embankments to regulate flow and reduce floods have resulted in major losses of river-associated habitats and species. In recent

years there have been severe floodings in many areas due to increases in the quantity of rainfall and run-off episodes. This has mainly influenced farmland and forests, but several cities have been much impacted.

Lakes and reservoirs – The distribution of lakes is uneven in the region, but there are some distinct lake areas, many in the zone close to the southern limit of the latest glaciation. Poland has a large number of lakes (more than 8 000 with a surface area bigger than 1 ha), while other countries have a much lower number (Table 3).

The lakes of the region are very different, varying from the rather shallow Masurian lakes (more than 3 000 lakes including the large lakes, Sniardwy and Mamry) and associated mires in eastern Poland to the many lakes in several parts of northern Germany and the very large lakes close to the Alps in Austria, France, Germany and Switzerland. The extremes are represented by the very deep Lac Léman (maximum depth 310 m) in France and Switzerland and the also large but extremely shallow Neusiedlersee (maximum depth 2 m) in the open agricultural plain on the border between Austria and Hungary.

Seven natural lakes in the Continental biogeographical region are larger than 100 km², the largest being Lac Léman and Bodensee, ranking 20 and 21 in order of size of European lakes. The region contains seven major reservoirs larger than 100 km^2 including the largest European reservoir, the Kuybyshevskoye on the River Volga. This reservoir is in fact the largest riverine water body in Europe (International Lake Environment Committee (ILEC): World Lakes Database; Groombridge and Jenkins, 1998).

In addition there are important coastal lagoons along the Baltic coasts in Denmark, Germany and Poland, and on the Adriatic coast of Italy (see below under Continental region coasts and islands in this section and in the chapters on the Baltic Sea and the Mediterranean Sea).

Table 3. Natural lakes with surface areas larger than 100 km² in the Continental biogeographical region.

Name	River catchment	Surface area (km^3)	Volume (km^3)	Max depth
Léman	Rhône	580	89	310
Bodensee	Rhine	540	49	252
Neusiedlersee	Danube	320		2
Neuchâtel	Rhine	220		153
Müritz	Elbe	120		33
Sniardwy	Vistula	110	1	23
Mamry	Vistula	102	44	12

Source: ETC/MCE, 2000, compiled from Herdendorf (1982) and other sources.

Floodplains – Extensive floodplains are found at the middle sections and lower courses of the big rivers: the Danube, Elbe, Loire, Oder, Po, Pripyat, Rhine, Sava, Vistula and Volga. The floodplains are normally quite flat with poor drainage, and contain naturally large swamp areas with bogs, humid forests and shallow lakes, forming a complex nature system between river, lake and bog. Regulation of the rivers and the building of embankments have resulted in strong regression of most of these habitats, rendering remaining natural floodplains among the most endangered ecosystems in Europe. Significant areas of the floodplains of Loire and Pripyat are still to a large extent intact.

1.4.1.3 Bogs and mires

The region is rich in different types of wetlands, including peat bogs, freshwater marshes, wet meadows and soda lakes and of man-made fishponds. Most of these valuable wetlands are unprotected and are still subject to drainage and cultivation or to excavation of peat. This trend was particularly strong in the period 1950–1990, where information such as from Germany and other countries indicated losses of 30–50 % of bogs of various types, more in the west and less in the eastern part of the region (Wetlands International <www.wetlands.org>).

The largest remaining bogs and mires are found in the eastern part of the region. The Pripyat Marshes, a vast waterlogged area in the basin of the Pripyat River between Belarus and Ukraine, represent the largest remaining wetland and bog area in Europe (more than 100 000 km²), with lakes in all stages of development into bogs. There is much interest in developing parts of this area into agriculture in both countries.

Raised bogs with *Sphagnum* moss earlier covered vast areas in the north European plain, where there is excess humidity and low nutrient levels. Most have been greatly reduced over the last few centuries. These bogs have a specific flora and fauna, sometimes serving as a refuge for arctico-alpine relic species, e.g.in France dwarf birch, *Betula nana*, can be found on bogs in Jura. Active raised bogs and a variety of other bog types are priority habitat types under the EU Habitats Directive.

An example of support to wetland conservation can be seen in the strategy and action

plan for mire and peatland conservation in Central Europe (Wetlands International, 2004). The strategy covers Poland, the Czech Republic, Belarus and Ukraine in the Continental region (and Estonia, Latvia and Lithuania in the Boreal region).

1.4.1.4 Coasts and islands

In the north, the Continental biogeographical region borders on the western Baltic Sea and Danish belts and in the south on the Adriatic part of the Mediterranean Sea. The coasts are mostly lowlying and many have large brackish lagoons and shallow waters, but also large stretches with sand shores, today increasingly use and developed for tourism. The Baltic lagoons and shallow marine waters provide large areas for both migrating and breeding waterbirds. These areas see increasing wintering of migrating birds, which used to fly further south. The shallow lagoons of the Adriatic coast are the homes of large waterbird populations during the winter and breeding seasons. In addition, the rocky Adriatic coast parts house important raptor populations.

1.4.1.5 Grasslands

During recent decades there has been a severe decline in grasslands, now covering less than 14 % of the region. As in other biogeographical regions intensification of traditional agriculture and afforestation leads to decline in permanent grasslands.

Similar to the situation for forests, the grasslands with long continuation and often also those with high numbers of indigenous species are the most threatened also in this region: these are either turned into intensive arable use or are set out for afforestation, or their broad species composition is changed towards fewer and higher yielding grass species through in-sowing and fertilisation. The general airborne influx of nutrients contributes to the fertilisation.

Dry grasslands in Champagne-Ardennes in France, for example, represent only 1 % of what they were at the beginning of the 20th century. In the southeastern parts of the Russian Federation and Ukraine wide areas of grassland used to occur naturally. However, these areas have been almost completely transformed into arable land with crops such as wheat, maize and sugar beet. The remaining grasslands are dominated by grass species such as *Festuca, Agrostis* and *Avena.* Species of *Stipa* and *Koeleria* also occur but they are more typical of the steppes further south. Flowering plants are strongly represented by different types of clover and other leguminous, nitrogen-fixating plants. Other areas of natural grassland do occur elsewhere, for example in sub-alpine belts in the Vosges, the Massif Central and the Böhmer Wald. In Austria, in the Weinviertel (north of Vienna), relic steppes on loess have a flora and fauna composition closely related to steppes further east. The large Swedish island Öland, with calcareous soil and a very dry climate, represents a northern outpost of the flora and invertebrates of dry and warm central Europe with steppic plants and insects. The same feature is seen on the calcareous soils in southern Denmark and northern Germany.

Dry grassland on the island Öland, off the Swedish east coast. Photo: Anna-Lena Anderberg.

Most of the grasslands of the region, however, whether dry, semi-dry or humid, are semi-natural, being the result of old deforestation in order to create land for pasture. Many of them date back several hundred years. Formerly most of these grasslands were maintained by extensive use through hayproduction and grazing, with many different types of local practice carried out throughout the region. When abandoned and left alone for only a few decades, dry as well as other types of grassland will normally revert spontaneously to woodland, being colonised by woody species (mostly by locally widely distributed deciduous trees and shrubs).

The diversity of plant life in grasslands is associated with a wide variety of animals, particularly insects, including butterflies, as well as many grasshoppers, spiders, bees and flies. In e.g. Germany dry grasslands contain around 372 plant species, the largest number for any habitat type in the country.

Dry, semi-dry and humid species-rich grasslands. Photo: Ulla Pinborg.

Flooded alluvial grasslands support typical swamp and alluvial plants such as *Gratiola officinalis*, *Peucedanum officinale* and *Iris sibirica*. Bird species such as the curlew (*Numenius arquata*) and the corncrake (*Crex crex*) also occur in these habitats. Their populations have fallen steeply. For the corncrake, which globally is endangered, a European action plan[1] as well as a number of national action plans have been elaborated.

1.4.1.6 Dunes

Extensive dunes are found in the region on the Adriatic coast in the south and on the Baltic coast in the north, where the diversity of dune vegetation is high. Many inland dunes have developed into grey or wooded dunes and later, through extensive grazing, into heathlands, such as in Germany, Poland and Denmark, but are now to a large extent either cultivated or afforested, mostly with conifers. Inland dunes also exist near Lac Léman in Switzerland.

1.4.2 Species

The last glaciation had forced animals and plants to the south of Europe, re-colonisation and re-immigration into the Continental region followed along two main routes:

- from the Mediterranean to western Europe, via present-day France
- from the Balkan Peninsula into eastern Europe via the Pannonian Basin and Ukraine

These differences in origin can still be traced, when comparing different parts of the region, particularly among herbaceous plants and insects, and even some vertebrates. For some species the re-colonisation is considered to still be ongoing. Tree species such as sycamore (*Acer pseudoplatanus*) are considered to be on a natural move northwards,

[1] Corncrake - BirdLife Species Factsheet

http://www.birdlife.org/datazone/species/index.html?action=SpcHTMDetails.asp&sid=2878&m=0

having naturally reached northern Germany whilst it at the same time is also spreading from planted stands north of this line. With changing climate the speed of re-colonisation may increase for those species that have the ability to spread in time to follow the change.

