Additional information

General overview of the site

Lonjsko Polje is at the same time one of the biggest spawning areas for fish in the Danube basin. Ecological processes and the dynamics of inundation set the pattern for the traditional land use, creating a unique mosaic of anthropogenic and natural habitats; the most important are extensive pastures with indigenous domestic taxa: the Posavac horse, the Slavonian-Syrmian Podolia breed of cattle, the Turopolje pig. The traditional agriculture and the rearing of indigenous breeds are still kept up, and constitute an important element in the preservation of biological and landscape diversity.

The long-lasting, enduring tradition of adjustment to and living *with* and not *against* the floods has created an outstanding system that impinges on all aspects of human interaction with the environment – the traditional wooden architecture, the pattern of the settlements and the shaping of the landscape. Such an approach has preserved its continuity in the water management flood control system, in which the natural floodplain areas are used for floodwater retention.

The organization of the villages is highly preserved in its traditional features. In Lonjsko Polje this is visible not only in the way in which the houses are used and built but also in the richness of folk customs, costumes, decorations and traditional farm practices.

Boundary description

From Stružec along the embankment to the confluence of the Česma and the Lonja."

The act proclaiming the Nature Park did not define the buffer zone, nor is it defined by the Nature Protection Law (OG 70/05, 139/08).

Justification for the application of each Criterion

Criterion 3

Due to the combination of regular flooding and high level of underground waters, this area contains a great variety of different habitat types, mostly depending on water and belonging to some of the Ramsar wetland types: marshes, wet grasslands and alluvial forests. These habitat types are highly representative for the continental biogeographic region of Europe.

Habitat types and plant species

Surface terrestrial water and wetlands or marshes occupy 2,255 ha, or 4.4% of the area of Lonjsko Polje Nature Park. Oxbows, ditches and pools are overgrown with the following vegetation: *Scripo- Phragmitetum, Glycerietum maximae*, *Sparganio- Glycerietum fluitantis,* sedges (*Caricetum gracilis; Caricetum tricostato- vulpinae).* Free water areas are covered with freely floating vegetation, in which the most prominent are: *Lemno-Spirodeletum polyrrhizae* and *Myriophyllo-Nupharetum.*

Significant plant species of these habitats include: the four leaf clover *(Marsilea quadrifolia)* – Annex II and IV of the Habitat Directive, michelianus sedges *(Cyperus michelianus),* mare's tail *(Hippuris vulgaris),* water soldier *(Stratiotes aloides),* spotless watermeal *(Wolffia arrhiza).*

Grasslands occupy 4,593 ha, or 10.1% of the area of the Park. The most represented habitat types are nitrophilous pastures and hay meadows of the lowland vegetation zone. They are mostly used for grazing and mowing within the traditional animal husbandry system. The grassland areas that are directly impacted by regular flooding are overgrown with the following communities: periodically humid meadows (*Deschampsietum cespitosae*) and Illyrio-Pannonic humid meadows *(Bromo-Cynosuretum cristati*).
Plant

Forests occupy 35,002 ha, or 67.7% of the area. The crucial ecological factor in the origin and development of forest vegetation in this area is water, whether it is to do with flood water, as is the case with the woods of poplars and willows, or ground water (the forests of common oak). In some cases both types of water are very important, as is the case in forests in which the dominant species are the alder or narrow-leaved ash. Forest vegetation of the planar zone in Croatia is characterized by certain specific features such as great richness of communities over a relatively small area, the thriving of the famed Slavonian forests of common oak, the occurrence of the narrow-leaved ash, the high biological diversity, and the good state of preservation of large forest complexes, and other things. The phytocoenological picture of the forests of the lowland vegetation zone is complex, and within it we can
distinguish:

- wetland woods along the course of the river - willows (*Salix triandra, Salix purpurea, Salix alba*), white poplar (*Populus alba),* black poplar *(Populus nigra*), white elm (*Ulmus laevis*), narrow leaved ash (*Fraxinus angustifolia*), common oak (*Quercus robur*)
- woods of depressions - three basic associations can be found: Alder swamp forests (*Frangulo-Alnetum glutinosae* Rauš 1968, Illyrian snowflake ash-oak forests (*Leucoio-Fraxinetum angustifoliae* Glav.1959), Riparian oak-ash forests (*Genisto elatae-Quercetum roboris* Ht. 1938)
- woods of micro-elevations or ridges - Illyrian riparian oak hornbeam forests (*Carpino-betuli-Quercetum roboris*, Rauš 1969)

