

# Information Sheet on Ramsar Wetlands (RIS) – 2006-2008 version

Available for download from [http://www.ramsar.org/ris/key\\_ris\\_index.htm](http://www.ramsar.org/ris/key_ris_index.htm).

*Categories approved by Recommendation 4.7 (1990), as amended by Resolution VIII.13 of the 8<sup>th</sup> Conference of the Contracting Parties (2002) and Resolutions IX.1 Annex B, IX.6, IX.21 and IX. 22 of the 9<sup>th</sup> Conference of the Contracting Parties (2005).*

## Notes for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.
2. Further information and guidance in support of Ramsar site designations are provided in the *Strategic Framework and guidelines for the future development of the List of Wetlands of International Importance* (Ramsar Wise Use Handbook 7, 2<sup>nd</sup> edition, as amended by COP9 Resolution IX.1 Annex B). A 3<sup>rd</sup> edition of the Handbook, incorporating these amendments, is in preparation and will be available in 2006.
3. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers should provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of all maps.

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Designation date

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Site Reference Number

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### 2. Date this sheet was completed/updated:

August 2008

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### 3. Country:

Bosnia and Herzegovina

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### 4. Name of the Ramsar site:

The precise name of the designated site in one of the three official languages (English, French or Spanish) of the Convention. Alternative names, including in local language(s), should be given in parentheses after the precise name.

Livanjsko Polje (Livno karst field)

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#### 5. Designation of new Ramsar site or update of existing site:

This RIS is for (tick one box only):

- a) Designation of a new Ramsar site ; or  
b) Updated information on an existing Ramsar site
- 

#### 6. For RIS updates only, changes to the site since its designation or earlier update:

##### a) Site boundary and area

The Ramsar site boundary and site area are unchanged:

or

If the site boundary has changed:

- i) the boundary has been delineated more accurately ; or  
ii) the boundary has been extended ; or  
iii) the boundary has been restricted\*\*

and/or

If the site area has changed:

- i) the area has been measured more accurately ; or  
ii) the area has been extended ; or  
iii) the area has been reduced\*\*

\*\* **Important note:** If the boundary and/or area of the designated site is being restricted/reduced, the Contracting Party should have followed the procedures established by the Conference of the Parties in the Annex to COP9 Resolution IX.6 and provided a report in line with paragraph 28 of that Annex, prior to the submission of an updated RIS.

b) Describe briefly any major changes to the ecological character of the Ramsar site, including in the application of the Criteria, since the previous RIS for the site:

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#### 7. Map of site:

Refer to Annex III of the *Explanatory Note and Guidelines*, for detailed guidance on provision of suitable maps, including digital maps.

a) A map of the site, with clearly delineated boundaries, is included as:

- i) a hard copy (required for inclusion of site in the Ramsar List): ;  
ii) an electronic format (e.g. a JPEG or ArcView image) ;  
iii) a GIS file providing geo-referenced site boundary vectors and attribute tables

b) Describe briefly the type of boundary delineation applied:

e.g. the boundary is the same as an existing protected area (nature reserve, national park, etc.), or follows a catchment boundary, or follows a geopolitical boundary such as a local government jurisdiction, follows physical boundaries such as roads, follows the shoreline of a waterbody, etc.

Delineation of the site follows the forest line at the foot of the mountains to the open or semi-open grassland area of the karst polje. In general, the contact area between the forests and open or semi-open karst polje landscape is best described by the 740 m isohips. From 270.21 km of the site perimeter, only 48.46 km in the southern part of the polje around Lake Busko, between Podgradina and Podhum, follow the roads ([Appendix 1a and GIS](#)).

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**8. Geographical coordinates** (latitude/longitude, in degrees and minutes):

Provide the coordinates of the approximate centre of the site and/or the limits of the site. If the site is composed of more than one separate area, provide coordinates for each of these areas.

Approximate centre: 43° 52' 32" N, 16° 46' 39" E

Southwest corner: 43° 36' 34" N, 17° 1' 0" E

Northeast corner: 44° 6' 21" N, 16° 36' 19" E

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**9. General location:**

Include in which part of the country and which large administrative region(s) the site lies and the location of the nearest large town.

The site is located in the Dinarides very close to the eastern Adriatic, Western Balkans, SE Europe. Livanjsko Polje is situated in the south-western part of Bosnia and Herzegovina (51,129 km<sup>2</sup>) in Hercegbosanska Zupanija/Canton 10 (4,929 km<sup>2</sup>), close to the border with Croatia, [see Appendix 1b-c](#). Straight-line distance to the Croatian border is 2.5 km, and 119 km to the capital of Sarajevo. Hercegbosanski Canton (Hercegbosanska zupanija or Canton No. 10) has some 90,000 inhabitants, with 38,624 of them living in the Council of Livno (year 1991). It is only the town of Livno with its 10,028 inhabitants and its karst springs that constitutes part of this Ramsar site. Canton (kanton) is the third administrative body after the State Government (državna vlada) which is composed of two entities (Federacija BiH and Republic of Srpska); the fourth is Council (općina). Hercegbosanski Canton, which is part of the Federation of Bosnia and Herzegovina, consists of 6 councils: Drvar (583.86 km<sup>2</sup>), Bosansko Grahovo (776.18 km<sup>2</sup>), Glamoc (1,041.90 km<sup>2</sup>), Kupres (576.87 km<sup>2</sup>), Livno (977.76 km<sup>2</sup>) and Tomislavgrad (973.29 km<sup>2</sup>). Livanjsko Polje Ramsar site lies in 3 councils of Hercegbosanski Canton (in brackets size of the site per council): Bosansko Grahovo (73.93 km<sup>2</sup>), Livno (328.82 km<sup>2</sup>) and Tomislavgrad (55.93 km<sup>2</sup>), [see Appendix 1d](#).