Table 4. Species of European importance in EU-27 Member States in the Continental biogeographical region. Birds Directive, Annex I (B AI) and Habitats Directive, Annex II (FFH AII).

Number of all birds directive annex I species and sub-species in the EU-15 Member States in the Continental biogeographical region (March 2000), limited to breeding bird species	110
Number of all Habitats directive (FFH) annex II species and sub-species present in the EU-27 Member States in the Continental biogeographical region	275
Number of all habitats directive annex II species and sub-species in EU-15 Member States in the Continental biogeographical region, by group	
Mammals	32
Reptiles	10
Amphibians	14
Fishes	50
Invertebrates	69
Vascular plans	83
Mosse/liverworts	17

Source: EEA/ETC BD from FFH directive annexes.November 2008. (European Commission, NATURA2000).

1.4.2.1 Flora

The plant life of the region is estimated to comprise some 4 800 indigenous vascular plant species. A relatively large variety of vascular plants is found in dry and mesic to dry grasslands (about 500 species) and in deciduous forests on alkaline soil (about 300 species). The tree and bush flora can contain up to 80 indigenous species, as in the Russian part of the region.

Endemic and relict plant species – The number of endemic plant species in the region is limited. In Germany, for example, there are only 32 endemic species and subspecies concentrated within a few areas with special ecological conditions. The Polish flora has 59 endemic plant species, most of them occurring in mountain regions. Also Belarus is rich in endemics.

1.4.2.2 Fauna

The composition of animal species reflects the intermediary nature of the Continental region between the Boreal and the Mediterranean regions. At least 578 vertebrate species, not including fish, occur (Table 5). There are around 30 000 known species of insects.

Wooded habitats host a considerable proportion of the natural fauna diversity. Many species depend on a diverse forest structure and age, and extensive areas of woodlands; they are thus vulnerable to forest fragmentation and unable to colonise new forests if these are not part of larger complexes.

Table 5. Number of vertebrate species in the Continental region from the European Atlas project inventory.

	Total	Amphibians	Reptiles	Mammals (2)	Breeding birds
Number of species (1)	578	39	66	125	348
Number of threatened species at European level (1)	124	2	2	26	94

Source *: EUNIS from the major European species Atlases. Compiled by ETC/NPB June 2000.*

Notes:
(1) Only present species are taken into account; extinct and introduced species are excluded.
(2) Excluding Cetaceans. Only 53 % of the total area of the Continental biogeographical region is covered by the Atlas of European Mammals.

Mammals – Of the 125 mammal species of the region 32 are of concern for the European Community (EU-27) and as such listed in Annex II of the Habitats Directive (Table 4).The mammal fauna is varied, both in types of species and in demands on habitats.
The mammals include the big carnivores, with the biggest populations occurring in the eastern part of the region and fewest in the west such as for the wolf. The herbivorous mammals such as deer are frequent and in most countries populations are managed for and by hunting. Large populations of several small mammal species can be found in the region. In some countries, for example the Russian Federation, around 40 % of the mammal fauna is estimated to be rodent species.

The rodents and deer are ecologically important, through grazing, tree and bush clipping, soil disturbance and soil mixing. Many of the deer species thrive with increased afforestation and land abandonment, while species dependent on open permanent grasslands are vulnerable. The European souslik (*Spermophilus europaeus,* Box 2) and the European hamster (*Cricetus cricetus,* Box 3) are examples of two vulnerable grassland species.

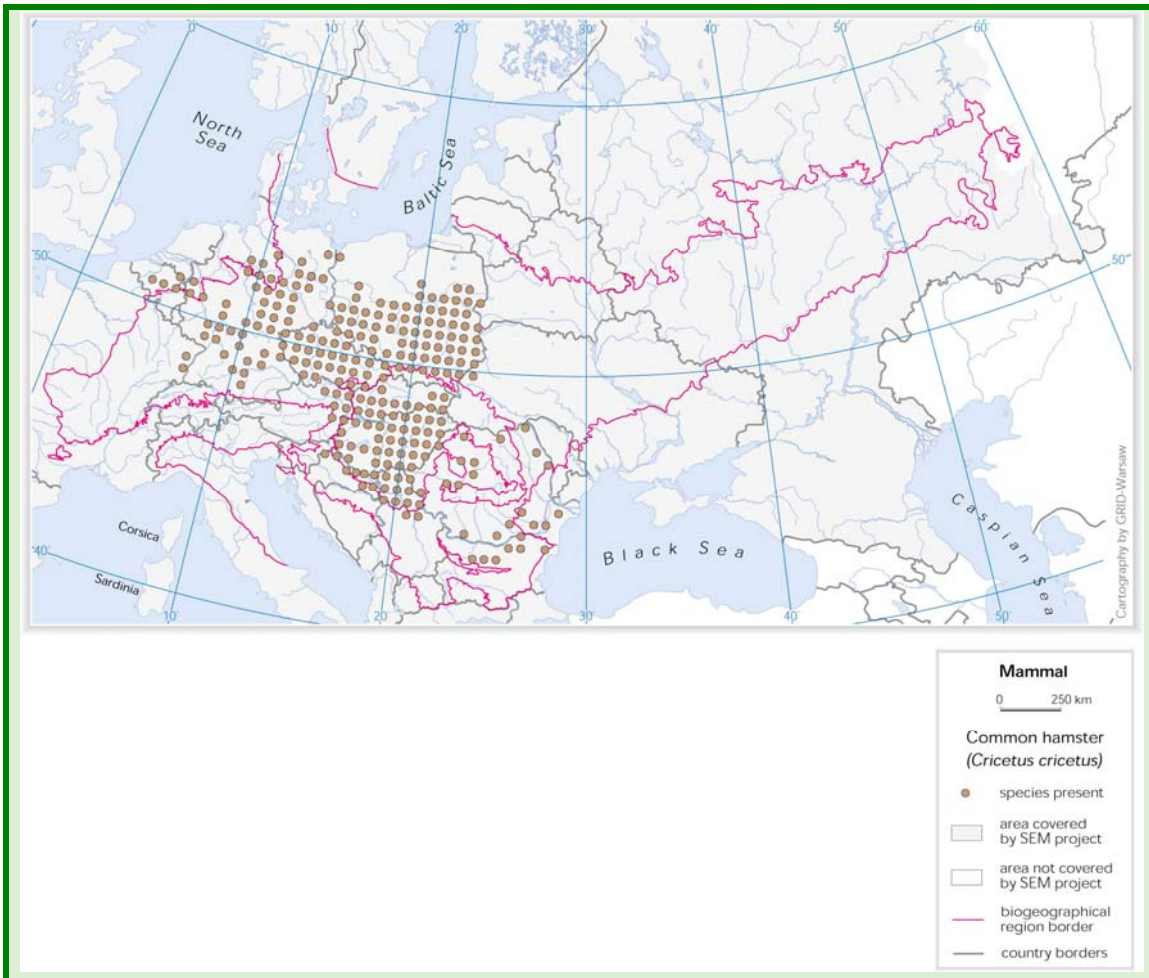
Fallow deer (Dama dama) *being excluded from a re-plantation of beech forest. Photo: Oddvar Fiskesjö.*

Box 2. The European souslik (*Spermophilus europaeus*) – an eastern rodent in danger

European sousliks occur in many areas of central Europe. They are well adapted to life on open plains, where they live in vast colonies, each with its own burrow. As the first farmers spread across the European landscapes they felled extensive areas of forest and created more and more grassland and crop fields. These were ideal habitats for the souslik, which spread west with the changing landscape, greatly extending its range. However, intensification of agricultural practices has been detrimental to many souslik populations. Sousliks and other burrowing animals play an essential role on the plains by digging and mixing the surface soils and organic materials, which helps to maintain nutrient richness and the healthy growth of grasses. The souslik is the prey of many predators typical of the steppes (e.g. the steppe eagle (*Aquila nipalensis*) and Saker falcon (*Falco cherrug*). Although there are still large and stable populations in the eastern European part of the region, it is considered that fragmentation of the distribution will be critical over time.

Box 3. The European hamster (*Cricetus cricetus*) - a rodent in danger in western Europe

The European or common hamster is one of Europe's eight hamsters. It originated in eastern Europe; it became prevalent in western Europe more than 500 years ago, when it was found mostly in the Continental and Atlantic regions, where it is now very rare. In France, for example, *Cricetus cricetus* occurs only in the northeastern part of the country in populations on the verge of extinction. The hamster is solitary and lives in farmland, where it formerly was widely distributed and lived in conflict with agriculture. The very small remaining population is in some areas supported by planting of lucerne fields. It is protected under both the Bern convention and the EU Habitats Directive. In central and Eastern Europe the status of the European hamster is better, even with some new sightings such as in Bulgaria, Croatia and Slovenia (Nechay, 2000).