Fauna

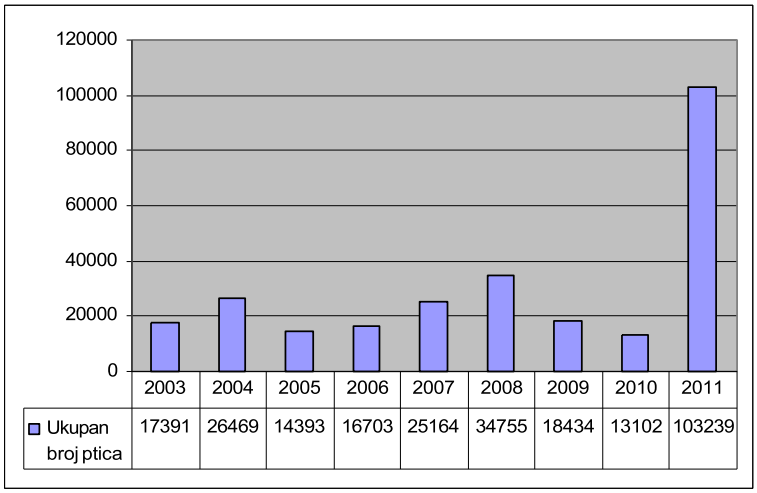
Lonjsko Polje Nature Park is of considerable importance for threatened species: marshy and aquatic habitats are permanent habitats for the fire bellied toad *(Bombina bombina),* yellow-bellied toad *(Bombina variegata)* and 14 other species of amphibians. The European pond turtle *(Emys orbicularis*) with its biology is bound to the water habitats. Threatened fishes include mudminnow *(Umbra crameri)* and wild common carp (*Cyprinus carpio*).
For some bird species this Ramsar site is one of the most important breeding areas in Croatia or even Europe. It is very important habitat for migration and wintering of northern European populations of many species of birds, above all of waterbirds, but also of small birds of prey, songbirds, etc. It represents a significant stop-over site of the Central European flyway for waterbirds (ducks, herons, storks, spoonbills, terns, waders, cranes etc.) The area is rich in various habitats (marshland with luxuriant vegetation, meadows and pastures, forests) that enable nesting to be carried out by many and different species that seek different habitats. Additionally, the area is exceptionally rich as a feeding site (the fishponds, marshes, meadows and pastures).

The white stork (*Ciconia ciconia*) is a part of the identity of Lonjsko Polje Nature Park and of all Posavina, as it is accustomed to coexisting with people.
The spoonbill (*Platalea leuocorodia*) nests in the Ornithological Reserve of Krapje Đol in a mixed colony with the purple heron *(Ardea purpurea),* little white egret *(Egretta garzetta),* squacco heron *(Ardeola raloides*) and the black-crowned night heron *(Nyctitorax nyctitorax*).
Alluvial forests of Lonjsko Polje Nature Park are the most important breeding place for the lesser spotted eagle *(Aquila pomarina)* in Croatia and one of the most important for the white-

tailed eagle *(Haliaeetus albicilla)*, the black stork *(Ciconia nigra)* and the black kite *(Milvus migrans)*.

Criterion 5

Lonjsko Polje Nature Park regularly supports 20,000 waterbirds, particularly during spring and fall migration, as well as in the wintering period. In the 2003-2011 period, a number ranging from 17,391 individuals (2003) up to 103,239 (2011) waterbirds were counted during the mid-January waterbird counts (Source: Lonjsko Polje Nature Park Public Service Management Office).



Physical features of the site

The Sava River is the fundamental factor affecting natural, cultural and landscape features in the Lonjsko Polje Nature Park. The Sava is the watercourse defining the southern border of the area of Lonjsko Polje Nature Park over its length of 96 km and with its hydrological features has a very strong influence on the water regime of the site.

Geology
The area of the Sava River lies on Quaternary deposits, which build the broad valley of the Sava River and of its tributaries; groundwater reserves are significant. Depending on the genetic type of sediment, in the area there are non-carbonate loess, lacustrine sediments and the alluvial sediment of the Sava terraces, proluvium, alluvial material from rivers and brooks. The Quaternary alluvia are formed by the
retreat of flood waters, which behind them leave coarse grained fluvial alluvia. The Sava deposits them in the whole area downstream area from Sisak to the confluence of the Una and Sava.

Geomorphology
Microrelief is one of the most important factors impacting the habitats. In the natural setting a difference of 10 cm will have an influence on the distribution of flora. Through flooding, naturally raised areas (or ridges) were formed, which themselves almost never flood. The flood water in the micro-depressions can disappear only by transpiration or evapotranspiration.

Pedology
Most of the soils of this area are hydromorphic soils of various types, subtypes, varieties and forms. The characteristic of hydromorphic soils is the naturally poor drainage, and the natural process of hydrogenation within a depth of 2 m, brought about by a surplus of surface and/or

ground water which is neither alkaline nor brackish. The largest areas of these soils appear as carbonate, and the characteristic of such soils is that they appear almost exclusively in an area with much fine mineral detritus, and the presence of skeleton is very small or hardly perceptible.

Hydrology

The site belongs to the southwestern part of the Pannonian basin. The development of the Croatian portion of the Pannonian basin should be considered in terms of the origin and development of the basin as a whole, whose origin and evolution model was proposed by Royden et al. (1983). The model is based on an extension of the Pannonian lithosphere, on one hand, and the stretching in the areas of the Alps, Dinarides and Carpathians, on the other, caused by developments outside this area dating back to the Eocene. Floods can occur at any time of the year, and several times a year as well. The reason for this lies in the arrangement of the river catchment areas situated in different climate zones. In the **spring**, snowmelt in the Julian Alps causes the Sava River level to rise. In the **summer**, when precipitation is at its peak in the Pannonian highlands, the water level in 3rd and 4th order tributaries flowing parallel to the Sava rises. In **autumn** the Kupa and Una, which mainly rise in the Dinaric and Dalmatian regions, bring a great deal of water into the Sava at their confluence at Sisak and Jasenovac. Primarily, it is Central Posavina that is in most cases indirectly inundated, which means the Sava floodplain is inundated indirectly by the rising water in its tributaries. The difference between low and high water can be over 9 meters, because of the very shallow drop of the river (0.07 m/km).

Natural lowland wetland areas (floodplain areas) are to be found on both sides of the Sava River. Lonjsko, Mokro and Poganovo poljes (plains, fields) are part of Lonjsko Polje Nature Park and are flood water detention zones that have an important role in flood mitigation. The largest flood zone is Lonjsko Polje, which has no direct connection with the Sava, but is a controlled floodwater detention zone with structures allowing for the release of water into and its discharge from the zone.