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**10. Elevation:** (in metres: average and/or maximum & minimum)

699 – 991 m (average of karst field 720 m)

**11. Area:** (in hectares)

45.868 ha

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**12. General overview of the site:**

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

The entire Dinaric karst covers 70,400 km<sup>2</sup>, within some 130 of its karst fields covering only 1,350 km<sup>2</sup> (Bozicevic 1992). Livanjsko Polje is the largest karst polje in the Dinaric karst (410 km<sup>2</sup>). Besides, little is known that Livanjsko Polje is the largest periodically flooded karst field in the world (Ritter-Studenicka & Grgic 1971). It has permanent streams, sinkholes, estavellas and karst springs above (Bistrica waterfall) ore at the polje level (e.g. Sturba, Zabljak). A series of temporary streams (e.g. Jaruga, Plovuca) and karst lakes (Mali and Veliki Zdravac – big and small “Crane Swamps”) is present, too. Although the southern part of the polje is used for energy production, it is still regularly flooded on 230 km<sup>2</sup> – 60% of its surface (55 km<sup>2</sup> big Busko reservoir as the former flooded area not included). The diversity of its fauna and flora, as well as the size of the wetlands habitats are exceptional for the Dinarides and even the nearest (30-40 km) eastern Adriatic. The position of Livanjsko Polje, as the largest peatland in the Balkans, is remarkable as well. A brief history of the polje from its discovery by naturalists to the present day and the main human impacts can be summarized as follow:

After 1871, the Austro-Hungarian monarchy began to carry out an extensive research into Bosnia and Herzegovina by its naturalists. In 1888, for example, it was visited by Othmar Reiser, who in his famous work *Ornis balcanica* eventually gave (in 1939) the first ornithological and brief botanical description of Livanjsko Polje (Reiser 1939). In the same year, “Tusnica Coal Mines” began to operate near Livno (black and brown coal) and peat began to be excavated at a small scale. Extensive water regulation plans for Bosnia and Herzegovina’s karst fields were made (Ballif 1896) and the first works in the peatland area south of Livno (called Jagma) started in 1887 (Vlahinic 1986). In the 1970s, a large-scale peat excavation started in Zdravovac – northern part of the polje (Obratil 2006). In 1973, Busko reservoir (55 km<sup>2</sup>) with canals and Lipa accumulation was built in the south-eastern part of the polje. In the same year, the Orlovac power plant in Croatia was also built. During and after the last war (1991 – 1995), human use of the polje was heavily reduced (e.g. minefields). However, several new destructive projects for Livanjsko Polje are being prepared.

Together with the transboundary Sava wetlands and its Ramsar sites Bardaca (BiH), Crna Mlaka (HR) and the Nature Park Hutvo Blato (BiH), Livanjsko Polje is the most important wintering, migration and breeding site for waterbirds and raptors in Bosnia and Herzegovina – it is in fact the keystone of Central European Flyway. One of the most fascinating facts is that the polje is surrounded by little (extensive grazing) or no human impacted karstland. Dry grasslands, peatland pastures, marshes, wet meadows and alluvial forest (!) form, on the basis of the water gradient, the characteristic polje landscape. The woodlands of Livanjsko Polje are the largest karst alluvial forests. The most important ecological features of Livanjsko Polje is the fact that in the very same year it is possible to catch fish and to mow the meadows in the same place! For centuries, Livanjsko Polje has had a significant impact on the people and Livno Council. The famous Livno cheese (livanjski sir) was a trademark and a very expensive product before the last war – it was simply the best karst cheese in the world and an indicator of the extensive meadow and pastureland preservation. The south-eastern part (Busko Blato) has been transformed to a reservoir.

### 13. Ramsar Criteria:

Tick the box under each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11). All Criteria which apply should be ticked.

- 1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9

### 14. Justification for the application of each Criterion listed in 13 above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

**Criterion 1:** Livanjsko Polje is described as the larger karst polje in the world and a unique site as natural and cultural landscape. After delineations used in the EU Habitats Directive (92/43/EEC) and for the EMERALD Network set up under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention), the site is situated on the border between the Alpine and Mediterranean biogeographic regions. After delineation of the European ecological region (DMEER), it belongs to the mixed forest region of the Dinarides. For all three regions, the size of the wetlands, its explicit natural (peatlands and alluvial forests) and near-natural wetland (dry to wet temperate grassland as meadows and pastureland) type is exceptional and unique. It is the best example of grassland management in Dinaric karst and on the eastern Adriatic coast (800 km) that also play an important role as most important seasonal water retention (floodplain and temporally karst lake) in Cetina river catchment. The polje is the surface part of extensive underground hydrological karst system.

**Criterion 2:** Referring to IUCN Red List of Threatened Species (2006), the proposed Livanjsko Polje Ramsar site supports one fish species, which is Critically Endangered (CR), three that are Endangered (EN) and one fish species that is Vulnerable (VU) (see table below and chapter 21. Noteworthy fauna for more details).

#### Pisces

*Telestes turskyi* – CR B1ab(ii)+2ab(ii)

*Phoxinellus alepidotus* – EN B2ab(ii,iii,iv)

*Chondrostoma phoxinus* – EN B1ab(i,ii,iii,iv,v)  
*Squalius microlepis* – EN B2ab(ii,iii)  
*Aulopyge huegelii* – VU A1acde+2ce

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The connected underground system of the Cetina Basin is a hot spot for endemic karst species like White-clawed Crayfish *Austropotamobius pallipes* (VU B2bce+3bcd).

Ritter-Studnicka (1972) describes for Glamocko and Livanjsko Poljes Eriophoro-Caricetum davallinae as relict plant associations. Another relict association of Livanjsko Polje is Molinio-Lathyretum pannonicum H-ić 1963. From Livanjsko Polje, the following three associations are only known: Nasturtio-Beruletum angustifoliae submersae Ritter-Studnicka 1972 and Rorippo-Fontinaletum antipyreticae Ritter-Studnicka 1972 and Festuco-Linetum flavi-angustifolii Ritter-Studnicka 1972. Another 4 associations and sub-associations, known only from the Dinaric karst fields, have their strongholds here. Livanjsko Polje is the largest (hygrophilous) meadow in the Dinaric karst and belongs to the largest meadow landscapes of the Balkan Peninsula (see chapter 12. Noteworthy fauna for more details).

**Criterion 3:** No general surveys of the species richness at Livanjsko Polje exist. Birds (Appendix 2) and plants (Appendix 3) indicate a high biodiversity of periodically flooded and freshwater environment for Bosnia and Herzegovina, Dinaric karst/Alps and the Balkan region. Livanjsko Polje provides survival for valuable populations of plants and animals important for conservation of biological diversity within the biogeographical region(s) it belongs to, such as: *Sesleria uliginosa*, *Serratula hycopifolia*, *Centaurea angustifolia* var. *pannonica*, *Plantago maritima*, *Hordeum marinum* f. *hystrix*, *Alium angulosum*, *Botaurus stellaris*, *Aythya nyroca*, *Circus gallicus*, *Aquila pomarina*, *Crex crex*, *Grus grus*, *Gallinago gallinago*, *Lanius minor*, *Canis lupus*, *Ursus arctos* etc. Five fish species are Dinaric karst endemites with small area of occupancy: *Telestes turskyi*, *Chondrostoma phoxinus*, *Squalius microlepis*, *Aulopyge huegelii* and *Phoxinellus alepidotus*.