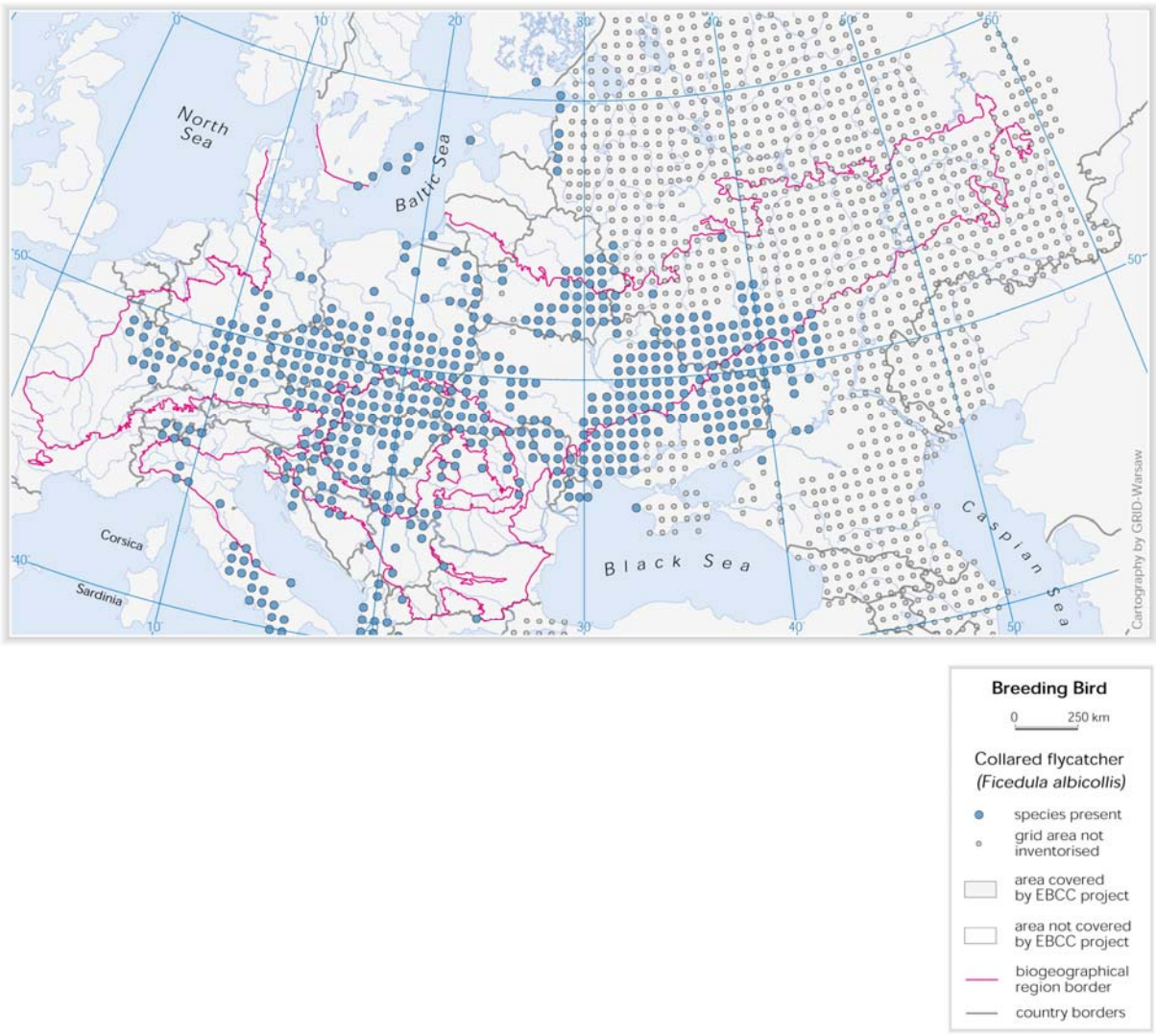


Source: EEA/ETC BD

The increase in roe deer, *Capreolus capreolus*, populations in many parts is considered to contribute to the wide spreading of tick-borne diseases such as borreliosis (Lyme disease), though some other species may also be involved. Borreliosis is at present considered the most widespread arthropod transmitted infection in Europe. The infection is caused by bacteria *Borrelia spp.* and the tick transmitting the infection by its bite is in Europe mostly *Ixodes ricinus.* Several countries have now regular reporting to central medical registers of cases brought to doctors and hospitals, but these are estimated to only cover a small proportion of the actual numbers. The heaviest infection rate occurs in central and eastern Europe. The same tick also acts as vector for tick-borne viral encephalitis (TBE) for which an increased awareness has resulted in large-scale vaccination programmes.

Birds – The region is of central importance for European birds, housing around 348 species of breeding birds and offering resting and stopover grounds for a large number of species on migration. The breeding birds make up about 60 % of the more than 500 regularly occurring European bird species. The composition of the bird fauna is very varied, the highest numbers being associated with the old forest parts and the wetlands. Although no bird species has a distribution following exactly the region's borders, the collared flycatcher (*Ficedula albicollis*), for example, of open forests and parks has a distinct association with the region (Map 2). The region also houses many spectacular birds: eagles, storks, herons and large groups of migrating cranes and geese in spring and autumn. In the Continental part of the EU-15 countries 110 bird species are of community concern and listed in annex I of the Birds Directive (Table 4).

Map 2. Collared flycatcher (*Ficedula albicollis*).



Source: EEA/ ETC BD based on data from EBCC (European Bird Census Council).

Reptiles and amphibians – Nearly all reptiles and most amphibians are associated with local climates with long and warm summer seasons. They are quite numerous in the region: in total around 100 out of Europe's 273 species. Under the Habitats Directive (Annex II) only 24 species occurring in the continental part of the EU-27 countries are considered to be of Community importance (Table 5).

Rana esculenta *is a key amphibian in the Continental region. Photo: Linus Svensson.*

Freshwater fish – The freshwater fish fauna is very varied over this large region. Although the precise number of freshwater fish species is not known, 50 of Europe's around 500 freshwater species are considered to be of Community importance in the Continental parts of EU-27 under the habitats directive (Table 5). The Russian Federation has 64 fish species; Belarus has 47 indigenous and 12 introduced or farmed fish species.

2. What is happening to biodiversity in the Continental biogeographical region?

2.1 Climate change

The Continental biogeographical region may expect an overall increase in average annual temperatures and some changes in the precipitation pattern as a result of climate changes. It is believed that a change in humidity and in frost pattern, geographically and over the year, may have more effect than a change in maximum temperature (IPCC, 2000a).

The southern and central European forest types are expected to spread north, while beech and other draught-sensitive tree species may face difficulties in areas with lower precipitation. Similarly, frost-sensitive trees may change their pattern of distribution. Discussions on these issues are ongoing and unresolved, and the full consequences of such changes for the biodiversity of the region cannot be predicted at this stage. If changes do take place towards more concentrated and heavy precipitation periods like the ones causing floods in the past decade, the water regime in the soils, drainage and run-off patterns may change, influencing not only rivers and lakes but also the big wetlands and bog areas and floodplains.

An increase in temperature together with higher CO_2 levels may underpin the ongoing rise in forest productivity. This may be further supported by a longer growing season.

The present stands of long-lived species such as trees and long-living clones such as of reeds and ivy may survive for a long time in their present locations even under different conditions.

2.2 Economic use of biological resources

2.2.1 Agriculture

Agriculture is the main land use of the region. Around 52 % is arable land, while an approximately additional 14 %, are grasslands, mostly pasture . There is huge variation in the pattern of agriculture and in the character of farms over the region. Most large farms and the most intensively used agriculture areas are found in the plains and on the floodplains. The most intensively cultivated areas appear in large tracts such as in the Paris basin, the lower Danube Valley and the Po Valley. Although there is considerable livestock production, the permanent pasture area is small or is concentrated along rivers. Agricultural intensification has not so far been as heavy in the eastern parts of the region as in te western parts, but the trend of change is evident, although there still are many areas with traditional small-scale mixed farming. The interest in sustainable farming initiatives in the most intensively managed areas has gradually grown (Box 4) as has the interest in organic farming.

Agriculture in the Continental biogeographical region – intensive farming on the plains, mosaic landscape in the hills. Photo: Ulla Pinborg.

Wine-growing is widespread in the region. Most wine is produced in the southern and eastern parts, but important wine areas also occur in all the northwestern parts of the region; production is slowly moving northwards as a result of a combination of improved climatic conditions and the use of hardier provenances. The largest production occurs in non-EU-15 countries. In the EU-15 part the wine-producing area is decreasing.

In the hilly areas of the region agricultural intensification and specialisation trends are often less advanced, leading to a different and more mosaic landscape. The cultivated areas are smaller, are interspersed with woodland, and the amount of permanent grasslands for pasture is greater. This gives room for larger numbers of open-land species (grassland species) than in the intensive agriculture areas. These areas also contain the most marginalised farms. The situation is not stable, because it is here we find the largest abandonment of cultivation and traditional grazing practices,

undergrazing and gradual loss of pastures. This mainly leads to natural or managed afforestation, and over time the forest component of these areas can be expected to continue to grow. What is now a refuge for many open-land species will then again disappear.

The decline in pastoral activities threatens open ecosystems. Open-land species depend in most cases on a delicate balance between light, low soil disturbance and low nutrient levels. Such effects can be seen in many areas such as with calcareous grasslands in France in Franche-Comté, Bourgogne and Champagne-Ardennes. Also in the Lozère, a low grazing level (undergrazing) is notably in the expansion of scrub and in the colonisation of pastures by conifers. On the island of Öland in the Baltic Sea undergrazing led to wide-scale spread of the characteristic *Potentilla fruticosa* on the steppic and orchid-rich limestone Alvar (World Heritage site in 2000, see photo). Restoration requires a delicate balance, because overgrazing may eventually be as problematic as undergrazing to maintain diversity.

