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# A preliminary assessment of the ornithological importance of Livanjsko Polje (Cetina River Basin, Bosnia and Herzegovina)

## Preliminarna ocena ornitološkega pomena Livanjskega polja (dolina reke Cetine, Bosna in Hercegovina)

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Twelve short visits to Livanjsko Polje, from spring 2002 to spring 2005, have indicated that its cultural and natural landscape has changed little over the years. Several of the indicator species present almost 100 years ago (Reiser 1939) are still found in good numbers. Besides the Corncrake *Crex crex*, the occurrence in good numbers of Great Bittern *Botaurus stellaris*, Snipe *Gallinago gallinago*, Redshank *Tringa totanus,* Marsh Harrier *Circus aeruginosus* and Montagu's Harrier *Circus pygargus* is of particular interest for conservation management. Several other species, including Spoonbill *Platalea leucorodia*, Pintail *Anas acuta*, Lesser-spotted Eagle *Aquila pomarina,* Crane *Grus grus* and Curlew *Numenius arquata* are probably still breeding and the potential breeding habitats for these species in the area are still considerable. Human impact and possible solutions for conserving the natural features of Livanjsko Polje are briefly described.

**Key words:** karstic polje, peat bog, temperate grassland, flooding, cultural landscape

**Ključne besede:** kraško polje, visoko barje, travišče, poplava, kulturna krajina

### 1. Introduction

Livanjsko Polje is situated in Herceg-bosanska County (Livno district / Canton) at the border between Bosnia & Herzegovina and Croatia, in the hinterland of Split. The massif of the Dinara Mountain (1913 m a.s.l.) separates the region from the Adriatic Sea, which is only 30 km away. Herceg-bosanska County is a mosaic of huge karstic poljes (about 30% of the surface: Kupreško Polje, Duvanjsko Polje, Glamočko Polje, Livanjsko Polje) and high mountains. karsticic poljes are large closed depressions, draining underground, with a flat floor across which there may be an intermittent or permanent stream. They may be liable to flooding and become lakes, and their floors make a sharp break with parts of the surrounding slopes (Jennings 1985). The area of the Herceg-bosanska County district is 5020 km$^2$ and until 1991, 155,000 people lived there, i.e. only 23 people per km$^2$. Karst is the typical landscape feature in the region (Božicević 1992) and its protection is a global task, as it is linked to very specific habitats and a high biodiversity (e.g. Vermeulen & Whitten 1999).

While the mountains in the NW of the county are a part of the Sava River Basin – here is the source of Unac, the small beginning of the Una River – the rest of the county lies within the Cetina River Basin. The Mediterranean Cetina river has two thirds of its basin in Bosnia and Herzegovina, but these parts of its catchment area are connected with the main river only by subterranean water courses (UNEP/MAP/PAP 2000).

Livanjsko Polje is surrounded by high mountains, which are characterised by very hard winters. The karstic polje runs in a NW to SE direction with Buško blato (today an artificial reservoir not included in this study) in the SE and Ždralovac on the NW edge. Ždralovac is some kind of bottleneck between the last Dinara Mountains and Šator where Livanjsko Polje is followed by Grahovo Polje. The length of the karstic polje is 65 km with an average width of 6 km. Its surface is 410 km$^2$, situated between 700 and 720 m a.s.l.

The best, and possibly the only, description of the ornithological and natural features is found in the great materials for an Ornis Balcanica by Reiser (1939). Apart from Hutovo Blato, which is currently the only Ramsar Site in Bosnia and Herzegovina, one of the three Important Bird Areas (IBA) and a nature park (Heath & Evans 2000), Livanjsko Polje constitutes the most important wetland in Bosnia and Herzegovina and the neighbouring countries, according to Reiser. It was described as hosting a unique community of water birds (Table 1). Most striking is the fact that the north western marsh and bog habitats are named after the Crane *Grus grus*, which was breeding here 100 years ago (ždral = Crane, "Ždralovac Blato" or "Ždralovac Veliki" = "Crane Swamp" or "Large Crane Area"). Nobody knows when this breeding tradition ended or, indeed, whether it still exists. It is clearly important to determine whether this indicator species is still present in the area and if its habitats have been preserved over the last 100 years.