**Criterion 4:** Livanjsko Polje is a significant stop-over site for waterbirds and raptors - very likely the most important in Bosnia and Herzegovina. As periodical or permanent wetlands in dry and rocky Dinaric karst, forming islands in the hinterland of the eastern Adriatic coast, Livanjsko Polje attracts and aggregates several thousands waterbirds during migration including shorebirds use large shallow flooded areas of the polje. It is one of the keystones for migration along the Adriatic coast, where wetlands are scarce (Central European Flyway). Owing to the good feeding areas during dry or winter periods, important numbers of raptors are present here (e.g. *Circus cyaneus* 1% of European wintering population). The role and international importance as a stop-over site of Livanjsko Polje are still overlooked and have to be investigated.

**Criterion 5:** Waterbird census started recently and first results in year 2007 indicate that 50.000 waterbirds stop in autumn on reservoir Busko jezero. Winter, spring and summer number of waterbirds in dry 2007 year varies between 3.500-6.000 (for details see Appendix 4, Euronature Database). Probably the most important time for stop-over migrants is spring when polje is flooded (compare Schneider-Jacoby *et al.* 2006).

**Criterion 6:** Under application/comparison of 1% criterion of Ramsar Convention in and WPE4 (2006) in Livanjsko Polje between 2002-2007, two bird species (*Mergus merganser* and *Fulica atra*) reach the 1% thresholds:

Detailed information under application/comparison of 1% criterion of Ramsar Convention in WPE4 (2006) with counts, estimates, waterbirds species and subspecies, populations, breeding, wintering and core non-breeding range is given for Livanjsko Polje in Appendix 5.

**Criterion 7:** Information as to species richness allows an estimate that 10% of fish species of Livanjsko Polje are endemic for Dinaric karst. For *Chondrostoma phoxinus*, *Squalius microlepis* (both with almost all global population at Livanjsko Polje) and for *Phoxinellus alepidotus* the polje is a very important habitat.

Biodiversity of fishes at Livanjsko Polje has not been generally investigated, but is expected to be studied substantially.

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**15. Biogeography** (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

**a) biogeographic region:**

Site lie in the Alpine and Mediterranean biogeographic region (European Environment Agency)

<http://dataservice.eea.europa.eu/atlas/>). It is not possible to classify Livanjsko Polje only in one of the mentioned biogeographic regions that cross the polje – not even arbitrary. The two regions meet at Livanjsko Polje and make the karst polje for both regions unique.

**b) biogeographic regionalisation scheme** (include reference citation):

Eastern Mediterranean Region (Wetlands International (2006): Waterbirds Population Estimates – Fourth Edition. Wetlands International, Wageningen, The Netherlands), Balkan Peninsula, Dinaric Alps/karst (e.g. Bozicevic 1992), Cetina River Basin (Adriatic catchment)

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**16. Physical features of the site:**

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Livanjsko Polje is situated in the southwest of Bosnia and Herzegovina. It spreads between the Karst Mountains of Dinara and Kamensica in the south, Tusnica in the east, Cincar and Golija in the north and Sator and Staretina in the west. The polje lies in Dinaric direction (NWW – SEE) 64,8 km in length and 6 km width on average (max 11,5 km). The surrounding mountain peaks are up to 2,006 m high. During the neogene, the field was under the water. Nowadays only few remaining lakes are present (when flooded ca 1,5-2 m deep). One of them – Busko blato – was transformed into permanent Busko reservoir (up to 17 m deep, 782 million m<sup>3</sup> water). Through the surface of Livanjsko Polje, several sink-hole rivers are running, the most important among them being the Sturba, Zabljak, Bistrica, Brina, Plovuca, Jaruga and Ricina. The principal springs are Duman 350, Zabljak 120 and Sturba 1,000 Qmin l/s (Hrvatovic 2004). In general, springs are located in the north-western and sinkholes (ponors) in the south-western parts of the polje. Villages and the town of Livno are located on the edge of the polje and are safe from floods. Usually, the polje is shallow flooded. The pastures and meadows flooded on April 17<sup>th</sup>, 2004, allow an estimate of water level of up to 1,5 m, and form a natural periodic karst lake (flooded area) of 230 km<sup>2</sup> (compare [Appendix 6 pictures 1-8 and 10](#)).

Livanjsko Polje is, characteristically, a contact area of the maritime and continental climates. During the cold half of the year, the continental influence prevails, while during the summer the Mediterranean impact is predominant (compare Cengic and Obradovic 2002, Obratil 2006 etc.) Mountains make climate more continental with cold winters (snow).

Annual average precipitation at Livno between the 1951-1972 period was 1,181 mm, and 1,174 mm between the 1973-1984 period. Monthly rainfall values (in mm) in the 1951-1972 period (1973-1984) were: **J** 93 (86), **F** 96 (96), **M** 86 (89), **A** 86 (89), **M** 88 (83), **J** 96 (87), **J** 61 (49), **A** 63 (76), **S** 72 (104), **O** 110 (156), **N** 170 (115), **D** 168 (143). Annual average temperature was 8.9 °C. Annual fluctuations (°C) of air temperature in the 1951-1972 period (1973-1984) were: **J** -1.1 (0.0), **F** 0.4 (1.0), **M** 3.8 (4.5), **A** 8.6 (7.4), **M** 12.9 (12.8), **J** 16.5 (16.1), **J** 18.3 (18.2), **A** 18.1 (17.3), **S** 14.5 (14.0), **O** 9.5 (9.4), **N** 5.2 (4.0), **D** 1.5 (1.1) (Republic Hydrometeorological Institute Sarajevo at Obratil 2006). Wind: the characteristic and strong wind from the continent during the cold half of the year is the “bura”. Water permanence: floods occur in the cold half of the year; karst lakes are dry at the peak of the summer (Busko reservoir is a permanent and oscillating water body).