Sheep graze in Potentilla fruticosa *rich areas on Öland, Swedish east coast. Photo: Ulla Pinborg.*

Intensive draining of wetlands for agricultural purposes has taken place over several centuries, though most was performed between the mid-1800s and mid-1900s. The trend has decreased significantly in many countries, but it still goes on in many parts of the region, often in smaller projects. During the last decade, intensive use and conversion have been countered in many parts of the region by wetland restoration and protection projects, in Natura 2000 areas as well as outside, though not enough to halt the decline of valuable wetlands. Large sums have been used from LIFE funds and from EU CAP.

The once-widespread raised bogs have been severely impacted in large parts of the region. Large amounts of peat have been excavated and the areas are now used for intensive agriculture or are highly managed forests. The remaining raised bog areas are mostly limited in size and influenced by eutrophication (long-distance or neighbour pollution), which will gradually change the species composition in protected areas as well. As an example: less than 1 % remains intact of the originally vast raised bog ecosystems in Lower Saxony. Of these a considerable part is strongly affected by drainage and other impacts, but around 4 000 ha are under regeneration. In the eastern parts of Germany,

raised bogs still cover up to 3 % of the land. The formerly vast raised bogs in Denmark show a similar picture: much of the peat has been excavated, large areas of the land are cultivated or afforested, and nature restoration and protection have saved only limited parts.

Some of the biggest bog areas still existing are found in the eastern part of the region in Ukraine in the Polissya swamplands (the southernmost portions of the Pripyat marshes with many bog types), but here, too, large areas have been drained and reclaimed for agriculture.

Box 4. Sustainable farming initiatives

As intensification and specialisation continue, there are also movements towards sustainable forms of agricultural management. From a slow start and mostly by private initiatives, the interest in organic farming has increased in the region such as in Germany, Italy and Denmark, not so much for the sake of biodiversity as for reasons of human health and the income to be gained from the increasing market for alternative products. The resulting decrease in, or elimination of, the use of pesticides and fertilisers in areas under such agricultural management is beneficial to biodiversity on a broader scale. From being small at the beginning organic farms are now increasing in size and effectivity just as other farm types.

A very important driving factor for the increasing interest in the sustainable management of farmlands is the availability of national or EU subsidies as part of rural development measures under the EU Common Agricultural Policy (CAP). These funds can be used to support environmentally friendly farming measures such as: encouraging the maintenance of local, endangered domestic breeds; reducing the use and impact of pollutants; encouraging extensive animal and arable farming; protecting and enhancing landscapes, natural resources, soils and genetic diversity; maintaining abandoned farmland or forest lands; taking farmland out of production for longer periods, i.e. for over 20 years, with a view to protecting habitats; helping farmers to convert to organic farming. A significant portion of environmental payments has been used to maintain, or return to management, biodiversity-rich permanent grasslands. In several countries such management has led to increases in species numbers, for example of birds, in these farmlands and to larger bird populations.

The reform of CAP in 2003 has changed subsidies from crop-dependency to the so-called Single Area Payment Scheme (SAPS). The influence in the region of this remains to be seen, also for the acceding countries.

Another important means of securing important habitats such as grasslands is through the EU LIFE-projects. These funds are limited in size and the broader needs must be tackled under EU rural development measures.

2.2.2 Genetic resources, old varieties and breeds

The diversity of cultivated plants and commercially useful animal breeds is constantly changing; the use of old forms and varieties decline or is abandoned and new ones are developed and taken into use. The same pattern exists in the other regions, the trend being towards more widely used uniform and higher yielding crops and animals. Among the European domestic animal breeds, 33 % are found in the Continental region (mainly cattle and pigs).

At the same time there are strong movements in the region to safeguard old breeds, often associated with organic farming, small-scale farming or with the increasing interest in conserving genetic resources. Most countries have or are considering how to secure crop and animal species as well as horticultural species (Box 5). Such measures are carried out in collaboration with international initiatives such as those of the EU and FAO. On the role of zoos and botanical gardens in the conservation of genetic resources see 3.1.6.

Box 5. Cultivated and domesticated species – preserving genetic resources

Around 1 400 plant species and subspecies are presently used in agriculture, horticulture and forestry. In addition there are approximately 1 400 types of apple and 1 600 types of other fruit (pears, cherries, etc.). However, only around 20 types of fruit are traded on a large scale. To preserve the genetic resources of cultivated plants and forest tree species, several countries have established centralised collections of varieties, e.g. Germany has one of the largest collections in the world. As a result of international cooperation presently almost 300 000 accessions and 122 000 000 seeds have been stored at the Svalbard Global Seed Vault.

The interest in using old vegetable varieties in private gardening is of growing, especially in the western and northern parts of the region, where intensive agriculture and gardening have pushed older varieties out of use.

With farm animals, only a small number of species are commonly used and the number of breeds has been narrowed down and been subject to intense breeding, thus endangering the existence of regionally typical traditional species varieties. Some of the open-air museums were the first to encourage the maintenance of land races in animals and some of the old crops and vegetables, but national parks and private farmers are now increasingly becoming interested, and some national activities are also taking place.

In line with the Global Strategy for the Management of Farm Animal Genetic Resources information on breeds are collected by FAO.

FAO: www.fao.org/

The Svalbard Global Seed Vault:
http://www.nordgen.org/sgsv/index.php?page=welcome

2.2.3 Forestry

Forestry in the Continental biogeographical region largely depends on a few main species (pines, spruces, firs, larch, oaks and beech). By widely regenerating with seeds originating from a limited set of local collection sites (provenances) the genetic origin of the commercially used species has been narrowed down. More recently, there is a trend towards natural regeneration with local provenances, a trend similar to the one for organic farming and for farmland crops and animals. Programmes for managing tree genetic sources are also now being widely developed[2].

The region's conifers were in the 1970 among the first to be observed suffering from the so-called forest death caused by long-range air pollution. Through international cooperation sulphur emissions have been successfully brought down and the detoriation in forest crown conditions stabilised from 1995 onwards (ICP Forests[3]).

Woody material was formerly the main fuel used in rural districts and in e.g. wood based industries. After a long period of low use there is now mainly because of climate change mitigation an increase in switching back to wood-based fuels, with substantial governmental subsidies, and a number of development projects towards biofuel for transport have been initiated.

[2] See further http://www.bioversityinternational.org/networks/euforgen/
[3] See further http://www.icp-forests.org/

2.2.4 Freshwater fishing

Central Europe has a long tradition for eating freshwater fish, and fishing in lakes and rivers has been and still is important in most areas, especially in eastern and southern parts. Fish farming in small ponds was formerly widespread. This is now decreasing, while larger fish-farming units are increasing. Stocking lakes and rivers with fish is widely spread over the region, meaning that only a few rivers or lakes are without influence from other pools of fish genes. There is at present no single overview either of the species or the amount of freshwater fish, crayfish and mussels caught in this large region. Fishbase contains information from FAO on uses and catches of fish by species and country, but not by region (www.fishbase.org).

2.2.5 Hunting

The hunting tradition is old in the region and involves a large number of species, though with different focus over the region. The major species groups hunted are birds (geese, ducks, doves, pheasants), wild boar and deer, but in some areas hares and squirrels are major game. Wolf and bear are hunted with some restrictions. Foxes, the introduced racoon and several other problematic species are treated very differently in the countries of the region as are the raptors.

Hunting large game (here moose Alces alces*) is important both as a leisure activity and from an economical point of view. Photo: Thomas Ohlsson.*

The numbers of game caught or shot are very large: in Belarus (both Boreal and Continental regions) the red squirrel (120 000 caught or shot), the mountain hare (80 000) and the European hare (105 000) are the most hunted mammals, while the mallard (*Anas plathyrhynchos*) accounts for more than 50 % of waterbirds shot. In Moldova (both Continental and Black Sea regions) ducks and doves account for more than 80 % of birds shot.

Hunting is economically important, both for local consumption and increasingly also for wider markets, and hunting tourism represents a rapidly commercial growing sector. For these reasons management of the game stock is important. Thus the number of ducks and pheasants annually bred and introduced into the wild for hunting is considered very high based on national estimates. Stocking of red deer (*Cervus elaphus*) and fallow deer (*Dama dama*) as well as wild boar occurs in many areas, but overstocking, in particular where hunting is commercialised, may result in heavy pressure on forests and on crops

and create local conflicts. Stocking with reared mallard has caused the wild mallard gene pool to be widely eroded and homogenised, resulting in a population often called park ducks. Continuous stocking with pheasant is very widespread in the region.

Pheasant, Phasanicus colchicus*, an important game species in the Continental region. Photo: Linus Svensson.*

Establishment of a self-containing permanent population in the wild of this southeastern Asiatic introduction may eventually occur.

2.2.6 Mushroom harvesting

Mushrooms or fungi have so far gained little interest in biodiversity conservation, though some species and some reserves are set out for protection either of rare species or for rich fungi communities, some reserves serving against too frequent picking of mushrooms.