Water quality

Determination of water quality in the Nature Park is carried out on national and local surface waters in line with the monitoring programme. The main objective of the monitoring is to provide a systematic check of the real state of water resource quality, thus ensuring the information necessary for the creation of rational and effective protection programmes, a precondition for proper management

of the resources. Systematic control of water quality in Croatia is carried out according to realistic possibilities, and in the last few years an important optimalisation has been carried out, of adjustment to the most recent world and European experiences and requirements, in which a special place goes to documents that were the working base for the adoption of the EU's Water Directive. Croatia is a signatory to several international treaties and bilateral agreements related to monitoring the condition of water resources, which all affect the scope and nature of the annual monitoring. The quality of national surface waters is determined by Croatian Waters after approval of the 2000 Monitoring Programme by the State Directorate for Waters, and Croatian Waters also carry out testing of the quality of surface waters at 7 stations in the area of Lonjsko Polje Nature Park (Sava Košutarica, Sava Jasenovac, Stari Trebež Pakra, the canal Lonja – Strug by Stružec, canal Lonja – Strug Trebež Sluice, canal Lonja – Strug by the bridge at Bročice, Ilova at the confluence with the Kutinica). The quality of local surface waters is determined according to the Environmental Protection Programme adopted at the County Assembly in 2003

(Sisačko-moslavačka County *Official Gazette*, no., 15.03). Water quality has been monitored since the end of 2004; the county Public Health Institute samples and analyses the water, and the Administrative Department for Environmental and Nature Protection produces an annual report. Quality testing is carried out at three sites in Lonjsko Polje Nature Park (confluence of

Česma and Lonja, Krapje Đol, the Lonjsko Polje flood water retention zone) and at 15 sites in the Park's buffer zone.

Climate

This area is strongly influenced by the humid type of continental climate and is affected by air masses moving from the Alps. Average temperatures range from -1.5 °C in January to 20 °C in July. Annual mean temperature is 9.5 °C. Mean annual precipitation is 872 mm, maximum precipitation occurs in June, and the minimum in February. The Lang mean annual precipitation factor is 82.3, which represents a humid type of climate. Mean annual air humidity is 77%, and the maximum occurs in July and December. Evaporation in the central course of the Sava River comes to between 520 and 600 mm p.a.

Late frosts are typical of the region, and there is always the possibility of the occurrence of late spring and of early autumn frost. Temperatures below freezing point do not occur only in the three summer months of June, July and August. According to the mean annual values of cloud cover, this is a cloudy area. The average number of bright fair days ranges from 43 to 59.3, and the number of cloudy days ranges from 132.6 – 142.3. According to data from Sisak weather station, the most frequent winds are from the NE (15%) and from N (13%), they are followed by the winds from W (11.7%), SE (11.6%), SW (11.3%), E (9.5%), NW (9.4%) and S (4.5%); 13% of the time is quiet and windless. The most uncomfortable winds are those from the NE and N, which in winter bring rather severe climatic conditions. The average number of days during which snow lies on the ground is 42.

Physical features of the catchment area

General information

The Sava River Basin (Sava RB) is a major drainage basin of South Eastern Europe with a total area of approximately 97,713.20 km2 and is one of the most significant sub-basins of the Danube River Basin, comprising 12% of this basin. The Sava RB (Figure) is located between 13.67 oE and 20.58 oE longitude and between 42.43 oN and 46.52 oN latitude.