Soil types of Livanjsko Polje are not mapped, but gley, pseudogley, semigley, fluvisol, histosol and sponitza could form the polje soils at least in patches. These soils are mostly exposed to floods, torrents, sliding, and sedimentation. In places, there is a high level of groundwater coming from the mountains

(compare Vlahinic *et al.* 2004). The bottom of Livanjsko Polje has been levelled owing to the sedimentation of the latest geological sediments (Pleistocene). On permanently wet grounds, humus-rich layers have developed, as well as peat, which are all neutral to mildly acid reaction, as the water rich with carbonates prevents acidation. (Ritter Studnicka 1974). According to Montanarella *et al.* (2006), the organic carbon content in topsoils (0-30cm) varies between 6-36% for the northern part of the polje called Zdravovac, where the relative cover of peat and peat-topped soils is more than 50% (GIS calculated 78 km<sup>2</sup>). However, the 23 km<sup>2</sup> (GIS calculated) large peat area south-west of Livno called Jagma, which was dried out some 100 years ago, is nowadays not recognised as soil with more than 6% organic carbon. Small peatland areas in the former Busko blato have been destroyed by Busko reservoir. The accumulated peat layers near Zdravovac reach 2-3 meters in depth, and below 1 meter at Jagma, and are of reed (Phragmites), sedges (Carex) and moss origin (Hrvatovic 2004).

During the rainy season, a stream network of approximately 605 km in total length develops at the polje. The artificial drainage systems at Zdravovac are 77 km, Jagma 139 km, and the bigger canals (mostly for reed production) 36 km in length.

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### 17. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, and climate (including climate type).

Although the Adriatic Sea watershed is an area with strong karst character, some important watercourses originate here. Two water basins are dominant: the Neretva river with the Trebisnjica river basin, and the Cetina river, with the Krka river karst water basin (Cengic and Cabaravdic 2004).

Karst fields of Bosnia and Herzegovina can be divided in two groups: northern-Bosnian and southern-Herzegovina groups. Kupresko, Glamočko, Duvanjsko and Livanjsko Poljes represent Bosnian group (Ritter-Studnicka 1974). This karst field group from the Cetina river catchment spreads over 3,937 km<sup>2</sup>. To Bosnia and Herzegovina, 2,310 km<sup>2</sup> belong (1,200 – 700 m a.s.l.), and 1,627 km<sup>2</sup> to Croatia (385 – 0 m a.s.l.). Inter-catchment relations are highly complex, and Kupresko, Glamočko and Livanjsko Poljes have underground connection to both the Adriatic (Cetina) and the Black Sea (Vrba and Una) catchments. The border between Croatia and Bosnia delineate the 105 km long surface watercourse of the Cetina river (Croatia) and 177 km of different surface watercourses (longer than 10 km) of Bosnian karst poljes group. Average annual flow of Cetina in Croatia is 99 m<sup>3</sup>/s. Of some 70% of the Cetina river basin in Bosnia, mountain landscape is characteristic. In terms of land use in the river basin of Bosnia, 35% are forests, 25% pastures, 20% agriculture and 5% irrigated land (on line: [http://www.inweb.gr/workshops/papers\\_groundwater](http://www.inweb.gr/workshops/papers_groundwater)).

The Cetina catchment is built of Triassic, Jurassic, and Cretaceous carbonate strata (Bonacci and Roje-Bonacci 2003). Karst limestones and impermeable tertiary sediments are characteristic of the Cetina river basin. Geological stratigraph pylon of south-west Bosnia include coals, sandstones, flintstones, marls and tufas (Hrvatovic 2004).

Characteristic of climate in the catchment area vary and are strongly influenced by altitude and distance from the sea: nearly modified continental climate influenced by mountains (sub-Alpine climate) sharply change to moderate Mediterranean climate. Mid-January temperatures varied for the continental climate from –3.4°C (in mountains) to up to 4.8°C for the Mediterranean climate (Cengic and Obradovic 2002). Estimated mean rainfall in the catchment area is 1,380 mm (Bonacci and Roje-Bonaci 2003). According to the arrangement of climatic regions in SE Europe (Horvat *et al.* 1974), the Cetina catchment belongs to two regions: the first is marked by the Mediterranean summer drought (the Split climatic subtype: short and poorly expressed summer drought, very much akin to Submediterranean climate), whereas the second is moderate climate with summer precipitation (Livno climatic subtype: montane-humid, similar to Central European type with mild Mediterranean influence, manifested in summer precipitation drop).

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### 18. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

In hydrological terms, the terrace-formed karst poljes of the Cetina watershed are important for flood protection. Large floodplains of poljes – especially Livanjsko Polje – form important and unique water storage mechanism that is the basis for flora and fauna diversity. Flood control mechanism at Livanjsko Polje is supported by large peatland and alluvial forests. The water regime and ecology of Livanjsko Polje were altered as well, namely by the formation of Busko reservoir and canals, so that the former character as of the largest floodplain in Dinaric karst and as of a wetland has been preserved. The size of wetland area has remained nearly unchanged during the last 100 years (loss of just 14% surface trough Busko reservoir).

Since 1960, numerous hydrotechnical works have been carried out on the Cetina river and within its catchment. Five hydroelectric power plants (HEPPs), five reservoirs, and three long tunnels and pipelines have been built. Their operation has significantly altered the natural hydrological regime (Bonacci and Bonacci 2003). Therefore, the role of Livanjsko Polje for water purification, quality and as sediment and nutrient retention is to be described as enormous (e.g. important for water supply for Croatian coast).

## 19. Wetland Types

### a) presence:

Circle or underline the applicable codes for the wetland types of the Ramsar “Classification System for Wetland Type” present in the Ramsar site. Descriptions of each wetland type code are provided in Annex I of the *Explanatory Notes & Guidelines*.

**Marine/coastal:** A • B • C • D • E • F • G • H • I • J • K • Zk(a)

**Inland:** L • M • N • O • P • Q • R • Sp • Ss • Tp Ts • U • Va • Vt • W • Xf • Xp • Y • Zg • Zk(b)

**Human-made:** 1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9 • Zk(c)

### b) dominance:

List the wetland types identified in a) above in order of their dominance (by area) in the Ramsar site, starting with the wetland type with the largest area.

Whole Livanjsko Polje is a wetland. Duration of flood events greatly change the size of different wetlands types between years.