As a contrast a number of species seem to fill a growing part of European consumption. By far the largest consumption is for food, followed by other uses such as for medicine and drugs. Champignons are the most widely directly cultivated and marketed species, but several other species are also cultivated in Europe or imported such as from Asia. Cultivation of fungi is no simple matter and it is only gradually that species are taken into cultivation by means of inoculation of soil, other dead organic material or trees and bushroots.

Cantharellus cibarius. *Photo: Linus Svensson.*

While the total amount seems to have decreased over recent decades in the Continental region, especially in the northern and western parts, it is still important in eastern parts, where consumption and export of fresh, canned and dried mushrooms is important. Export is increasing to western markets. There is no overview of the many species harvested, but from Belarus alone it is reported that more than 100 species are harvested in the country. Some wild species have for long been harvested in the wild, but are progressing towards cultivated or semi-cultivated status, based on intensive research and experiments: champignons, porcini (*Boletus edulis*) and chanterelles (mostly *Cantarellus cibarius*), but also other species. The increased appreciation of culinaric specialities is also evidenced by a renewed interest in truffles. Several of these underground species occur in Europe, but historically mainly *Tuber melanosporum* and *Tuber magnatum* (black and white truffles) in the Mediterranean and southern part of the Continental regions, in Germany also *Tuber aestivum* (black summer truffle), have been harvested on lime rich soils and sold at huge prices. The European harvest is declining in many of the traditional areas from combined causes of warmer and drier climate, urban sprawl and use of chemicals in agriculture. The range of harvest and assisted cultivation of truffles in Europe seem however to be spreading somewhat, even to the northern parts of the Continental region and into the Boreal region, with planting of inoculated host trees such as oak on unpolluted lime rich land, often grasslands en route to abandonment.

2.2.7 Medicinal plants

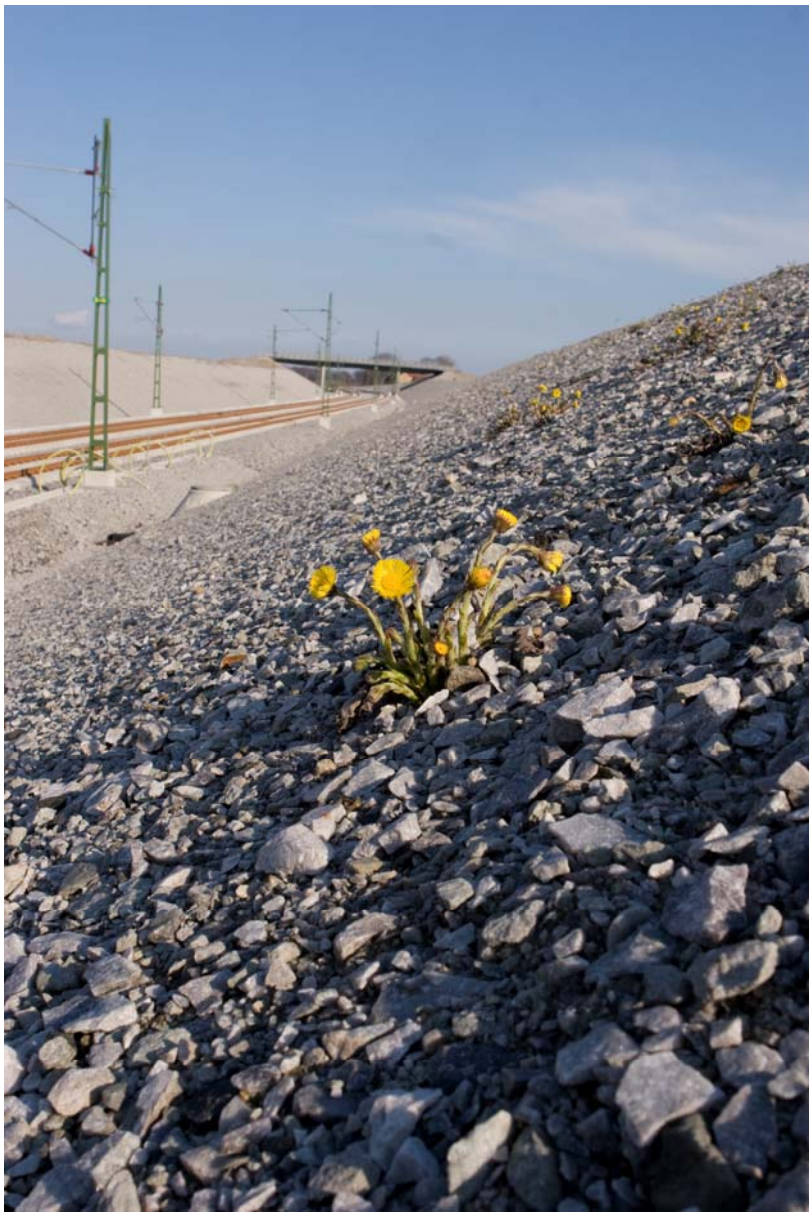
Use of and trade in indigenous vascular plants, in particular, for medicinal purposes has a long history in this region, especially in Ukraine, the Russian Federation, Germany and Romania, where there is now an increasing interest in protecting species and areas with species for medicinal purposes. Natural populations have decreased, mostly as a result of

intensification of agriculture.

2.3 Other major pressures on biodiversity

2.3.1 Infrastructure development and pressure from urbanisation

The road and railway infrastructure and networks in the Continental biogeographical region are well developed and still growing in the western and northwestern parts, from France, Belgium and Germany into Poland and Austria, as well as in the Po Valley. In these areas the urbanisation is ongoing, creating vast contiguous urban landscapes. The Ruhr district in Germany has the densest railroad network in Europe. In many eastern countries infrastructure is however also increasing. Although infrastructure is most developed around urbanised areas, the interconnecting fast roads and railways are also growing, with increased traffic loads. EU supports a number of large infrastructure projects throughout the region, both as motorways, bridges and railsystems.



Infrastructural projects are one of many treats to biodiversity in the Continental region. Photo: Linus Svensson.

As a result of dense infrastructure network as well as of more intense traffic, natural and semi-natural habitats in these areas are suffering heavily from fragmentation. When added to the impacts of intensive agriculture and industry, the region is among the most

severely affected in Europe. Also, pollution caused by traffic influence close areas directly and other areas by widespread pollution.

Ecoducts is a mean to allow animals to pass major infrastructural barriers. Some of the ducts are monitored and passages of deers have been recorded. Photo: The Swedish Road Administration.

As a consequence of habitat fragmentation and heavy traffic load, large numbers of animals are killed on roads and railway lines, as well as through collisions with electric power lines. As in other regions, several of the countries are using mitigating measures such as fencing along roads and railways, which greatly reduces traffic killing but leads to the isolation of animal populations. In several countries fauna passages have been built: for facilitating river flow and the movement of river species, mostly fish, and as dry passages under or over highways for terrestrial species. In Germany protection of amphibians for short but intensive periods when they wander across roads in large numbers, causing a danger to traffic (car sliding) was one of the first examples of dealing with the conflict between traffic and animals. Austria has built a series of landscape bridges and passages for roads and motorways throughout the country (Voelk *et al.*, 2001). The Infra Eco Network Europe (IENE), established in 1996, is a European network of authorities and experts involved in the phenomena of habitat fragmentation caused by the construction and use of linear transport infrastructure, especially motorways, railways and canals (waterways)[4].

[4] http://www.iene.info/

Deers are common roadkills. Killed fallow deer (Dama dama)*. Photo: Linus Svensson.*

An impact of fragmentation is the isolation of species populations, which may become too small to continue or develop inbreeding problems. Distinctly different gene pools (different DNA spectra) may however also result in beginning of sub-speciation. There are several examples of these conditions. Differentiation of gene spectra of badger populations in western Denmark (Jutland) have been shown to follow the main road structure, indicating a long-term effect of separation caused by roads and traffic.

2.3.2 Intensive use of rivers

The larger rivers of the region are heavily used as waterways, and most of the rivers are regulated, mostly to facilitate run-off, hydropower production and river traffic. The interconnected waterways make it possible to navigate through large parts of the region from river system to river system by canals across watersheds.

The river systems of the Danube, Elbe, Oder, Rhine, Vistula and Volga have changed greatly because of both river control and water pollution. The river system of the Dnepr is intensively used for production of hydroelectric power (the Dnepr cascade includes five reservoirs). The Kiev and Dnepr reservoir holds large amounts of radioactive alluvial sands as a result of the Chernobyl nuclear catastrophe.

It is important to point out the complex picture of the condition of rivers and lakes: although the Vistula, together with the Oder, is the biggest polluter of the rivers feeding into the Baltic Sea, long stretches of natural river landscape remain along its course with intact species-rich habitats. For example, many sandy river islands form important habitats for fauna and flora – especially for 180 species of breeding birds. This also holds true for stretches of the upper reaches of other rivers. The Loire is one of the last big rivers in western Europe whose dynamic river system remains largely intact for long stretches.

In the period after the second world war water pollution led to the virtual extinction of life in many stretches of rivers, especially those downstream from larger urban areas or polluting industries. The river conventions and the special conventions or programmes for single rivers have begun to reverse the trend. Several countries have devoted large resources to habitat restoration, with recent evidence of success. The Rhine was rich in wild salmon two centuries ago, but by the 1970s heavy pollution (combined with dam

construction, channelisation, floodplain modification and the introduction of non-native fishes) led to a marked decrease in the populations of many native fish species and the collapse of fisheries. Since the end of the 1970s, water quality has improved in the Rhine and the decline in fish populations has slowed or reversed (Lelek, 1996; Lelek and Köhler, 1996; Groombridge and Jenkins, 1998).