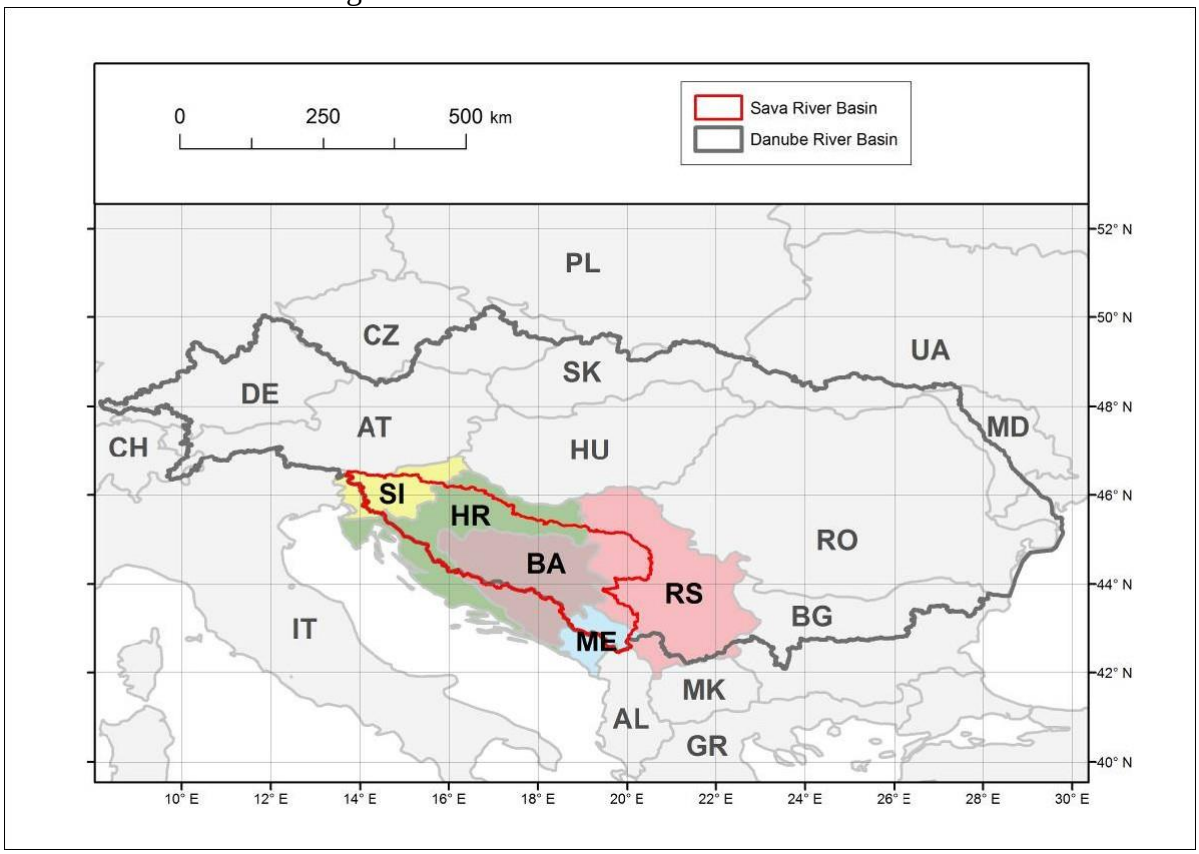


Figure: Location of the Sava River Basin

The basin area is shared among five countries: Slovenia, Croatia, Serbia, Bosnia and Herzegovina, Montenegro, while a negligible part of the basin area also extends into Albania. Except for Serbia and Albania, its watershed covers 45 to 70% of the surface area of the other four countries. Its water resources constitute nearly 80% of the total freshwater resources in those four countries. Table 1 presents some basic figures with regard to the countries' share of the Sava RB area. A more detailed overview of the location of the basin is presented in Map above.

Over 18 million people live in the five countries of the region and over half of them live in the Sava River Basin.

Climate

The Sava River catchment is situated within a region characterized by the dominant moderate climate of the northern hemisphere, which is modified by the influence of relief. Thus, mountainous zonal climate characteristics are present especially in the eastern southern part of the area. Cold and hot seasons are clearly defined. The winter can be severe with abundant snowfalls, while the summer is hot and long.

Climate conditions within the basin can be classified into three general types: Alpine climate; Moderate continental climate; Moderate continental (mid-European) climate.

Relief and topography

The landscape within the Sava River Basin is diverse. The general relief characteristics are illustrated in Figure 2. Mountainous relief (the Alps and the Dinarides) dominates in the upper part of the basin, which is part of Slovenia (the highest peak is Triglav, 2,864 m a.s.l.2), and the southern part of the basin is also mountainous.

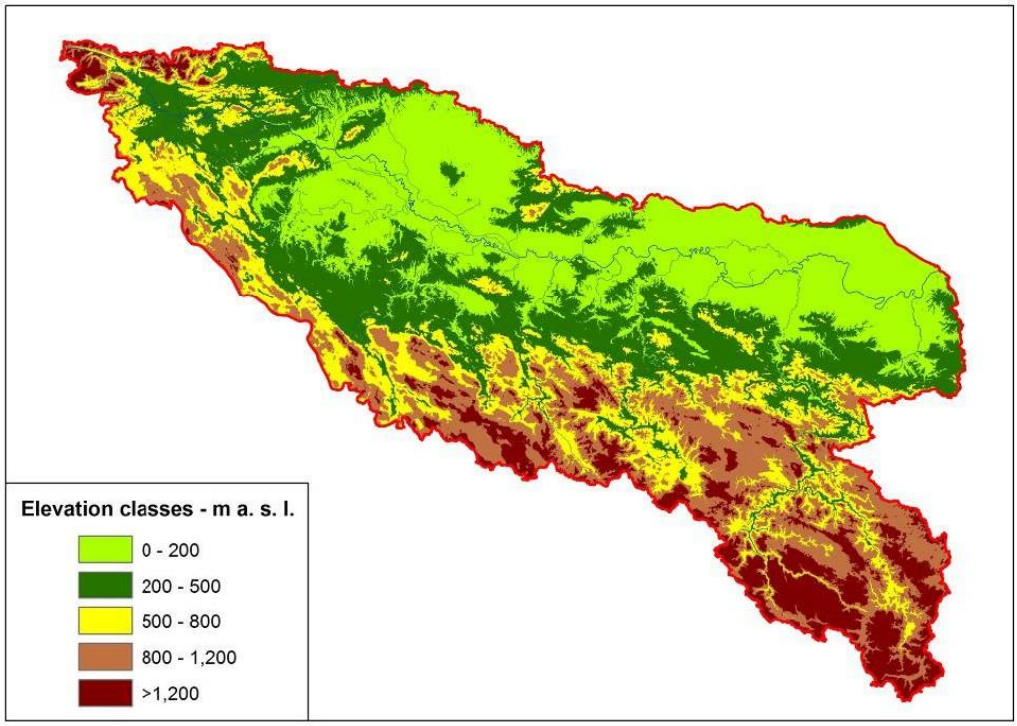


Figure: Sava River Basin elevation

Particularly rugged terrain is a feature of Montenegro and Northern Albania. The mountains of Montenegro include some of the roughest terrain in Europe. They average more than 2,000 meters in elevation and occasionally exceed a height of 2,500 meters (the peak of Bobotov Kuk

in the Durmitor Mountains). The northern part of the Sava River Basin is situated in the Pannonia Plain, which is characterized by fertile agricultural land.
The elevation of the Sava River Basin ranges between 71 m a.s.l. at the mouth of the Sava River in Belgrade (Serbia) and 2,864 m a.s.l. (Triglav, Slovenian Alps). The mean elevation of the basin is approximately 545 m a.s.l.