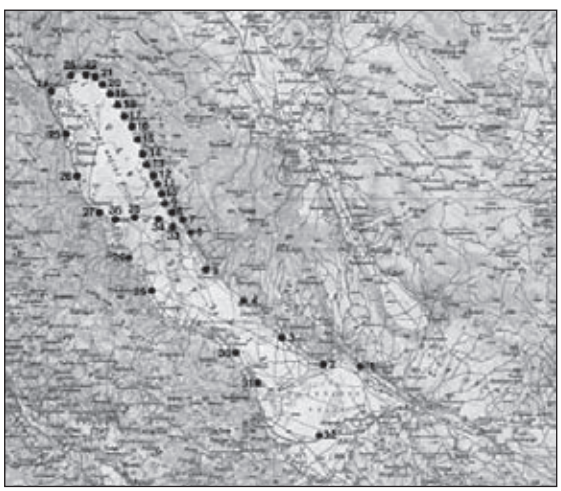

**Figure 1:** Livanjsko Polje, without Buško blato in the SE. The observation points (1 – 32) used in the present survey are marked. The landscape features near the points are as follows: 1, 2 and 32: SE part, mainly consists of meadows and pastures, some arable land, old peat excavations sites and a small part is impacted by coal mining; 3, 4, 30 and 31: Central part with large pastures and some meadows; 5, 6, 28 and 29: Northern central part with main forest complexes; 7 – 27: NE Livanjsko Polje ("Ždralovac Veliki" = "Crane Swamp") with elder forests (25, 26), reed beds (17 – 22) and meadows (7 – 16), the central part is impacted by peat excavation and needs restoration; 33 – 36: road through the north of Livanjsko Polje with flooded meadows and some birch and oak forests left and right. Source: Generalkarte von Mitteleuropa, Kartenstand 1894, Wien.

**Slika 1:** Livanjsko polje, brez Buškega blata na JV. Označene so opazovalne točke (1 – 32), uporabljene v tej študiji. Pokrajinske značilnosti v bližini točk so: 1, 2 in 32: JV del, v glavnem travniki in pašniki, nekaj obdelovalne zemlje, nekaj izkopov šote, in manjši izkop premoga; 3, 4, 30 in 31: osrednji del z velikimi pašniki in travniki; 5, 6, 28 in 29: severni osrednji del z glavnimi kompleksi gozdov; 7 – 27: SV Livanjsko polje ("Ždralovac veliki") s starejšimi gozdovi (25, 26), trstišči (17 – 22) in travniki (7 – 16), na osrednjem delu je precej izkopa šote in potrebuje renaturacijo; 33 – 36: cesta skozi severno Livanjsko polje s poplavljenimi travniki in nekaj bukovimi in hrastovimi gozdovi ob cesti. Vir zemljevida: Generalkarte von Mitteleuropa, Kartenstand 1894, Wien.

The study is based on ongoing inventories and projects dedicated to preserve key sites of the European EECONET in SE Europe by Euronatur. The justification for these studies and projects is the basic lack of ornithological data from at least the last thirty years for many sites, and for some areas even longer. From old published data it is obvious that the Balkan Peninsula hosted many more species, and more sites important for the conservation of endangered species, than we know today (compare Heath & Evans 2000, IUCN 2004). The question is, do we just not have enough information to determine how much, if anything, has been lost?

## 2. Methods

The war did not allow the area to be visited during recent years, because it was one of the major battlefields. There are still mine fields inside the area and its surroundings, partly marked by signs or traces of mine excavation.

The first visits by the authors were undertaken in 2002, using the main road through the area twice in March 2002 (B. Štumberger, B. Rubinić and M. Schneider-Jacoby). These were followed by three more systematic counts from the small road around the site (numbers 6 to 32 on Figure 1), once in June 2002 (B. Rubinić), twice in July 2002 (M. Schneider-Jacoby) and once in May 2003 (N. Aleš, A. Vrezec and B. Rubinić) during travels to or from southern Dalmatia. Subsequent counts were made from selected points by P. Sackl, B. Štumberger, B. Mozetič, A. Vrezec and B. Rubinić in September 2002, January 2003, April 2003, April 2004 and January 2005. All counts were made as point counts, scanning the area by different stops