In recent years several severe flooding incidents have taken place in regulated rivers in the region: the Danube, the Elbe, Morava, Oder, Rhine and the Meuse. The causes have been exceptionally heavy rainfall, with total annual precipitation recorded within a few days. Ecological consequences were flooding of vast areas of agriculture and some forests, and highly increased nutrient and pollutant concentrations in the estuaries and adjacent receiving seas.

The interconnected river systems not only facilitate traffic, but also enable species to spread via the water or via vessels and ballast tanks. With possible climate change towards warmer weather and consequently warmer water, organisms now prevented from spreading by low water temperatures in winter may increasingly spread from one river system to another.

2.3.3 Contaminants

The Continental region is one of the most contaminated regions of Europe but the pattern is complex, with large and increasingly condensed, often contaminated areas, heavy air and water pollution and some of the most affected rivers, lakes and wetlands and forests. However, during the last decades large efforts have been exerted to master contamination, both for water and air. The importance for health of soil contamination is also increasingly understood, but programmes for cleaning up only begin to function.

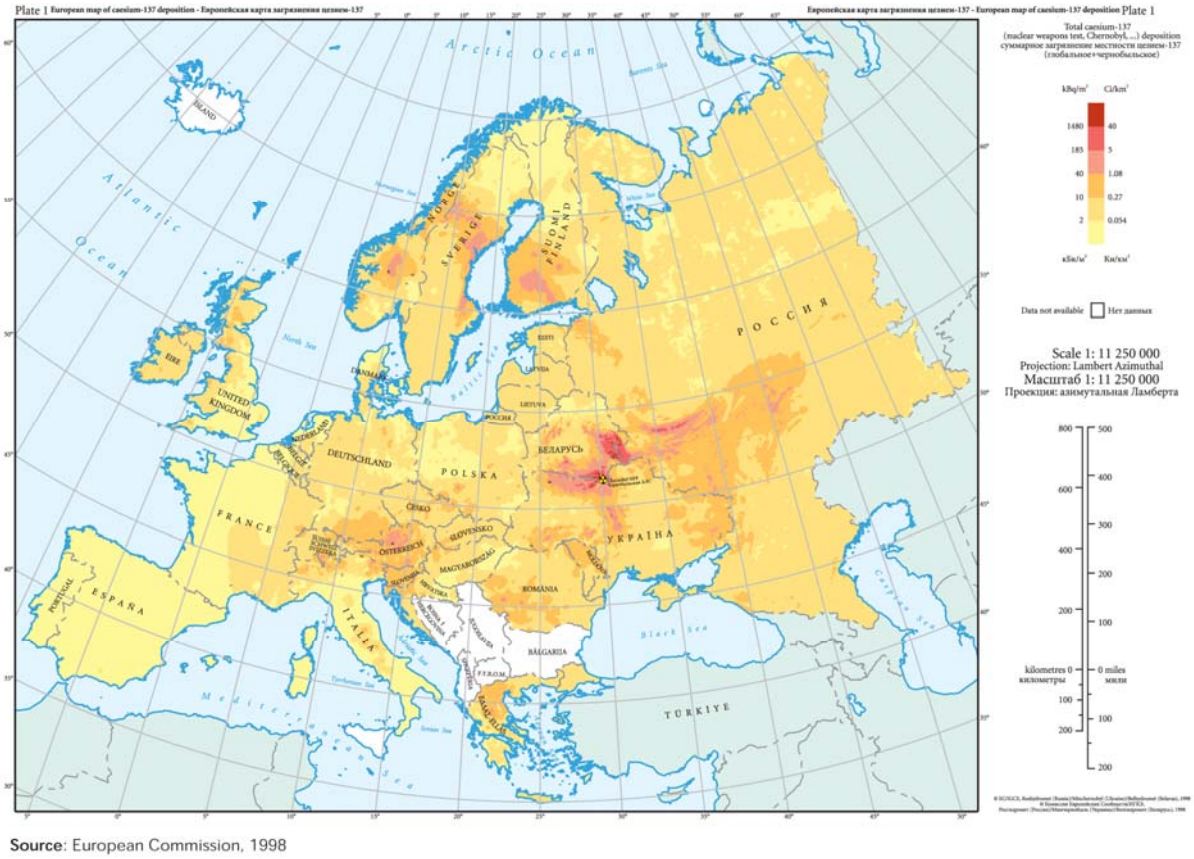
Industry and mining **–** Some of the most polluted areas in the world are found in the Continental biogeographical region. The river Ruhr in Germany has given its name to one of the world's largest single industrial regions. Rapid industrialisation in Poland and the neighbouring areas of the Czech Republic and eastern parts of Germany has severely polluted many areas. Upper Silesia and Kraków, in particular, have suffered some of the highest levels of atmospheric and groundwater pollution in Europe. The major rivers of that part of the region are all heavily polluted by industrial and urban effluents, as many of the cities and larger towns still are major sources of pollution.

Mining activities in Germany.
Photo: Vattenfall.

Mining and quarrying also seriously alter the landscape, disrupting land use and drainage patterns and removing habitats for wildlife. In the area of the Black triangle (Czech Republic, Germany, Poland), most notably in and surrounding Krkonose, problems result from the use of the locally mined and extremely sulphur-rich lignite and coal. Coal and lignite mining has also impacted heavily in Belgium and parts of Germany. Germany has performed major restorations of brown coal-mining deposits with afforestation and recreational use. Mineral excavation areas in Denmark have similarly been restored for recreation and nature purposes. Large-scale restoration works here have shown that restoration is a complicated and slow process and may not be environmentally fully sound, but that many areas may become very useful, not the least to recreation.

Radiation – The accident in 1986 at the Chernobyl nuclear power plant has created severe environmental problems in northwestern Ukraine. Vast areas of land were and are contaminated by short- and long-lived radioactive isotopes, notably strontium-90. The immediate effects on surrounding ecosystems were scorching of vegetation in some areas and radioactive fall-out, which was carried far into north and western Europe. Contamination was seen in subsequent years in berries, lichens, mushrooms and animals such as reindeer, reaching into the Boreal and Arctic regions (EEA, 2003: Map 10.1). The contamination is decreasing. The long-term impacts on nature, such as possible changed genetic conditions for species, diseases and changes such as in the calcium metabolism, are still not clear, however (Map 4).

Map 4. Deposition from Chernobyl in Europe.



Source: EEA 2003.

Contamination from waste water spills – In addition to the general pollution of rivers and lakes, major accidental wastewater spills can create serious conditions for water users, for fishing and for the river ecosystem plants and animals. Major accidents are all different, as are their consequences. The initial effects are often large and difficult to manage in a short time. The effects of water pollution are rapidly carried downstream to areas that may be much more vulnerable than the site of the actual accident.

Forest health condition – air pollution – Aspects of forest health conditions have been mentioned above under forestry. The health condition of forests is regularly monitoried by most countries of the region as part of the international co-operative programme on assessment and monitoring of air pollution effects on forests (ICP Forests) and the associated EU scheme on the protection of forests against atmospheric pollution, now called Forest Focus (The EU Forest Focus regulation COM (2002).

The ICP 2002 Executive Report shows, that defoliation continues to have a severe impact on forest ecosystems also in the Continental region, but the picture is very varying and uneven, even from year to year (ICP, 2002, UNECE and European Commission, 2002). The broadleaved trees now appear somewhat more affected by defoliation than conifers in the region, especially oak (MCPFE, 2003).

2.4 Alien species

Over the last centuries, a large number of vascular plant species (estimated at several thousands) were introduced and spread in central Europe, mostly from horticulture but also from parks and forests and via railroad tracks and roads. The biodiversity in cities is today largely characterised by non-native wild living plant species (in Berlin, for example, 30 – 50 % of all plant species).

Although only a limited number of these introduced species have survived and established themselves permanently in the wild, some of them present major problems in the region: e.g. the black locust (*Robinia pseudoacacia*), which colonises dry grasslands and is difficult to eradicate, and glandular touch-me-not (*Impatiens glandulifera*), giant hogweed (*Heracleum mantegazzianum*), and herbaceous knotgrass (*Reynoutria* spp.). The effective management of these species often conflicts with environmental policies to abandon the use of pesticides.

Giant hogweed (Heracleum mantegazzianum) *is an invasive species in the Continental region. Photo: Linus Svensson.*

Over the last few decades several hundreds of animal species are estimated to have been intentionally or accidentally introduced, e.g. the racoon (*Procyon lotor*), exotic birds, amphibians and numerous invertebrates. The practice of introducing fish species such as salmonids and carps is of long standing in all the countries of the region. The connectedness of rivers and lakes in the region allows species to spread gradually over large aquatic areas.

Some introductions during recent decades have been reintroductions of species formerly extinct, or have been to support populations of threatened indigenous species. The bison is the most famous example, but otter and beaver have also been reintroduced in the region or transferred among regions. Moving various deer species from deer farming, deer parks or reserves have meant that gene pools have become mixed and indistinct.

