

Additional material

Summary

A brief history of the polje from its discovery by naturalists to the present day and the main human impacts can be summarized as follows:

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 Zdrlovac – northern part of the polje (Obratil 2006). In 1973, Busko reservoir (55 km²) 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.

Noteworthy Flora

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*, *Plantagenetum 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, Bistrica and small 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.

Noteworthy Fauna

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 pairs breed around both Zdralovac blatos but the Livanjsko Polje stronghold seems to be at Jagma.

Through 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 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 km² and area of occupancy <10 km² 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 km²) 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 Mandekko near Livno. The area of occupancy is estimated to be around 10 km² (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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