**Table 1:** Water and marsh birds previously reported in Livanjsko Polje by Reiser (1939)

**Tabela 1:** Vodne in močvirske ptice na Livanjskem polju po Reiserju (1939)

| Species / Vrsta | Year / Leto | Abundance / Številčnost | Site and remarks / Območje in opombe |
|---|---|---|---|
| *Circus aeruginosus* | 1888 | several | Ždralovac blato |
| *Circus aeruginosus* | 1896 | 3 nests | Ždralovac blato |
| *Circus pygargus* | 1896 | >6 nests | common breeding bird in Ždralovac blato near Bataši |
| *Haliaeetus albicilla* | 1904 | 1 | middle aged bird over Ždralovac blato |
| *Egretta garzetta* | 1888 | colony | Ždralovac blato |
| *Egretta garzetta* | 1896 | 20 – 25 nests | Ždralovac blato |
| *Ardeola ralloides* | 1904 | 30 – 35 pairs | Ždralovac blato |
| *Ardeola ralloides* | 1896 | 40 pairs | Ždralovac blato |
| *Nycticorax nycticorax* | 1888 | 30 – 35 pairs | Ždralovac blato |
| *Ixobrychus minutus* | 1888 | 1 specimen | Ždralovac blato |
| *Botaurus stellaris* | 1888 | several | Bataši – very likely a breeding bird |
| *Platalea leucorodia* | 1888 | >9 nests | Ždralovac blato |
| *Platalea leucorodia* | 1904 | 30 nests | Ždralovac blato |
| *Plegadis falcinellus* | 1888 | only 1 | Ždralovac blato |
| *Porzana parva* | 1894 | 1 | Ždralovac blato, very likely breeding |
| *Grus grus* | 1894 | 2 eggs | Ždralovac blato |
| *Grus grus* | 1904 | 3 pairs | Ždralovac blato |
| *Gallinago gallinago* | 1904 | good number | breeding in Ždralovac blato, Prisap and Bataši |
| *Tringa totanus* | 1888 | >2 pairs | eggs near Livno, Bataši and Crni Lug |
| *Tringa totanus* | 1904 | several pairs | Ždralovac blato near Crni lug with flegded young |
| *Vanellus vanellus* | 1888 | many pairs | Ždralovac blato |
| *Anas acuta* | 1888 | eggs | Livno, few breeding pairs |
| *Chlidonias niger* | 1896 | >>200 pairs | Ždralovac blato and near Nuglašica, two colonies |

along the road (Figure 1). P. Sackl visited Livanjsko Polje again in May 2005.

On 9 Jun 2002 and 16 May 2003 road transect counts were performed on the western part of the Polje in order to identify common breeding bird species (passerines). Birds were counted within a belt of approximately 200 m on both sides of the road from a car at a speed between 10 to 15 km/h.

Time is given as Central European Time (CET).

## 3. Results

### 3.1. Early spring observations in March 2002

Livanjsko Polje was visited briefly for the first time in March 2002. On 6 Mar 2002, point counts were made from the main road at the north-western end of the polje from 16.00 until 17.10 h. On 9 Mar 2002, observations started at 16.00 and lasted until dawn (approx. 18.00 h).

In March most of the northern polje was covered by water. This large wetland (>7000 hectare) is used by many species in large numbers. On 6 Mar 1200 birds, including Grey-legged Goose *Anser anser* (120), Wigeon *Anas penelope* (200), Gadwal *A. strepera* (20), Teal *A. crecca* (300), Garganey *A. querquedula* (6), Pintail *A. acuta* (50), Mallard *A. plathyrynchos* (500), Crane (5) and Hen Harrier *Circus cyaneus* (7), were counted from only one point where the Polje is approximately 6 km wide (point 26, Figure 1). The real number of birds present was impossible to estimate, but most probably was much higher. According to information from local people, hunting and other human disturbances are present and are probably lowering the capacity of the site.

On 9 Mar, it was obvious that, for species like Crane (14 observed), Marsh Harrier *Circus aeruginosus* (19) and Hen Harrier (8), the whole polje is an

important feeding site (points 1 to 6). Large flocks of Corn Buntings *Miliaria calandra* with up to 200 and 300 birds were seen in central parts of the polje (Štumberger 2002). Concentrations of this number of passerine birds provide a good food basis for wintering birds of prey. Cranes were seen at different sites wandering about in groups of 2, 2 and 4, and two families with 1 young each, between Livno and the northern part of the polje. On 6 Mar Cranes – a group of 5 was seen – arrived so late in the northern floodplains, that due to darkness it was not possible to count them. Here probably is the roost of the birds for the whole 40,000 hectares large polje. However, groups of cranes were also seen by the team in other adjoining karstic poljes (Rubinić 2002a).

### 3.2. Breeding bird community in summer 2002

In summer 2002 the breeding bird community was checked during whole day visits on 9 Jun 2002, and subsequently during two morning excursions on 5 Jul and 9 Jul 2002. Birds were registered at 36 points with good visibility across the polje, and a first quick overview of the breeding birds community was gained. For points that were counted twice, the better figure was taken into the analysis to give a first, rough picture on the distribution of selected bird species. On Jun 9 all the points (1 to 36) were visited between 10.00 and 17.30 CET, starting from the SW end, through the W edge of the Polje (points 32 to 24), ending on the SE edge in Livno (point 1). The day was cloudy with excellent observation conditions. On 5 Jul 2002, from 4.20 until 11.00 h, points 1 to 32 were visited and, on 9 Jul 2002, from 3.45 to 10.00 h points 7 to 27 and 33 to 36. Table 2 shows the numbers of typical species seen during the June and July 2002 counts. The numbers often refer to territorial birds (calling Snipe *Gallinago gallinago*, Bittern *Botaurus stellaris*, displaying males of harriers).