Ecosystem Services

Hydrological values:

The biggest water flew through the Sava River is in autumn and spring, and through the Sava tributaries is in spring and summer. In the central Sava basin the flooding is most commonly caused by indirect filling of the tributaries of the Sava and their overflowing their banks into the floodwater retention area. The retention areas of Lonjsko Polje (11,500 ha), Opeke (5,700 ha), Trstika (2,100 ha) and Mokro Polje (12,800 ha) constitute 7% of all the floodplain of the Sava. All except Lonjsko Polje are areas liable to flooding with natural dynamics of inundation. The embankments that lie around the floodwater retention zone to the north, south, east and west of Lonjsko Polje can retain up to 600 million cubic metres of water. Groundwater is derived exclusively from precipitation, the Sava and its tributaries having a subsidiary role, which means that only during flooding do they have any quite major effect on the groundwater level. Groundwater feeding occurs by the infiltration of precipitation, while infiltration from the course of the Sava occurs only during high waters.
At the moment the retention basin Lonjsko Polje is the only regulated inundation zone, where the water can be maintained high or low through a system of weirs. Because the weir Trebež I is also the only outlet of the large alluvial depression with 18,200 ha it has to be normally open. In contrary to the Lonjsko Polje regulated inundation area, the other "poljes" have a unregulated contact with the Sava or Kupa river.
Except the Lonja and Česma Rivers, which are now flowing into the Sava through the weir Trebež I, all other tributaries such as the Sunja, Ilova, Pakra, Strug and Odra are unregulated.

Scientific research:

- International Waterfowl Census (accounting of the wintering birds)
- Monitoring and ringing of white stork (*Ciconia ciconia*)
- Monitoring of black stock (*Ciconia nigra*)
- Monitoring of white-tailed eagle (*Helliaetus alibicilla*)
- Monitoring of corn-crake (*Crex crex*)
- Monitoring of great cormorant (*Phalacrocorax carbo*)
- Monitoring of herons
- Monitoring of spoonbills (*Platalea leucorodia*)
- Monitoring of ferruginous duck (*Aythya nyroca*)
- Research into bird populations on the agricultural land (arable land, meadows and pastures, overgrown areas) in Lonjsko Polje Nature Park
- Research into the distribution of the Golden jackal (*Canis aureus)* in Lonjsko Polje Nature Park
- Research into distribution of the European mudminnow (*Umbra krameri)*

Current recreation and tourism:

The site is used for ecologically sustainable tourism that is organized by the Lonjsko Polje Nature Park Public Service. About 20,000 visitors take organized tours in the area, including boat trip on the Sava River. The number of bird-watchers is increasing, as well as of those engaged in walking, cycling, and angling.

Current land (including water) use:

To give a real picture of land use, the table shows the results of research carried out in 2006 - see the map 2 in Appendix 1 (printed) and Appendix 2 (JPEG and GIS files on CD):

Land use category	Area in hectares	%
marshes	1481.5	2.89
arable land	6123.0	11.93
forests	36782.7	71.67
grasslands	5460.7	10.64
urban areas	414.4	0.81
waters	1058.2	2.06

Table . Land use in Lonjsko Polje Nature Park

Forestry
As branch of the economy forestry occupies an important position in land use, more than two thirds of the Park being covered by forests. The forests are managed by the state owned corporation Croatian Forests Ltd. according to the stringent ecological, social and economic standards of FCS certification (Forest Stewardship Council).

Water management
The development of the flood defense system started in the 1970s, after disastrous flooding in the cities along the Sava. The whole flood defense system is based around three main objectives: to protect people, property and agricultural land.
The system is calculated as being completed to the level of around 40%. In the current period, the system as partially effectuated has proved to be effective but has also thrown some failings into relief. The fact that the planned system has not been built to the full should not be seen as a failure, but as a possibility for the modification of the basic approaches, in line with new results of research and new knowledge about the need to protect biological and landscape diversities. Areas naturally liable to flooding are covered in the system, their basic function thus being preserved, and the protection of biological and landscape values going hand in hand with modification of the flood control system.

The Central Sava basin flood control system, which includes the Lonjsko Polje Nature Park, consists of a series of planned constructions and operations, and covers the area from Zagreb and Karlovac in the West to Nova Gradiška in the East.
The major part of the flood control system is found in the Nature Park area. These are areas for the retention of flood waters, which are for a certain time of the year inundated. This area includes several units, as follows:

- Lonjsko Polje – controlled flood water retention zone of 25,630 ha
- Opeke, Trstika and Mokro Polje, uncontrolled retention area of 20,600 ha.

In Lonjsko Polje Nature Park there are two drinking water sources (Drenov Bok and Osekovo) used in water supply.

Traditional agriculture
The traditional pasturing system is an ideal manner of using the human and natural resources, because its role is positive in several ways:

- local indigenous breeds are best for pasturing due to their adapted to the habitat conditions, additionally. Local indigenous breeds are threatened and thus need to be preserved
- pasturing is a manner of making use of the grassland that best protects the landscape
- this kind of extensive manner of livestock keeping in a preserved environment results in quality products (needing good marketing however), which is essential for rural tourism
- animals kept in the Park in the traditional way are an additional draw for visitors.

Hunting
In Lonjsko Polje Nature Park the hunting is implemented in accordance with the provisions of the Hunting Law and the Nature Protection Law. According to the Hunting Law, in the park it is permitted to hunt: red deer (*Cervus elaphus)*, roe deer (*Capreolus capreolus*), wild boar (*Sus scrofa*), several other mammals as well as certain bird species. According to the Regulation concerning protection of some animal species it is forbidden to hunt the wild cat *(Felix silvestris)*, and the edible dormouse (*Myoxus glis)*; a ban on hunting all bird game species except for pheasants *(Phasianus colchicus)* is in the pipeline.