Percent (%)	Area (km <sup>2</sup> )	Wetland type
32 (59)	131 (243)	4 – <b>Seasonally flooded agricultural land</b> (including intensively managed or grazed wet meadows or pastures) – domestic agriculture 39 km <sup>2</sup> , 92 km <sup>2</sup> not intensively grazed pastures, 111 km <sup>2</sup> meadows (243 km <sup>2</sup> grasslands at Livanjsko Polje in total)
25 (56)	101 (230)	Ts – <b>Seasonal/intermittent freshwater marshes/pools on inorganic soils</b> ; includes sloughs, potholes, seasonally flooded meadows, sedge marshes
13	55	6 – <b>Water storage areas</b> ; reservoirs/barrages/dams/impoundments (generally over 8 ha)
15	60	U – <b>Non-forested peatlands</b> ; include shrub or open bogs, swamps, fens
6 (56)	26 (230)	P – <b>Seasonal/intermittent freshwater lakes</b> (over 8 ha); includes floodplain lakes
5	21	Xf – <b>Freshwater, tree-dominated wetlands</b> ; includes freshwater swamp forests, seasonally flooded forests, wooded swamps on inorganic soils
3	11	7 – <b>Excavations</b> ; gravel/brick/clay pits; borrow pits, mining pools
1	< 3	N – <b>Seasonal/intermittent/irregular rivers/streams/creeks</b>
present	1	9 – <b>Canals and drainage channels, ditches</b>
present	< 1	M – <b>Permanent rivers/streams/creeks</b> ; including waterfalls
present	present	2 – <b>Ponds</b> ; include farm ponds, stock ponds, small tanks; (generally below 8 ha)
<b>100%</b>	<b>410 km<sup>2</sup></b>	<b>11 wetlands types</b>

Satellite habitat mapping by Euronature is in preparation and more accurately data will be available in the future.

## 20. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site, and the ecosystem services of the site and the benefits derived from them.



The main ecological process is flooding of the polje by karst rivers. Through the annual cycle of flooding, capacity of sinkholes to drain the polje and evaporation, the ecological value is naturally maintained. This process is disturbed by the use of water for energy production.

Grassland covers 243 km<sup>2</sup> (dry to wet meadow and pastures), seasonal fresh water marshes and lakes between 26 and up to 230 km<sup>2</sup>, water storage areas 55 km<sup>2</sup>, non-forested peatlands 60 km<sup>2</sup> and alluvial forests 21 km<sup>2</sup>. Before the last war (1991-1995), Livanjsko Polje was a large-scale pasture. Compare land use in 2005 [Appendix 7 and GIS](#).

Mostly dry karst forest of *Carpinetum orientalis* surround the polje that is deeply embedded between the karst mountains. Sparsely covered with vegetating or even bare limestone areas are present on the eastern mountain slopes: grazing (before war) and regular burning (after last war) are characteristic.

Deleted: i

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## 21. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 14, Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

315 plant species were recorded (see taxonomic list of species, [Appendix 3](#)). The most significant species belong to the boreal, pannonian-pontic or Illyrian floral kingdoms, respectively.

Ritter-Studnicka (1972) describes for Glamocko and Livanjsko Polje *Eriophoro-Caricetum davallinae* as relict plant associations. At Livanjsko Polje, this association of small sedges that grow on peat is developed in fragments. Different wet meadows of Livanjsko Polje have great species richness and form relict *Molinio-Lathyretum pannonicum* H-ić 1963 association, which can be divided in 4 sub-associations (following increasing wetness on humus rich soils): *serratuletosum lycopifoliae* Ritter-Studnicka 1972, *typicum* H-ić 1963, *caricetosum paniceae* Ritter-Studnicka 1972, *salicetosum rosmarinifoliae* Ritter-Studnicka 1972 (Ritter-Studnicka 1972). This association and sub-associations are characteristic only of Bosnian karst fields and represent the largest meadow community at Livanjsko Polje.

*Deschampsietum mediae illyricum* H-ić 1963 meadows communities on mineral soils that dry out in the summer belong to the following three associations: *Centaureetum pannonicum*, *Plantagenatem altissimae* and *Deschampsietum* (Ritter-Studnicka 1954). The main range of these associations are karst fields of Bosnia and Herzegovina. *Centaurea pannonica* is a Pannonian plant and the karst fields are quite far away from the main range of this species. Bold form f. *glabrescens* Stoj. et Acht is spread over poljes. In the group of dry meadows in the central part of Livanjsko Polje, a new association is described: *Festuco-Linetum flavo-angustifolii* Ritter-Studnicka 1972 on rock limestone soils, which are permanently grazed by stock (Ritter-Studnicka 1972).

Three alluvial forest types are known at Livanjsko Polje: *Alnus glutinosa* forest, *Quercus rubor* forest and *Fraxinus angustifolia* forest. This is quite remarkable, considering that in karst fields of Bosnia and Herzegovina (and this holds good for the entire Dinaric karst) no more forest vegetation can be found. The largest area is covered by oak wood of *Quercus rubor* belonging to the *Genisto elatae-Quercetum roboris* community that form unique and new subassociation “*poetosum silvicole*” growing on soils rich in humus of a peat-like character. In the stand of *Fraxinus angustifolia*, species characteristic of the south European alluvial forest can be found (Ritter-Studnicka and Grgic 1971). On the basis of palynological (pollen) investigation by Gigov and Nikolic (1959), the oak of Livanjsko Polje was the dominant tree from the start of peat forming till today. It is very possible that oaks *Quercus rubor* from Livanjsko Polje represent special ecotype which differ physiological and genetically from the lowlands river floodplain oaks (Ritter-Studnicka and Grgic 1971).

For communities of fast flowing, cold and on carbonate rich permanent karst streams *Sturba*, *Zabljak*, *Bištrica* and mall stream near *Golinjevo*, new plant association is described by Ritter-Studnicka (1972) as *Nasturtio-Beruletum angustifoliae submersae*. For temporally streams, which dry out in the summer, new

association is described: Rorippo-Fontinaletum antipyreticae Ritter-Studnicka 1972. This association is known only from Livanjsko Polje.

## 22. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 14. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

During the 1890-2007 period, 204 bird species – 128 breeders – were recorded (Reiser 1939, Obratil 2006, Schneider *et al.* 2006, Euronatur database 2002-2007). A List of Birds is given in [Appendix 2](#).

Two species are of special interest: Common Crane *Grus grus* and Goosander *Mergus merganser* (compare Criterion 2). Livanjsko Polje holds an outstanding breeding place of Cranes (up to 8 pairs before 100 years, Reiser 1939) that is separated by 800 km straight line from the breeding range of the species in Europe. The origin of Livanjsko Polje Cranes is not known. Cranes probably still breed there, although their numbers are not known as accurate field studies are missing (e.g. observation of one breeding pair on 17.4.2004, Schneider *et al.* 2006, [Appendix 6 picture 9](#)). Busko reservoir is probably one of the main wintering areas for the Goosander breeding in the Balkans. And breeding of the Balkan Goosander on Busko reservoir is possible.