Although the mixed heron colony described by Reiser (1939) was not found – only a small colony of Grey Herons *Ardea cinerea* with 14 pairs was seen in the alluvial forest – species composition, numbers and distribution of birds show that Livanjsko Polje has maintained its main character throughout the last 100 years. The core area is still Ždralovac Blato, where five male Great Bitterns were heard calling in July and an adult Purple Heron *Ardea purpurea* was observed flying from a potential breeding habitat of extensive reedbed in June. Redshanks *Tringa totanus* and Lapwings *Vanellus vanellus* are still abundant, and successful broods of Great Crested Grebes *Podiceps cristatus* (4 pairs in June and 3 families in July) and Garganeys (one family with 7 half grown ducklings in July) were seen. Even a Curlew *Numenius arquata* moved slowly through the vegetation in July about 2 km from the road in the central part of the large Crane Swamp, where the bog area is already impacted by drainage canals.

In June and July large areas of the northern part of

**Table 2:** Spring, summer and autumn observations of birds of prey in Livanjsko Polje

**Tabela 2:** Opazovanja ujed na Livanjskem polju spomladi, poleti in jeseni

| Species – Date/ Vrsta – Datum | 9 Jun 2002 | 5 Jul 2002 | 9 Jul 2002 | 13 Sep 2002 | 2 Apr 2003 | 8 May 2005 |
|---|---|---|---|---|---|---|
| *Pandion haliaetus* | 0 | 0 | 0 | 0 | 0 | 1 |
| *Circus pygargus* | 37 | 14 | 13 | 1 | 0 | 24 |
| *Circus cyaneus* | 0 | 0 | 0 | 0 | 0 | 1 |
| *Circus aeruginosus* | 29 | 12 | 10 | 0 | 0 | 14 |
| *Falco subbuteo* | 2 pairs | 4 | 0 | 0 | 0 | 6 |
| *Falco tinuculus* | 4 pairs | 1 | 1 | 10 | 1 | 3 |
| *Falco columbarius* | 0 | 0 | 0 | 0 | 0 | 1 |
| *Buteo buteo* | 9 pairs | 1 | 2 | 37 | 2 | 4 |
| *Pernis apivorus* | 0 | 0 | 2 | 0 | 0 | 0 |
| *Aquila pomarina* | 1 | 1 | 0 | 0 | 0 | 0 |
| *Circaetus gallicus* | 1 | 1 | 0 | 1 | 0 | 1 |
| *Accipiter gentilis* | 0 | 0 | 0 | 1 | 0 | 0 |
| *Accipiter nisus* | 0 | 0 | 0 | 0 | 0 | 1 |
| *Milvus migrans* | 0 | 0 | 0 | 0 | 1 | 0 |

**Table 3:** Spring road transect counts of passerine birds on a 37.3 km long road transect between Mali Guber and Donji Kazanci (W part of Livanjsko Polje). Numbers indicate singing males.

**Tabela 3:** Spomladanska opazovanja ptic pevk s transekta, dolgega 37,3 km, med vasema Mali Guber in Donji Kazanci (Z del Livanjskega polja). Število pomeni pojoče samce.

| Species / Date | 9 Jun 2002 | 16 May 2002 |
|---|---|---|
| *Alauda arvensis* | 100 | 12 |
| *Galerida cristata* | outside transect | / |
| *Lullula arborea* | outside transect | / |
| *Hirundo rustica* | 2 | 13 |
| *Motacilla alba* | 2 | 5 |
| *Motacilla flava cinereocapilla* | 18 | 4 |
| *Luscinia megarhynchos* | 16 | 3 |
| *Oenanthe oenanthe** | 1 | / |
| *Oenanthe hispanica* | 1 | / |
| *Saxicola rubetra* | 6 | 2 |
| *Saxicola torquata* | / | 3 |
| *Turdus merula* | 4 | 5 |
| *Sylvia atricapilla* | 3 | 1 |
| *Sylvia communis* | 1 | 2 |
| *Sylvia nisoria* | outside transect | 1 |
| *Sylvia hortensis* | / | 2 |
| *Acrocephalus scirpaceus* | 1 | / |
| *Acrocephalus arundinaceus* | 2 | 1 |
| *Parus major* | 4 | 5 |
| *Parus caeruleus* | 1 | / |
| *Lanius collurio* | 26 | 43 |
| *Lanius minor* | 9 | 1 |
| *Pica pica* | 2 | / |
| *Corvus monedula* | 1 | / |
| *Corvus corone cornix* | 7 | 1 |
| *Sturnus vulgaris* | 6 | 4 |
| *Sturnus roseus* | 1♂, 2♀ | / |
| *Oriolus oriolus* | 1 | 2 |
| *Passer domesticus* | 25 | 15 |
| *Passer hispaniolensis* | 45 | 5 |
| *Passer montanus* | 1 | / |
| *Fringilla coelebs* | 1 | / |
| *Carduelis cannabina* | 8 | / |
| *Carduelis carduelis* | 2 | / |
| *Carduelis chloris* | 1 | 4 |
| *Coccothraustes coccothraustes* | 1 | / |
| *Emberiza citrinella* | 2 | / |
| *Emberiza cirlus* | 1 | 2 |
| *Emberiza melanocephala* | outside transect | / |
| *Miliaria calandra* | 126 | not counted |