Fishing
In line with the Freshwater Fishery Law and the Nature Protection Law, fishing activities will be carried as recreational fishing and as traditional fishing. For both kinds of fishing the Spatial Plan Lonjsko Polje Nature Park (OG 37/10) foresees fishing zones.

Social and cultural values:

Cultural values
The Ramsar site represents and unites all the aspects of the historical period of the 15th to 19th century reflected in the material and the intangible parts of the cultural heritage. The material heritage of this period includes an intact cultural landscape with a several-century-long land-use pattern related to the traditional way of farming, the chief branches of which are animal husbandry, arable farming and extensive exploitation of the forests, together with its historical distribution of communications, its hydrological system and the function of the space. The cultural landscape represents the intact settlement pattern of a system of linear rural settlements created in the 17th-19th centuries along the Sava River, the axis of the centuries-old communications, as well as the historical territorial border.
The settlements preserve all kinds of historical buildings characteristic of the historical period, a particularly representative number of original wooden dwellings and pertaining outbuildings produced in the well-known oak timber, with their particular spatial and structural approaches.

Socio-economic values
Current socio-economic values are based on the forestry, water management, agriculture and husbandry, tourism, hunting and fishing.

Forestry
Sixty eight per cent of the Park is covered with forests of common oak and narrow leaved ash. Most of the woodland area is economically exploitable in forest management, while a smaller part, about 10%, consists of protection forests and special purpose forests. Forest land is of interest to the local population for the carrying out of the traditional system of animal husbandry.

Water management
The area of the Park is a natural floodplain region where the naturally flooded land is used as part of the flood control system. The water masses of the Sava River at the time of high water are channelled via sluices, relief canals and some smaller canals into the flood water retention

zone of Lonjsko Polje. The areas of Mokro Polje, Opeke and Trstika are not within the controlled flooding system.

Traditional agriculture
The basic way in which the local population in the Park makes its living is agriculture, and within this, animal husbandry, in the form of traditional extensive production (pasturing, foraging, haymaking). The traditional pasturing system is an ideal manner of using the human and natural resources. The indigenous species are an essential component of the pasturing system, of the preservation of extensive farming and the keeping up biological diversity, for they can cope with the extreme conditions of life in the open – they have strong constitutions that enable them to live outdoors, they have modest food requirements and have good social behavior, all of which are adjusted to the conditions of flooding.

Game and fishing
Many of the forest, grass and aquatic habitats provide considerable diversity of wild animals, particularly of birds and mammals. The Hunting Law considers some of these wild animals as game species.
The fish stocks are used via both sporting (angling) and traditional fishing.

Tourism
Today the natural resources are also used for the purposes of visiting, education and recreation, and tourism, as branch of the economy, is occupying an increasingly important position in the development of the area. In line with the requirements, during zoning of the Park, areas are set aside that are used, as natural resources, in the visiting system. They comprise areas rich in bird life, in forest, grass and water areas, as well as areas with a rich cultural and landscape tradition.

Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects

within the Ramsar site:

Relevant documents (past, present pressures)
Law on Agricultural Land - Public Service does not manage meadows and pastures in state owned land, because according this law meadows and pastures in protected areas can be rented to the pasture's communities or to the people who do not live in or surrounding the Park area.
Law on the Protection and Preservation of Cultural Heritage - there is no modus elaborated for protecting traditional architecture or the heritage of an ambient character, apart from the measure of proclaiming something a cultural heritage , and no making of landscape plans with an identification of the landscape, analysis of features and changes is stipulated.

Law on the Spatial Planning and Construction - the landscapes are not sufficiently well incorporated into spatial plans of counties nor towns and municipalities. The law does not prescribe the elaboration of landscape plans with an identification of landscape, analysis of features and changes.
Areas of Special National Concern Law - a part of the Park belongs to an area of special national concern (the settlement of the municipality of Jasenovac), which has resulted in unbalanced conditions for the development of the area as a whole. It is proposed that this Law should be amended in order to include areas of protection of natural and cultural values as areas of special national interest.

Development pressures (past, potential pressures)

There are no very significant development pressures, because there is little interest in building and making changes in the space, which has been brought about by depopulation and reduced interest in the area for living and settling in.
Pressure is manifested much more in the decline of activity and life and in the motivation of people to invest and make adjustments to the new standards, standards of living and hygiene, the maintenance of settlements and public amenities, joint actions and getting people together around the idea of living together in small village communities.

Demographic factors (depopulation) – past pressures
The fact that the cultural landscape of Central Posavina was created through the interaction of people and nature tells us that abandonment of the area is bound to have negative effect on the landscape. In the 1990s, because of the war, most of the population that dealt with animal husbandry left the area, and hence the herds were reduced. The absence of livestock resulted in vegetation succession on the grasslands. The demographic situation is constantly exacerbated by the drain of population from rural to city areas.
Depopulation, affecting the younger generations living in rural areas, has become particularly crucial in the Park. The end of the era of village life and the poor connections with urban centers and between the right and left banks of the Sava River are the cause of depopulation. And with the people, the development of rural culture, together with the very worthwhile architectural heritage, is also vanishing. Many of the wooden houses have been abandoned and are falling into decay.