Breeding of Common Snipe *Gallinago gallinago* is remarkable (one of the southernmost breeding sites in Europe). Some 20 bp breeds around both Zdralovac blatos but the Livanjsko Polje stronghold seems to be at Jagma.

Trough IBA criteria for designation of future IBA Livanjsko Polje in Bosnia and Herzegovina according to the criteria in Birds in Europe II, 12 breeding birds species significant on the European scale:

BiE2 Scientific name	BiE2 SPEC category	Minimum European breeding population estimate (pairs, unless stated)	Maximum European breeding population estimate (pairs, unless stated)	1990-2000 European breeding population trend	BiH	0,5% MIN	0,5% MAX	Livanjsko Polje
<i>Aythya nyroca</i>	SPEC 1	12.000	18.000	Large decline	●	60	90	4-20 bp
<i>Circaetus gallicus</i>	SPEC 3	8.400	13.000	Small decline	●	42	65	>3 bp
<i>Aquila pomarina</i>	SPEC 2	14.000	19.000	Moderate decline	new	70	95	1-2 bp
<i>Falco tinnunculus</i>	SPEC 3	330.000	500.000	Moderate decline	●	1650	2500	25-30 bp
<i>Coturnix coturnix</i>	SPEC 3	2.800.000	4.700.000	Fluctuating	●	14000	23500	50-300 bp
<i>Crex crex</i>	SPEC 1	1.300.000	2.000.000	Fluctuating	●	6500	10000	315 bp
<i>Otus scops</i>	SPEC 2	210.000	440.000	Unknown	●	1050	2200	40-60 bp
<i>Bubo bubo</i>	SPEC 3	19.000	38.000	Stable	●	95	190	10-15 bp
<i>Upupa epops</i>	SPEC 3	890.000	1.700.000	Moderate decline	●	4450	8500	22-40 bp
<i>Lanius collurio</i>	SPEC 3	6.300.000	13.000.000	Small decline	●	31500	65000	400-600 bp
<i>Miliaria calandra</i>	SPEC 2	7.900.000	22.000.000	Moderate decline	●	39500	110000	800-1500 bp

Most interesting zoographic features are probably provided by fishes: **a)** Turskyi Dace *Telestes turskyi* Heckel, 1843) is an endemic fish species occurring only at Livanjsko Polje and another two streams in the neighbouring areas of Croatia (online: <http://www.ribe-hrvatske.com/images/Telestes%20turskyi/untitled.htm>). *L. turskyi* has an extremely limited distribution. It was thought to be extinct but has recently (2002) been rediscovered. It has an extent of occurrence <100 km<sup>2</sup> and area of occupancy <10 km<sup>2</sup> and survives at one location, the Cikola River (Crivelli 2005), **b)** Endemic Dalmatian Barbel Gudgeon *Aulopyge huegelii* Heckel 1842, occurs only at Glamocko, Livanjsko and Duvanjsko poljes and in the Cetina (Cetina catchment, BiH/HR) and Krka rivers (Krka catchment, HR) (Soric and Banarescu 1999), **c)** Spotted

Minnow *Phoxinellus alepidotus* Heckel 1843, is found at three, possibly four locations (Cetina river basin) (Crivelli 2005), **d**) Minnow-Nase *Chondrostoma phoxinus* Heckel 1843, a restricted range species (extent of occurrence <5,000 km<sup>2</sup>) only known from less than five locations (Crivelli 2005) and **e**) *Squalius microlepis* Heckel 1843, is restricted to three locations in the Neretva river basin. One small population is in a karst stream at Livanjsko Polje, with the main population in two lakes, Busko and Mandecko near Livno. The area of occupancy is estimated to be around 10 km<sup>2</sup> (Crivelli 2005).

Alien fish species at Livanjsko Polje are *Oncorhynchus mykiss* and *Carassius auratus gibelio* (online: <http://fmoit.gov.ba/FMOiT/dokumenti/okolis/Biodiverzitet/18%20-%20Invazivne%20vrste.pdf>). Beside this we found during field surveys as introduced species *Cyprinus carpio*, *Silurus glanis*, *Esox lucius* and *Thymallus thymallus*.

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### 23. Social and cultural values:

**a)** Describe if the site has any general social and/or cultural values e.g., fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values:

**b)** Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning?

If Yes, tick the box  and describe this importance under one or more of the following categories:

i) sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:

mainly connected with iii) (see below), e.g. before peat extraction the whole area of periodic karst lake Zdralovac was used as combination of meadows and pastures for sheep and cows grazing after flooding was over between July – September/October.

ii) sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:

iii) sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples:

Livanjsko Polje is important for the identity and the image of the local community of Livno. Livno and its surroundings are known for their excellent cheese, whose making was some hundred years ago perfected by the Austrians. This highly esteemed cheese began to be produced in the 19<sup>th</sup> century on family farms around Livno, according to the model and technology of the French gruyere cheese. Today, its major producer is the "Mljekara Livno", with annual production exceeding 700 tons (2005). Best known apart from this cheese are numerous horses, rivers rich with noble fishes and crabs, stockbreeding and, prior to the last war (1991-1995), textile industry.

iv) sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

The wide open landscape of Livanjsko Polje is an important landscape value in the Dinarides.

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### 24. Land tenure/ownership:

a) within the Ramsar site:

The site represents a mixture of privately and publicly (council and Federation of BiH) owned land. According to our knowledge, no digitalized land cadastral register of Livanjsko Polje exists (cadastral register which is still in official use was made by the Austro-Hungarian monarchy).

b) in the surrounding area:

See above.

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**25. Current land (including water) use:**

a) within the Ramsar site:

Land use cover: 14% energy production (in southern part of the polje, but the entire polje is impacted), 53% pastures and meadows (central part), 6% domestic agriculture (around the polje), 5% forests (northern part), 3% peat extraction (mostly in north), 3% urban surface (mostly rural, around polje); the rest are mostly dry scrub and stone areas on mountain slopes and wet swamp, peat and forest areas on the bottom of the polje. Sand extraction and spreading of settlements for trade and industry (Livno) seem to be new and important in the future. Livanjsko Polje is used as traffic communication behind the Adriatic coast, and spare time activities, such as angling, hunting, flying with ultra light planes and water sports, etc. Other values include research, environmental education and (linked) tourism. Hunting has not been banned at the site by law or the Council itself.