*Rubinić (2002b)

**Figure 2:** View from point 21 (compare Figure 1) over the flooded NE part of Livanjsko Polje with large reed beds at the foot of the Dinara Mountain bordering Croatia (Photo: M. Schneider-Jacoby / Euronatur)

**Slika 2:** Pogled s točke 21 (primerjaj sliko 1), prek poplavljenega SV dela Livanjskega polja, z velikimi trstišči ob vznožju Dinare, na meji s Hrvaško (foto: M. Schneider-Jacoby / Euronatur)

the Polje were still under water (dark grey in Table 6), offering excellent habitats for a great variety of breeding water birds. Obviously the area is still one of the most important and unique wetlands in the Balkans. Even in July most of the meadows were still wet. The distribution of Corncrake *Crex crex* and Snipe – calling birds, display was not observed – indicates areas of wet meadows (light grey in Table 6). Both species are good indicators for these rare and valuable marshland habitats. Orchids (e.g. *Orchis palustris*) and Gladiole *Gladiolus illyricus* were abundant in this habitat type. The main road through the polje from Bojmunte to Pržine – points 33 – 36 offers a great view into the centre of the marshes which is intersected with birch *Betula* sp. and broad leafed alluvial forests. Because only point counts were made, population numbers of Corncrakes for 2002 (on the basis of July counts that were conducted in the early morning) are estimated at a minimum of 200 callers, but it was late for counting. This part of Livanjsko Polje is about 12 x 6 km. The middle part of the Polje and the areas near Livno were already too dry for Corncrakes in summer 2002. Other species like Quail *Coturnix coturnix*, Lesser Grey Shrike *Lanius minor* and Hoopoe *Upupa epops* are typical for the drier parts and edges of the polje.

Montagu's Harrier *Circus pygargus* is still widespread in the area, as it was 100 years ago. The population is estimated at 30 – 50 breeding pairs. Up to six males in June and five males in July were seen together, when they started to fly in the morning near Crni Lug, where six nests were found 100 years ago. Although the area was visited only very briefly and during morning hours, or on a cloudy day, an interesting variety of birds of prey was seen, including both in June and July endangered species like the Lesser Spotted Eagle *Aquila pomarina*. In June a single bird observed near Ličtani (point 30, Figure 1) was conducting a display flight, clearly suggesting breeding in this area. Two Long-legged Buzzards *Buteo rufinus* were seen in neighbouring Duvanjsko Polje, 10 km from Livno. Furthermore Short-toed Eagles *Circaetus gallicus* were observed on three occasions – a single bird again near Ličtani on Jun 9, one close to Čaprazlije (point 29, Figure 1) on 13 Sep 2002, and a pair seen, together with Mato Gotovac, on 7 Apr 2004 in the north-western part of the polje (point 15 – 17; Figure 1).

### 3.3. Road transect counts of spring passerine birds in June 2002 and May 2003

Road transect counts of passerines were performed during two visits in spring: on 9 Jun 2002 (between 10.00 and 14.30 h) and on 16 May 2003 (between 12.00 and 14.00 h). Birds were counted at the western part of the polje between Mali Guber and Donji Kazanci (Points 32 and 27, Table 3) on a 37.3 km long road transect. These data provide an indication only, since the time of the day was not optimal for breeding

**Table 4:** Spring observations (number of idividuals) on 17 Apr 2004 from the main road and in the northwestern part of Livanjsko Polje (points as in Figure 1); abbreviations: bp – breeding pair, s – calling, ex – individual