Among the first to consider the need for European actions related tio invasive alien species was the Council of Europe some three decades ago, an activity which e.g. has lead to publishing of a European strategy on invasive alien species 2004.

The problem has come under renewed European and also global scrutiny by the Convention on Biological Biversity (CBD)[5]. As an example in the Continental region half

[5] See http://www.cbd.int/invasive/

of the 24 countries reported during 2000 on the national status of invasive alien species in their country[6]. The European Environment Agency is currently investigating establishement of an early warning and information system for invasive alien species. Also within the European Union the Commission shows an increased interest in cooperating in managing invasive alien species[7].

3. Policies at work in the Continental biogeographical region

3.1 Nature protection

3.1.1 International agreements

The Atlantic biogeographicalal region is not covered by any special types of international collaboration on biodiversity, but by the general international, pan-European and European Community collaboration. Below some of the most important relevant agreements and processes are briefly mentioned[8].

The UN Convention on Biological Diversity is signed by all countries of the region as well as by the European Community[9].

The Convention on Wetlands (The Ramsar Convention) is signed by all countries of the region[10].

The Convention on the Conservation of Migratory Species of Wild Animals (CMS, Bonn Convention) is signed by all countries of the region, excluding the Russian Federation (cooperates however via a memorandum of understanding), Montenegro and Bosnia-Herzegovina, and by the European Community[11].

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, Washington Convention) is signed by all countries of the region and CITES is implemented in European Community legislation[12].

The Convention on the Conservation of European Wildlife and Natural Habitats (Bern convention) under Council of Europe) is signed by 22 countries of the region, excluding Belarus and the Russinan Federation, and by the European Community[13].

The Pan-European Biological and Landscape Diversity Strategy (PEBLDS) facilitates cooperation among countries of all Europe in order to stop and reverse the degradation of biological and landscape diversity values[14].

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[6] http://www.cbd.int/reports/search/?type=NR-03
[7] See http://ec.europa.eu/environment/nature/invasivealien/index_en.htm
[8] For an update of the EU biodiversity policy and legal measures see http://ec.europa.eu/environment/nature/index_en.htm
[9] See further http://www.cbd.int/
[10] See further http://www.ramsar.org/
[11] See further http://www.cms.int
[12] See further http://www.cites.org/ , http://europa.eu/index_en.htm
[13] See further http://www.coe.int/t/dg4/cultureheritage/conventions/bern/default_en.asp

The UNESCO World Heritage Convention[15] aims at protecting the world's cultural and natural heritage.

The Convention on the Protection of the Marine Environment of the Baltic Sea Area (The Helsinki Convention)[16] concerns collaboration among countries bordering the Baltic Sea. It is ratified in the Continental region by: Denmark, Germany, Poland and Sweden, and by the European Community. Although it mostly concerns the marine part of the Baltic Sea, it also covers coastal biotopes.

3.1.2 Protected areas

Areas designated for nature protection may be protected by national legislation as well as under international instruments.

3.1.2.1 Internationally protected areas

Several of the international and European Community instruments lead to area based protection of nature.

Ramsar sites: In the Continental region many important breeding, migration and wintering sites for water and wading birds have been designated under the Ramsar convention, some along the Adriatic and Baltic coasts, but mostly inland sites with lakes, mires and rivers. Most Ramsar sites are normally later also designated under the NATURA2000 Network in EU Member States.

UNESCO World Heritage sites and Biosphere reserves: There are several important biosphere reserves and world heritage sites in the region. The sites of the Continental region are very different in character and size, but all with wide internal ecological variation (Box 6).

[14] See further http://www.peblds.org/
[15] See further http://whc.unesco.org/en/about/
[16] See further http://www.helcom.fi/Convention/en_GB/convention/

Box 6. Biosphere reserves

Biosphere Reserve Krkonose/Karkonosze (Czech Republic and Poland):

This reserve shows an example of transboundary cooperation. The reserve is characterised by mixed mountain and highland systems and covers an area of 60 000 ha. It has since 1992 been jointly managed by the administrative bodies of the two national parks. Several habitat types are represented, including peat bogs, spruce forests, beech forests and flower-rich meadows. There are many endemic plant species. There has been cooperation in assessing the impact of air pollution on mountain ecosystems, in standardising methods for monitoring the main species and ecosystems as well as on a programme to limit the influence of introduced species.

Biosphere Reserve Srebarna (Srebarna Nature Reserve, Bulgaria):

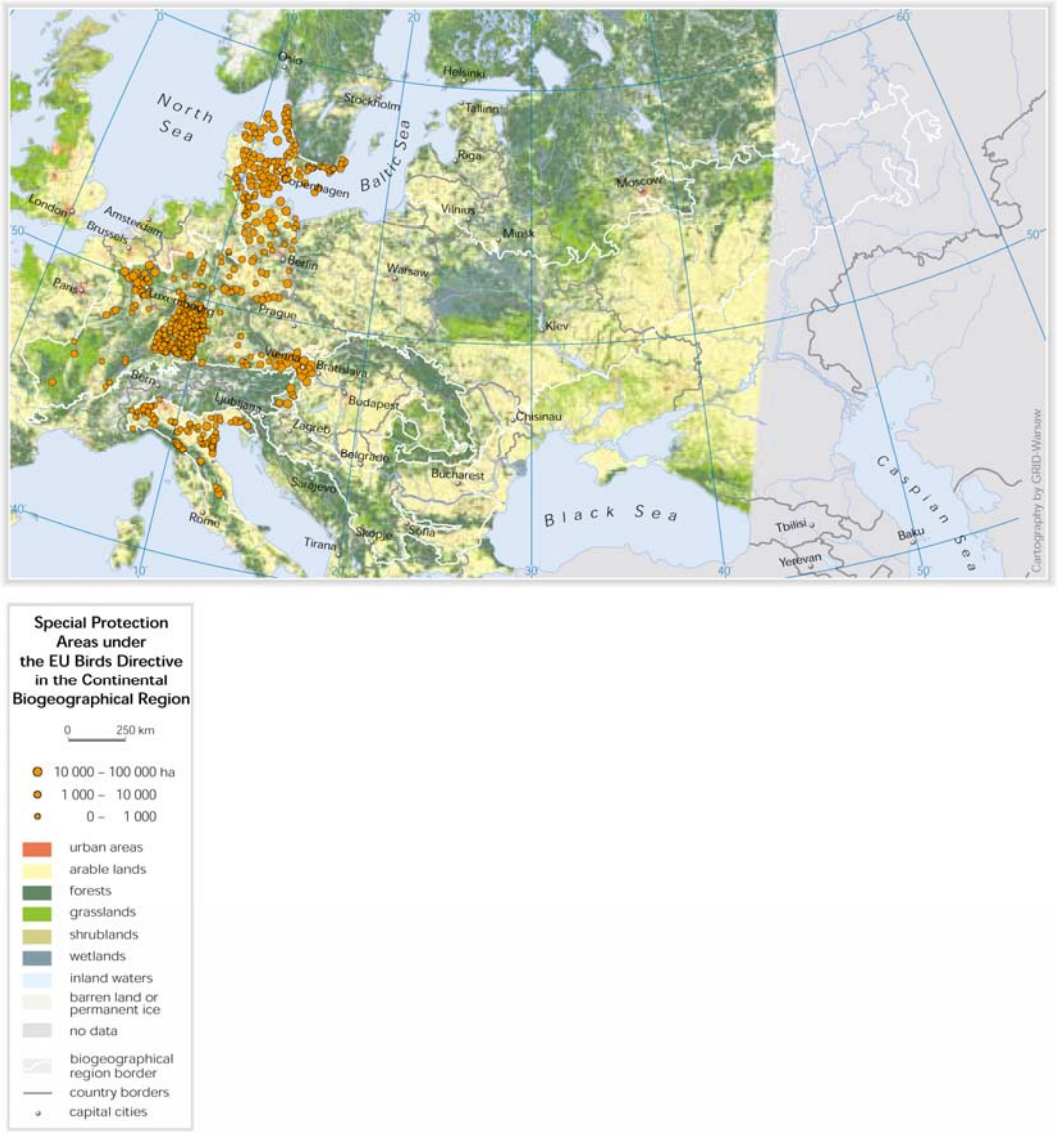
The Screbarna Nature Reserve is much smaller than the Krkonose reserve, only around 600 ha. It has status also as Ramsar site and World Heritage site. The freshwater lake lies in the flood plain of the Danube, to which it is now again connected. The vast surrounding reed beds are dominated by common *Phragmites australis*, the reserve containing nearly 70 other plant species. The reserve was established primarily for birds, housing more than 50 % of Bulgaria's birds, many internationally threatened (ca 100 breeding species and 80 migratory). Spectacular are the Dalmatian pelican (*Pelecanus crispus*) and six species of herons, a great many ducks and geese.

Information on biosphere reserves can be found at the UNESCO biosphere reserve web site < http://tinyurl.com/5ptssp>.

European Community NATURA2000 Network: The Continental list of sites of Community Importance was adopted in 2006. By the end of 2008 the EU-27 Member States in the region had designated 1478 Special Protected Areas (SPAs under the Birds Directive, Map 5), and 7475 Sites of Community Interest (SCIs under the Habitats Directive) were put forward, to become part of the NATURA2000 network. These sites are often based on existing national parks, biosphere reserves and nature reserves. Old and riverine forests as well as raised bogs are among the priority habitats of the region.