Water management (past, potential)
The Lonjsko Polje Nature Park is part of the flood control system built up in 1970. Monitoring and research results signified some negative impacts on biological and landscape diversity:

- The results of soil research show the presence of heavy metals (As, Cd, Hg) which means that the flood water that ingresses into the retention zone does not pass through any treatment plan
- Because of the construction of water management facilities, the natural entry of fish to the spawning grounds has been frustrated, and the result of this is a much reduced spawning success
- Construction of new canals that interrupted the natural flows of the Lonja, Strug and Trebež rivers
- Construction of dikes has resulted in the interruption of the freshwater entering in oxbows
- Drained oxbows, grasslands and pastures have a negative impact on the diversity of flora and fauna
- Regulation of the Sava River and project aiming to upgrade the navigation category upstream and downstream from the Park area can be a threat to flooding ecological system if the flood dynamic will change

Negative factors in arable farming and livestock rearing (present, potential pressure)
Agriculture and traditional farming as the main interest for local people present the main artery in preservation of the biodiversity of grasslands, pastures and little-plot parcels and cultural identity of Lonjsko Polje Nature Park. Since the 1990 war livestock rearing as a main agricultural branch is in the process of revitalization, but the livestock breeders have many problems that have a negative impact on the revitalization process:

- pastures covered by neophyte false indigo, Indigo bush *(Amorpha fruticosa)*, Rough Cocklebur (*Xanthium strumarium) and* ragweed *(Ambrosia artemisifolia)*
- the problem of "State-Owned Farmland" is unresolved
- the killing of cattle by hunters or poachers
- insufficient communication between breeders and institutions that take care of the selection programme or provide the veterinary services

- the poor work of the organizations that carry out breeding programmes, the absence of any standardization and the marketing of products of traditional farming
- Livestock is not guarded on the pastures.

The expansion of non-indigenous species (past, present, potential pressures)
Indigo bush *(Amorpha fruticosa)* originates from the central and south east areas of North America. It was introduced to Europe as a decorative plant, but soon ran wild and made itself totally at home in southern and central Europe. The indigo bush *(Amorpha fruticosa)* spreads along lowland regions, along the banks of rivers and lakes. In the last 20 years the expansion of introduced and invasive species has become a serious problem. Indigo bush *(Amorpha fruticosa)* creates problems not only in forest ground, but also overgrows the meadows, plough land and pastures. During the homeland war the flight of the local population greatly reduced, which led to a commensurate reduction of the herd.
The absence of traditional agriculture and animal husbandry resulted in our having today hectares and hectares of abandoned land covered with indigo bush. Today, 2.5% of the Park is covered with pure stands of this intruder, or 1,201 ha (see map of habitats), while the mosaic areas that false indigo has started to cover occupy an area of 5,817 ha or 11.4% of the total Park's area.

Cultural Heritage (past, present, potential)
Negative factors and risks in the preservation and revitalization of the cultural heritage are visible at several levels:

- neglect of the settlements and poor physical condition of the traditional buildings
- holdings are neglected
- inappropriate new interventions in historical settings
- property issues
- demolishing houses and moving them out of the Park for secondary uses, illegal export of material
- low awareness of living in wooden houses
- insufficiently well-informed local administration
- a low level of authenticity in the case of restoring the architectural heritage
- the failure to use traditional techniques of building and revitalization (use of sheetrock walls), poor understanding of restoration of the building heritage (the principle of conservation is of prime importance for the preservation of authenticity)
- shortage of qualified tradesmen for the renovation of the architectural heritage
- shortage of cured oak for construction, and the high price of materials makes it difficult to implement the planned objectives
- cadastral data and detailed maps of settlements with all topographic details are not up to date, and have not been digitalized
- shortage of funding
- economic uncertainty for activities that are preferred by the management objectives

Tourism (potential pressure)
The development of the tourist industry in Lonjsko Polje Nature Park is still in the initial phases, and for the moment it can be said that with the annual 20,000 entry tickets into the Park sold, there has been no negative impact on the natural and cultural values of the Park. However, for some years, the Park has experienced the presence of visitors unevenly distributed in terms of time and place. This means that in a certain part of the year (April-June) there is a large number of visitors, who are concentrated in two visiting sites; the rest of the year, the number of visitors is very small.

in the surrounding area:

Surface water

Common sources so that data provided by the Sava River Basin countries is comparable with regard to pollution and methodology has been developed for the identification of significant pollution environmental emissions. The methodology for the identification of significant pollution sources in the Sava RB is based on EU Directives – primarily 91/271/EC UWWT Directive and the Directive on Industrial Emissions (2010/75/EC).
These Directives, or as a minimum their main principles, have been transposed into water legislation in all Sava RB countries. Further, the country specific generated load and emissions regarding organic, nutrient and hazardous substance pollution presented in this chapter should be considered in relation to the respective countries' share of the Sava RB.

Organic pollution from urban wastewater - The population of the Sava RB (excluding Albania) is approx. 9.0 million and its activities in urban areas represent the main pressure on the environment.

Industrial organic pollution - Numerous industrial activities are undertaken within the Sava RB. A preliminary inventory carried out during the development of the Sava RBMP identified 1,096 industrial enterprises. The following industrial sectors and industrial facilities were represented: i. energy (11 power plants), ii. chemical industry (38), iii. metal processing (93), iv. Paper and v. wood industry (32), all of which have been present for some time in the region.

Nutrient pollution - The Sava is the third longest tributary of the Danube and discharges the largest volume of water into the Danube of all its tributaries. With regard to nutrients, it discharges into the Danube approx. 1.79 – 6.89 kt/a of total P and 37.86 – 85.59 kt/a of total N. This estimate was calculated from the ICPDR TNMN qualitative data from monitoring sites at Sremska Mitrovica and Ostružica using also hydrological data from the monitoring site at Sremska Mitrovica and from ISRBC and Serbian HMI Yearbooks for 2005 – 2007.