**Tabela 4:** Spomladanska opazovanja (število osebkov) dne 17.4.2004 z glavne ceste na sveverozahodnem delu Livanjskega polja (točke kot na Sliki 1); okrajšave: bp – gnezdeči par, s – kliče, ex – osebek

| Point in map/ Točka na zemljevidu | 1 | 2 | 3 | 4 | 5 | 6 | 35 | 27 | 24 | 23 | 20 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species / Time | 15.45 | 16.00 | 16.15 | 16.30 | 16.40 | 17.10 | 17.15 | 17.25 | 17.40 | 17.50 | 18.10 | Total |
| *Podiceps cristatus* | | | | | | | | 3 | 2 bp (1 nest) | 1 bp | | 3 bp (1 nest) + 3 ex |
| *Phalacrocorax carbo* | | | | | | | | 1 | | | | 1 |
| *Ardea cinerea* | 2 | 10 | | 1 | | | | | | | | 13 |
| *Platalea leucorodia* | 7 | | 2 | 2 | | | | | | | | 11 |
| *Botaurus stellaris* | | | | | | | | 1 s | 1 s | 5 s | | 7 booming |
| *Anas penelope* | | | | | | | | 2 | | | | 2 |
| *Anas acuta* | | | | | | | | 38 | | | | 38 |
| *Anas clypeata* | | | | | | | | 18 | | | | 18 |
| *Anas platyrhynchos* | | | | | | | | 7 | | 3 | | 10 |
| *Anas querqedula* | | | | | | 10 | | 15 | 2 | 15 | | 42 |
| *Anas crecca* | | | | | | | | 32 | | | | 32 |
| *Aythya ferina* | | | | | | | | 16 | | | | 16 |
| *Fulica atra* | | | | | | | | | 1 | 12 (1 nest) | | 14 ex (1 nest) |
| *Grus grus* | | | | | | | 1 bp | | | | | 1 bp |
| *Hematopus ostralegus* | | | 3 | 3 | | | | | | | | 6 |
| *Vanellus vanellus* | | | 4 bp | | | 3 bp | | | | | | 7 bp |
| *Larus cahinnans* | 45 | 14 | 3 | 638 | | | | | | | | 691 |
| *Larus fuscus* | | | | 18 | | | | | | | | 18 |
| *Circus pygargus* | 6 (5♂, 1♀) | | | 1 | | | | | | | | 7 (5♂, 2♀) |
| *Circus aeruginosus* | 1 | | | | | | | | | | 1 | 2 (1♂, 1♀) |
| *Falco tinnunculus* | 1 | | | | 1 | | | | | | | 2♀ |
| *Buteo buteo* | | | | | 1 | | 1 | | | | | 2 |

passerines census. Furthermore the methodology provides only the approximate abundance of passerine communities (Table 4) and not breeding density.

The road transect between Mali Guber and Donji Kazanci passes mainly through open landscape. On the southern part of the transect, the habitat is open marshy or substeppe (depending on water level) flatland with sparse shrubs and solitary trees, mostly along the road. The area is the main breeding place for Skylark *Alauda arvensis.* Due to the fact that most of the transect passes open landscape, Skylark is also one of the most abundant species along the whole transect. On several trees close to the villages there are a number of small colonies of Spanish Sparrows *Passer hispaniolensis*, with one to five nests. The road passes through or near 10 settlements, 4 of which were destroyed and abandoned between the war, in the years 1992 and 1995. Most of the settlements are surrounded with pastures and very little cultivated land. There are some orchards, the main breeding place of Lesser Grey Shrikes. The northern part of the transect has a submediterranean substeppe character with abandoned fields that are becoming overgrown by tall grass and surrounded by shrubs. This is the main breeding area for Red-backed Shrikes *Lanius collurio* and Corn Buntings. Both species are extremely numerous, showing great breeding preference for the succession phases between abandoned pastures and grasslands and the thick shrubs that are plentiful around the northern part of the transect. The sighting

of Rose-coloured Starling *Sturnus roseus* in this part of the polje is also very interesting. Here most of the villages have been destroyed, so that once cultivated land is gradually becoming overgrown by bushes. At a few places the road comes very close to the surrounding submediterranean forest of Downy Oak *Quercus pubescens* and Manna Ash *Fraxinus ornus* that spreads above the west side of the Polje. Here is where most of the typical forest species have been recorded.

### 3.4. Spring observations in April 2004

On 17 Apr 2004 about 50% of Livanjsko Polje was flooded. In the northwest part, due to the high water level, mainly water birds were observed (points 20 – 35, Table 5). Of particular interest is the great diversity of dabbling ducks (Anatini), which were feeding or resting in groups of obviously paired birds, like a flock of 19 pairs of Pintails, a species which was a common breeder 100 years ago. Very interesting is also the late observation of a pair of Cranes, which may indicate breeding in the area. The large reed beds in the northern part of the polje are core breeding habitats for Bitterns, with a total of 7 booming males heard in April 2004. Furthermore, the observation of at least 11 Spoonbills *Platalea leucorodia* is of special interest, because this species is also a potential breeder in the area. Montagu's Harriers were only present in the drier central and eastern parts of the polje.