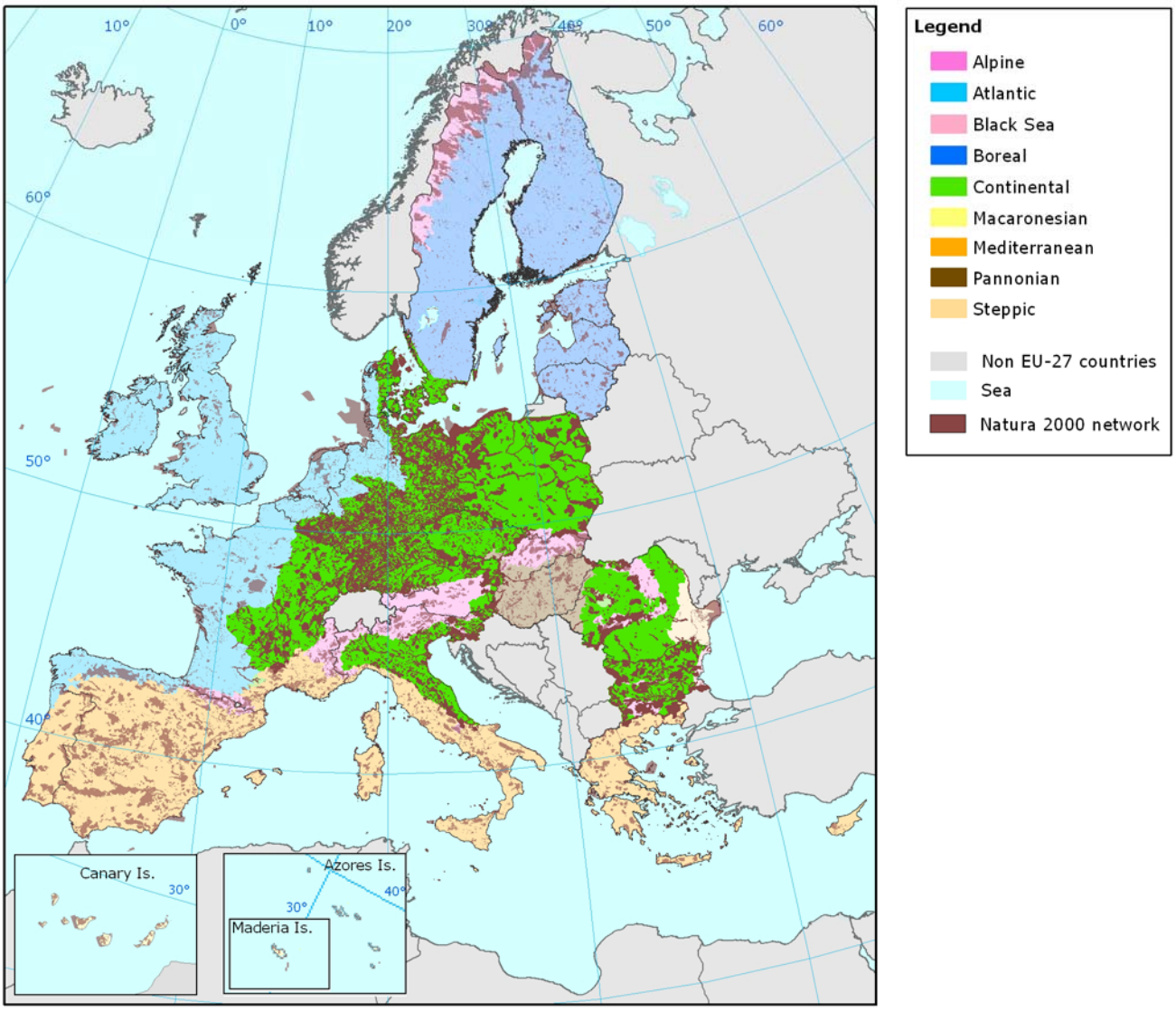
The EMERALD Network: The designation of sites under the EMERALD network was initiated in the region as a pilot project in some countries outside EU at the same time as the EU Natura2000 program was running in EU. For countries later entering EU it served as background for NATURA2000.

Map 5. Specially Protected Areas (SPAs) under the EU birds directive (status for EU-15 Member States of the Continental region)



Source: ETC/NPB compiled from EU birds directive database. March 2001.

Map 5. NATURA 2000 network in the Continental region



Source: EEA / ETC BD compiled fromNATURA 2000 database. November 2008

Few of the species, which are of Europe conservation concern under the EU directives, occur solely in the Continental region.

3.1.2.2 Nationally protected areas

All countries of the Continental region have a large number of protected areas that fall under national protection. Data on nationally protected areas are a priority dataset for countries collaborating with the European Environment Agency and can be found through the EUNIS database (site part, data set: nationally designated areas http://eunis.eea.eu.int/index.jsp).

3.1.3 Red lists

An overview of red lists in Europe is provided by the European Topic Centre for Nature Protection and Biodiversity. The global threat status for single species can be found at the IUCN Red List web site.

International Red Lists in the region – There is no Red List for this large and uneven region as such. Lists of threatened species in the Baltic and Nordic Region are maintained by the Swedish Species Information Centre[17].

Threat status for many species of the region can be found in the EUNIS web application. IUCN's Red List 2006 holds information by country on the global scale of many species (IUCN Red List web site < http://tinyurl.com/3bu5fd>).

Many countries in the region have now developed national red lists of threatened species. The number of species groups considered varies from mammals and birds to a wider number of groups.

3.1.4 Multilateral actions programmes for river systems

Multilateral conservation efforts are necessary to protect river systems possessing high ecological value and to restore river systems. International conservation treaties and action plans have been established with an aim to improving water quality and conserving and promoting near-natural stretches of water and the biodiversity of rivers. Examples are the UNECE convention on the protection and use of transboundary watercourses and international lakes and the conventions for rivers such as the Danube, Elbe and Rhine. A treaty on the protection and management of the Dnestr is established between Moldova and Ukraine.

The work on the Danube and the Rhine has been the model for much later work, but many programmes and activities have been weakened by poor coordination and slow implementation, and by the conflicts between users and protectors of rivers. Programmes have been initiated mostly to monitor and control traffic, water level/floods and water pollution issues, but are gradually also taking biodiversity issues, including fish, into consideration (Box 7).

There are, however, good examples of successful efforts. The Rhine has undergone intensive restoration during the last decade and can now be considered as one of the best restored major rivers in Europe with renewed active populations of trout and salmon. The International Commission for the Protection of the Rhine (ICPR) has been a major instrumental body and large amounts of EU funds have been used. Under the plan Loire grandeur nature (supported through the EU LIFE-Nature programme) France is working towards a large-scale restoration of the river Loire and the dynamics of parts of the river.

LIFE funds (environment, nature) have been used in several other river and lake restoration projects (LIFE-Nature web site).

The RiverNet web site contains information about many European rivers, conventions, programmes and restoration projects, though with very varying updating.

[17] http://www.artdata.slu.se/english/

Box 7. UNECE Conventions relevant to rivers and lakes

The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (UNECE water convention, 1992) is intended to strengthen national measures for the protection and ecologically sound management of transboundary surface waters and groundwaters. The convention obliges parties to prevent, control and reduce water pollution from point and non-point sources. The convention also includes provisions for monitoring, research and development, consultations, warning and alarm systems, mutual assistance, institutional arrangements, and the exchange and protection of information, as well as public access to information.

In 2003, a protocol on civil liability and compensation for damage caused by the effects of industrial accidents on transboundary waters was adopted, linking the UNECE water convention and the UNECE industrial accidents convention (UNECE web site).

Transboundary water cooperation in Eastern Europe, Caucasus and Central Asia (EECCA) is being developed and will be shared among EECCA countries and between EECCA and other countries (UNECE web site).

3.1.5 Botanical and zoological gardens – ex situ conservation

Botanical and zoological gardens exist in all the region's countries, and include some of the oldest in Europe. Although most were founded for scientific and education as well as for recreational purposes, and still have large collections of exotic species, there is now a trend in many of the botanical gardens and to some extent the zoos towards demonstrating national species and participating in schemes to safeguard national gene pools, and in some cases global gene pools as well.

Of the more than 600 European botanical gardens and arboreta that are registered by BGCI (Botanical Gardens Conservation International) a large number of both small and large gardens fall within the region, some of them more than 100 years old. The Czech Republic, Germany and Poland have the largest number of botanical gardens of the region. The main contents are plants from non-European countries, but more and more gardens display local species and participate in national ex-situ conservation of endangered species. No analysis exists specifically for the region. National overviews of botanical gardens and arboreta were delivered to the CBD from several countries of the region in 2000 (CBD web site).

Sixteen of the countries of the region have zoos or aquaria that are among the ca 300 zoos and aquaria in Europe recognised by the EAZA (European Association of Zoos and Aquaria). How many of them promote and inform about local wild living animal species is not known. Several participate in the EEPs (European Endangered Species Programmes) in order to conserve gene pools that are threatened. A few EEPs concern European species of the region such as the European bison and the European otter, but most concern non-European species.

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