Hazardous substances pollution - Hazardous substances include man-made chemicals, naturally occurring metals, oil and its compounds and numerous emerging substances, e.g. endocrine disruptors, personal care products and pharmaceuticals.
Sources of hazardous substances are primarily industrial effluents, storm water overflow, pesticides and other chemicals applied in agriculture as well as discharges from mining operations and accidental pollution. Atmospheric deposition may also be of significance for some substances.
Agricultural pesticides are used in large quantities to protect field and orchard crops, but they are also used extensively to protect livestock. Pesticide application is used preventively, as pre-emergence application, and reactively, as post-emergence application to reduce damage to infested crops and animals.

Hydromorphological alterations - The key driving forces causing river and habitat continuity interruption in the Sava RB are primarily hydropower (78%), water supply (10%), and flood protection (6%). There are 31 barriers in the Sava RB (SI -7; HR - 7, BA – 9, ME – 2, RS - 8) with 8 barriers on the Sava River itself and 23 on the tributaries.
Disconnection of adjacent wetlands/floodplains - The Sava River has lost a significant area of floodplain, although along the lower courses some important floodplains still remain. The Sava River has the second largest active area of floodplains (1,900 km2) after the Danube (exclusive of the Delta, around 5,000 km2).
The lateral connectivity of river and floodplain is included as one of the features of morphological alteration assessment.

Groundwater
Pressures on groundwater quality - According to the collected data, groundwater quality is mostly endangered in urban areas and areas with intensive agriculture production, which are

mostly located on the alluvial plains of the Sava River and its tributaries. Groundwater pollution has been recorded
in four Sava countries: Savinjska kotlina and Krška kotlina (SI), Zagreb area (HR), Semberija, Lijevče polje (BA) and Mačva area (RS). The main causes of groundwater pollution in the Sava River Basin are:

- Intensive agriculture;
- Insufficient wastewater collection and treatment at municipal level;
- Inappropriate waste disposal sites;
- Urban land use;
- Mining activities.

Pressures on groundwater quantity
Aquifers of intergranular porosity such as the fluvial deposits of the Sava River and downstream sections of its tributaries - Ljubljanica, Krka, Kupa, Una, Vrbas, Ukrina, Bosna and Drina are directly hydraulically linked with river courses, which are often used for water abstraction by bank filtration process. The public water supply of major cities such as Ljubljana, Zagreb and Belgrade, rely almost entirely on these water resources.

Current communications, education and public awareness (CEPA) activities related to or benefiting the site

It is expected that the main reception centres (the main entrances into the Park) will direct visitors in the Park. The orientation of visitors in the framework of these measures has the following objectives:

- At the info centre visitors to the Park must be able to pick up a varied menu of interesting activities and an insight into the cultural and natural landscape
- Because of the actual product and the accompanying protection measures, the impacts on the animal and plant species have to be reduced to the lowest possible level
- The population of the Park must have a share in the revenue from tourism, and it is expected that the administration of the Park and the households dealing with tourism will be in close working contact
- The making of a weekend programme for visitors and its implementation in collaboration with households that are licensed to offer bed and board

Several private collections have been set up and opened for visitors. As follows:

- the Sučić Collection, Čigoč No. 32, textiles, tools, vessels; the family inventory has been added to since 1950 by purchases and gifts. The collection has been open to the public since 1990.
- the Ravlić Collection, Mužilovčica No. 72, furniture, textiles; the ethnographic objects of the Ravlić Family is located in the house and outbuildings, and have been accessible to the public since 1999.
- the Blažeković Collection, Lonja 164, fishing accoutrements…
- the Palaić Collection, Krapje 48 (furniture, carpentry tools and so on; family inheritance, open to the public since 1995.
- Each collection numbers several hundred different objects.

Exhibitions at Lonjsko Polje Nature Park info points:

- Čigoč 26, in the renovated traditional wooden house there is a rather small exhibition of authentic traditional items of a carpenter’s workshop: chisel, plane, saw, worktable, compass and so on.
- Krapje 1, in the renovated traditional house, ground floor only, there is a small exhibition of photographs, texts on panels, and some artefacts concerning the values and specific features of Lonjsko Polje.

Promotional materials and souvenirs

In the info-centres in Čigoč and Krapje, the Public Service sells promotional material and souvenirs. Specialized publications, tourist maps, LPNP bulletins, bird books, bird guides, the LPNP Book, the Guide for Rangers and Guide for Teachers, can be bought in info-centres.

Trails

The visitors can use the walking trails in LPNP as follows:

- "the Posavac trail" in Čigoč village with five educational signboards
- "the Borderers' trail" with two observation towers in the Ornithological Reserve Krapje Đol. The trail stretches from Krapje to village Drenov Bok
- "the Tena trail" - educational forest trail

6 cycling routes connect tourist destinations in LPNP as follows:

- *The Posavina Route* follows the left bank of the Sava River along the county road, for a length of 76 km
- *The Subocka Route* is a circular route, 41 km long, starting out from Krapje – Architectural Heritage Village – and heading for the settlement of Jasenovac
- *The Lipovljani Route* is a circular route 39 km long. It starts out from Krapje – Architectural Heritage Village
- The 50 km long *Sunja Route* is reached from the Posavina Route, where from the village of Kratečko with an extremely pleasant ride that makes use of a traditional ferry over the river that gets you to the right bank of the Sava
- *The Una Route*, which is 61 km long, and moves in the same direction as the Sunja Route, splits off however at Sunja and goes through the villages of G. Hrastovac and Stubalj towards Hrvatska Kostajnica
- *The Moslavina Route* is 34 km long, and starts off from the European Stork Village, Čigoč, towards Gušce, and then breaks off to the right towards Svinjičko, a village famed for its traditional style of fishing