Human population of the Ramsar site could be estimate at 20,000 – 25.000 inhabitants (2007)

b) in the surroundings/catchment:

Important feeding areas for raptors are extensively grazed pasturelands and meadows in the surroundings of Livanjsko Polje; poljes are regularly flooded, whereas karst slopes, hills or mountains are dry with completely different ecology. For general land use feature in the catchment see Chapter 17, Physical features of the catchment area. Trough water use and coal extraction, energy production has/will have major impact on land use.

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

a) within the Ramsar site:

Most important factor affecting the site character was building the canals, Busko reservoir and Lipa reservoir Orlovac powerplant in Croatia. Hydrological character of Livanjsko Polje has changed greatly after 1972. Despite the fact that water management works at Livanjsko Polje began 120 years ago (see Ballif 1896), the greatest problem lies in the fact that works for water extraction (e.g. extension of the existing canals) for energy production are still in progress without EIA. Human pressures, especially construction of dams and reservoirs, water transfer trough long tunnels and pipelines in the surrounding karst areas are often connected to hazards (Bonacci 2004). Positive is that floods at Livanjsko Polje still occur and that the floodplain is preserved. But development project to simulate natural flood conditions and to make groundwater level higher are missing (e.g. serious damages on alluvial oak forest are visible).

Important past, present and potential factor affecting the site concerns mineral raw materials. Owing to the great stocks of brown coal (lignite), which amount to about 600 million tons, construction of a thermoelectric plant is planned in the Councils of Livno and Tomislavgrad (<http://tusnica.de.wikivx.biz/>). The Livanjsko Polje stocks are located at Celebic/12,640,000 t (lignite), Prolog/95,974,000 t (lignite) and Tusnica/16,352,000 t (black coal) (Hrvatovic 2004). Due to the 18,5 mil tons of peat reserves near Zdralovac, exploitation will be continued and different new agricultural projects, where peat is in needed, are discussed (Hrvatovic 2004). Peat excavation (in combination with drainage) as currently practiced by the firm "FINVEST Tresetište - Bosansko Grahovo - eksploatacija i prerada treseta" is unsustainable and will destroy the largest Balkan peatland. Restoration measures are needed for the impacted area including closing of drainage canals.

Uncontrolled burning of peat, grassland and scrub areas in the winter and early spring at Livanjsko Polje is a serious problem: the shocking figures from drained peatland areas in January 2007 allow an estimate of 10,000s of tons of peat being burned in the dry winter 2006/2007 (at least 200 km<sup>2</sup> of the polje where

burnt, including 73 km<sup>2</sup> peatlands of Zdravovac in its northern part). This carbon store is now being released to the atmosphere in the form of CO<sub>2</sub> through drainage of peatlands (oxidation of peat material) and fire (Hooijer *et al.* 2006). Ongoing fires are known from the mountain slopes in the NE part of the polje. Even on satellite maps, fires are present regularly (online: <http://www.maplandia.com/bosnia-and-herzegovina/federacija-bosne-i-hercegovine/bogdase/>).

Over-grazing after 1995 in large-scale is not problematic – after the war, large areas have lost their livestock (mainly sheep and cattle), especially in the northern half of the polje. It seems that the locals are preventing changes in the vegetation structure of grassland by (uncontrolled) fires.

Endemic fish species are threatened by water extraction and human impacted drought, agricultural pollution and introduced specie (Crivelli 2005). Measurements, carried out during the past years, showed a significant increase in nitrate content as well as in the coli bacteria and a less significant increase in total phosphorus content in Busko reservoir (Stambuk-Giljanovic 2001). Lowering of (ground) water level has a negative impact on waterbirds (especially shorebirds like Common Snipe and Redshank *Tringa totanus* or Common Crane) and grassland. Whitout EIA aquaculture planed in reservoir Busko jezero could have disastrous effect on endemic fish species (compare chapters 14 and 22).

An important migration corridor for wolfs exists west from Livno - traffic victims are often reported. Excessive hunting is a major problem, for large carnivores are often targeted (e.g. just 200 EUR for a bear in the year 2003 (interview with locals). Anglers often use the shallow north zone of Busko jezero or block its water surface; all kind of waterbirds, especially Spoonbills *Platalea leucorodia* or Goosander, are forced to leave the site. Many plans for water sports are in preparation or are to be still discussed (online: <http://www.tourism.ba/tourist/tourist8.pdf>).

It is not known how many alien plant species inhabit Livanjsko Polje, but for Bosnia and Herzegovina 48 have been recorded. (online: <http://fmoit.gov.ba/FMOIT/dokumenti/okolis/Biodiverzitet/18%20-%20Invazivne%20vrste.pdf>)

b) in the surrounding area:

Human pollution (waste water, industry) and water use for energy production in the catchment area can affect the water quality, which is used for human supply.

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## 27. Conservation measures taken:

a) List national and/or international category and legal status of protected areas, including boundary relationships with the Ramsar site:

In particular, if the site is partly or wholly a World Heritage Site and/or a UNESCO Biosphere Reserve, please give the names of the site under these designations.

Livanjsko Polje fulfills the criteria as Important Bird Area (IBA) And will be proposed in the next update as new IBA for Bosnia and Hercegovina (Drazen Kotraosan in litt, for data see Chapter 22, Noteworthy fauna).

Livanjsko Polje is proposed to be listed as a Biosphere Reserve (UNESCO). Based on the Biosphere Reserve Concept and zonation, the best conservation goal in the protected area planning will be achieved in the future with delineation of Livanjsko Polje as mixture of core, buffer, and transition zones.

Livanjsko Polje might be also a potential mixed World Heritage site as a continued cultural landscape due to his size (largest karst polje) and the unique ecological features.

b) If appropriate, list the IUCN (1994) protected areas category/ies which apply to the site (tick the box or boxes as appropriate):

Ia ; Ib ; II ; III ; IV ; V ; VI

c) Does an officially approved management plan exist; and is it being implemented?:

Management planning process, specific for nature and resource protection of Livanjsko Polje, has not yet started.

Management planning on the basin scale is present. For example, integrated management of the river Cetina in the shape of action programme is printed, which covers environmental and socio-economic aspects of the Cetina catchment in Croatia and Bosnia & Herzegovina (Online: [http://www.ramsar.org/wa/w.n.cetina\\_book.htm](http://www.ramsar.org/wa/w.n.cetina_book.htm)). However, Livanjsko Polje is in this programme presented as a field area void of floodplain forests!

d) Describe any other current management practices:

Beneficial for the flora and fauna is the existing grassland practice (burning excluded): low pressure grazing and grass cutting are important for many species and preserved open landscape.