The presence of large numbers of Lesser Black-backed Gulls *Larus fuscus* of the subspecies *graellsii* (16 ad.) and *fuscus* (2 ad.) indicates the importance of Livanjsko Polje for birds using the central European flyway to reach their breeding areas in northern Europe. This may also be true for the Oystercatchers *Haematopus ostralegus* present in April 2004.

### 3.5. Winter observations on Livanjsko Polje

Livanjsko polje was visited briefly on 29 Jan 2003. The team of Borut Rubinić and Sašo Weldt counted 286 Common Buzzards *Buteo buteo,* 82 Hen Harriers, 1 Sparrowhawk *Accipiter nisus,* 20 Kestrels *Falco tinnunculus* and 8 Great Grey Shrikes *Lanius excubitor* on the 56 km long main road transect between Crni Lug and Veli Guber (points 24 and 32, Figure 1). The number of Hen Harriers shows the importance of Livanjsko polje as a wintering area for the species. The estimated 100 to 150 wintering birds constitutes more than one percent of the European Hen Harrier wintering population.

### 3.6. Spring observations in May 2005

The late beginning of the breeding season is obvious from the count in May 2005. Corncrake, Redshank and Snipe are still missing. Also Quail, Hoopoe and Lesser Grey Shrike are still rare. The observations of the Squacco Herons *Ardeola ralloides* and the pairs of Pintails, both formerly recorded bird species in Livanjsko Polje, are interesting, in that they would still find ideal breeding habitats (Table 6).

## 4. Discussion

Livanjsko Polje is one of the most specific natural phenomena in Bosnia and Herzegovina, representing the typical carstic landscape features. Furthermore, by Livanjsko Polje is the largest periodically flooded karstic polje in the world (Ritter-Studnićka & Grgić 1971), offering a unique opportunity for sustainable development for the district of Livno, capital of the county "Herceg-bosanska County / Canton". Almost 100 years ago Livanjsko Polje was described by Reiser (1939) as the most specific and important natural site of the country besides Hutovo Blato. Although the area is impacted by peat extraction and water use for electricity production, the cultural landscape and the key habitats are still in a very natural or semi-natural state. Apart from this, Livanjsko Polje is the largest wetland in Bosnia and Herzegovina with more than two thirds of its area regularly flooded, as we saw in April 2004.

The vegetation of Livanjsko Polje is a very special mix of northern European grasslands and forest elements, as well as plants characteristic of the Mediterranean coast, e.g. plants which are typical for brackish water lagoons near Pag (Ritter-Studnićka 1974). Visitors to the area are impressed by the vegetation of the karstic polje, which may remind them of bog and fen landscapes typical in northern Europe, and the mountains with a high diversity of grassland associations (*Centaureetum pannonicae* Horvatic 1963, *Molinio-Lathyretum pannonici* Horvatic 1963, *Deschampsietum mediae* Horvatic 1963, *Plantaginetum altissimae* s. lat., *Nardetum strictae* s. lat., *Festuco illyricae-Linetum flavi* Ritter-Studnicka 1972; see Ritter-Studnićka 1972, 1974). While these grassland associations could still be found in some other karstic poljes, the natural and semi-natural forests are unique to Livanjsko Polje. Huge areas – about 20% of the whole surface – are covered by old forests of three associations, which are of great importance for nature conservation: pure Alder *Alnus glutinosa* forests, large wet or seasonally flooded Pedunculate Oak *Quercus*

*robur* forests and a very interesting type of Ash *Fraxinus angustifolia* forest, which is partly used for hay-cutting (Ritter-Studnićka & Grgić 1971). The threatened Lesser Spotted Eagle is an indicator of the ornithological importance of these forests which, as a result of land-mines from the last war, are still only partially accessible. The uniqueness of Livanjsko Polje and its global ecological value according to the criteria of the Ramsar Convention (size, vegetation, indicator species such as the Corncrake, karstic phenomena), together with the ecological importance of other karstic poljes in the upper parts of the Cetina River Basin, have to be integrated into the UNEP/MAP/PAP study (2000) and the spatial development model based on existing sectoral plans (UNEP/MAP/PAP 2000); furthermore, the first plans to enhance the national system of protected areas in Bosnia and Herzegovina have to give more attention to the unique karstic poljes (Chape *et al.* 2003) because, until now, their protection has not been proposed (Vilušić 2000), although their ecological significance is outstanding (see Ritter-Studnićka 1972, 1974).