Euronatur as management basis starts zoning concept for reservoir Busku jezero in December 2007.

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#### **28. Conservation measures proposed but not yet implemented:**

e.g. management plan in preparation; official proposal as a legally protected area, etc.

The Livanjsko Polje Ramsar site has no official conservation status. UNESCO, UNDP, IUCN, Euronature, WWF, Council of Europe, FAO and SNV have joined forces and created the Dinaric Arc Initiative (DAI), where protection of Livanjsko Polje is one of the major points (online: [http://portal.unesco.org/en/ev.php-URL\\_ID=37429&URL\\_DO=DO\\_TOPIC&URL\\_SECTION=201.html](http://portal.unesco.org/en/ev.php-URL_ID=37429&URL_DO=DO_TOPIC&URL_SECTION=201.html)).

UNDP has recently developed a preparatory assistance for a medium size project (USD 1 million.) on Biodiversity conservation (protection of the biological and landscape diversity) at Livanjsko Polje, to be submitted to the GEF for funding. (online: <http://www.undp.ba/index.aspx?PID=21&RID=48>).

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#### **29. Current scientific research and facilities:**

e.g., details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

Reiser (1939), Ritter-Studnicka (1971, 1972, 1973, 1974), Obratil (2006), Schneider *et al.* (2006) etc. described the great value of Livanjsko Polje between the years 1888 and 2006. After the last war (1991-1995), 12 visits of the area in Bosnia and Herzegovina between 2002-2005 indicate that the cultural and natural landscape of Livanjsko Polje have not changed much over the years (Schneider *et al.* 2006). The monitoring, which was organised by Euronatur and started in 2007, was based on the experience gained between 2002 and 2005. The monitoring scheme include waterbird, raptor and shrike *Lanius* sp. counts in combination with human impacts (hunter, fisher, recreation, burning, etc.) and water conditions on the whole surface of the polje. One survey of the entire area of the polje embraces 154 stipulated points and roads that surround or cross the polje. Special species surveys, like night counting of the Corncrake *Crex crex* or day counting of the Red Fox *Vulpes vulpes*, are in progress, too. In **Appendix 8**, the monitoring scheme is visually presented, whereas in **Appendix 9** first mapping results (January – October 2007) are given for Livanjsko Polje.

Monitoring of the water discharge for the Orlovac powerplant and monitoring of the water level at Busko reservoir have probably been carried out by HEP, but no online information is available.

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#### **30. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:**

e.g. visitors' centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

Up to now communication and public awareness activities implemented by local grassroots NGO are related just to protection of Sturba river (a permanent stream in Livanjsko Polje) targeting local population and local government.

Small groups of students come in the field visits but only on one-day basis and in their own arrangement.

Livanjsko Polje is one of the best – if not the very best – examples to understand karst phenomena, geology, hydrology and human impact in karst regions of the world. Therefore, the environmental education potential is enormous.

From a modest monasterial collection, the Gorica- Livno Franciscan Museum and Gallery, which are housed at Livno Franciscan Monastery, has developed into a modern museum with rich archaeological, sacral, ethnographic, philatelic collection as well as monasterial library and permanent exhibition by Gabrijel Jurkić (online: <http://www.hic.hr/dom/386/dom10.htm>). The fantastic impressionistic poljes landscapes painted by Jurkić (1889 - 1974) are unique and of special interest, as well as a notable document of the Livanjsko polje cultural and natural history (online: <http://www.croatiahistory.net/etf/gjurkic.html>).

In the “Sharing water” Project for “Healthy river basins and wetlands in the Dinaric Arc” Livanjsko polje is included as a freshwater ecosystem relying on water fluctuation. In the project WWF will look at a broad scale (basin/sub-basin) and at promoting good policies and approaches for integrated water resource management. A group of stakeholders is organized (Flora) to take part to decisions. Euronatur looks at the level of priority wetland at the natural values and propose development measures including zonation. An important task is the creation and start of a monitoring programme.

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### 31. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

Tourism and recreation have developed on individual basis and are present throughout the year. Some activities like angling are frequent and intensive: on 3 April 2007, 64 anglers completely blocked the shallow banks and two fishing boat water surfaces of Busko reservoir (fish species not known). At least 7 anglers blocked a whole segment of the Sturba river (Salmonides). Most hunters operate individually or in small groups in the northern part of polje. Game species are the wild boar *Sus scrofa*, even brown bear and mostly waterbirds (Euronatur database). Water sports on Busko reservoir are developing very fast indeed: canoeing, kayaking and windsurfing, in combination with “wild” camping, are in progress. The fact that Livno field, together with adjacent slopes and peaks, create the so-called thermal boiler is well known, and ideal conditions for gliders are present. Paragliding on slopes west of Livno has been reported. Tourists are coming mostly from BiH and the neighbouring Croatia.

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### 32. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept of Agriculture/Dept. of Environment, etc.

Territorial jurisdiction:

Dr. Nediljko Rimac, predsjednik vlade  
Hercegbosanska županija  
Stjepana II Kotromanića  
BiH-80101 Livno  
Phone: 00387 (0)34 200161  
Fax: 00387 (0)34 200902  
Web: <http://www.vladahbz.com/>

Functional jurisdiction:

Hikmet Hodžić, minister  
Ministarstvo graditeljstva, obnove, prostornog uređenja i zaštite okoliša Hercegbosanske županije  
Stjepana II Kotromanića  
BiH-80101 Livno  
Phone: 00387 (0)34 200472  
Web: <http://www.vladahbz.com/>

dr. Nevenko Herceg  
Ministarstvo turizma i zaštite okoliša F BiH  
Alipašina br. 41

Sarajevo  
Phone: 00387 (0)33 562870  
Fax: 00387 (0)33 201602  
E-mail: [fmoit@fmoit.gov.ba](mailto:fmoit@fmoit.gov.ba)  
Web: [www.fmoit.gov.ba](http://www.fmoit.gov.ba)  
<http://www.fbihvlada.gov.ba/>

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### 33. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Has not established yet.

The management of the site is divided based on the present land use. Northern part (Zdralovac area is under 30year concession by FINVEST company for peat extraction. Southern part (Busko Jezero) is under management of HEP (Hrvatska Elektroprivreda) and they practically make all decisions on water management in southern and central part of polje.

Central part of the field is almost under no management at all. Extensive grazing and moowing by local farmers are present on the small plots on very small scale. Also small coal pits are present in the central part by state owned company "Tusnica", but extraction is made without concession.

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### 34. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see 15 above), list full reference citation for the scheme.

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