Published data on the globally threatened Corncrake (EU Species Action Plan, <http://www.corncrake.net/Download/crex-ap.rtf>) point to the fact that the conservation of Livanjsko Polje is of great international concern. The plan encourages Bosnia and Herzegovina to designate Livanjsko Polje as a protected site under the nature conservation law**,** undertake a national Corncrake census to identify key sites, and to protect Livanjsko Polje from any further melioration programmes or peat extraction. In a paper on the Corncrake population in Croatia, the Institute for Ornithology in Zagreb has published an important statement concerning the current situation of the species in Livanjsko Polje: "*Paško Polje* is the only breeding site in the whole Mediterranean Croatia. The small population (10 – 20 singing males) probably survived in the vicinity of the large population of Corncrakes in the neighbouring *Livanjsko Polje*… There were at least 1000 males in Livanjsko Polje before the recent war..." (Radović & Dumbović 1995). During the first International Corncrake Symposium in Munich (Germany) the karstic poljes of former Yugoslavia, and in particular Livanjsko Polje, were identified as important breeding sites of the species (Schneider-Jacoby 1991). It is surprising that Reiser (1939) does not mention the occurrence of Corncrake in Livanjsko Polje.

The dozen short visits between 2002 and 2005 indicate that the cultural and natural landscape of Livanjsko Polje is not greatly changed, beside the ongoing peat excavation and impacts in the south-eastern part by the water regulation, and that several of the indicator species described by Reiser (Table 1) could be still found in good numbers (Table 2 – 8). Because the present assessment is rapid and preliminary, it defines the lower limits of populations present. The occurrence of Bittern (7 booming), Snipe (>8 territories), Redshank (at least 10 – 20 pairs), Montagu's and Marsh Harrier (each 30 – 50 pairs) in good numbers is significant. More research is needed to define the size of the populations, especially of Snipe and Redshank, but also of other marsh birds including ducks and crakes. The number of pairs for several passerine species is difficult to estimate for the whole Polje. The fact that Red-backed Shrike (estimate over 100 pairs), Lesser Grey Shrike (over 20) and Corn Bunting (over 300) are still common indicates the persistence of a rich cultural landscape. In addition the polje is an important breeding site for Hoopoe (over 50) and Quail (over 100).

With potential breeding habitats still abundant in Livanjsko Polje for several other species including Spoonbill, Pintail, Crane and Curlew, breeding is still possible. Local people reported that they have seen small flocks of Cranes over the whole summer of 2004. Observations of Lesser Spotted Eagle (twice in summer 2002, probably one territory) and Short-toed Eagle (two territories) prove the importance of the Polje as a breeding habitat for very rare birds of prey. The wintering population of Hen Harriers is of great importance, as the area hosts more than one percent of the European wintering population. Birds of prey should be monitored more precisely to provide more reliable data on breeding and wintering species and population numbers. The use of the polje and adjoining Buško jezero by migrating birds is indicated by the observation of Cranes and other waterfowl, but its continuing importance is threatened by widespread hunting activities.

The recorded impacts endangering the ecological and hydrological characteristics of Livanjsko Polje are (1) the use of the water for energy production, including the canal system for Buško Lake hydro-power plant near Livno (Božicević 1992); (2) the excavation of peat and associated canals built by FINVEST on a large area (about 30%) in the northwestern part of the Ždralovac Polje and (3) planned meliorations cited in the UNEP/MAP/PAP study (2000). An additional impact on grassland ecosystems is the reduction of traditional grassland management due to the depopulation of many settlements following the recent war.

To maintain the unique site and to use it for sustainable development in the region, Euronatur proposes the following urgently needed measures:
(1) A supplement to the UNEP/MAP/PAP study

(2000) defining the ecological and hydrological importance of the karstic poljes in Bosnia and Herzegovina;
(2) Immediate examination of the peat excavation by FINVEST and preparation of rehabilitation measures. These large-scale works require a transboundary environmental impact study and a programme for restoring the bog area;
(3) Inclusion of ecologically significant karstic poljes – in particular Livanjsko Polje – into a new national system of protected areas;
(4) Nomination of Livanjsko Polje as a RAMSAR site and IBA;
(5) Preparation of a pilot project "Livanjsko Polje" or "Sustainable use of karstic poljes" to implement the UNESCO Biosphere Reserve concept in Bosnia and Herzegovina. It would be an important step, for example, to include sustainable use of the grassland areas, with the production of cheese ("Livanjski sir"), into the development and return programmes, especially in the northwestern and wettest parts of the polje;
(6) Preparation of a GEF project based on the global importance of Livanjsko Polje and neighbouring sites. In addition to the Sava wetlands and the Neretva-Hutovo Blato ecosystem, the karstic poljes of the Livno district need urgent international support.

Note: Livanjsko Polje, together with the Dinara massif, is already included as a priority site for transboundary cooperation in nature conservation in the new IUCN Strategy for southeast Europe (IUCN 2004).

## 5. Povzetek

Dvanajst kratkih obiskov Livanjskega polja od pomladi 2002 do pomladi 2005, je pokazalo, da sta tako naravna kot kulturna krajina dobro ohranjeni. Veliko indikatorskih vrst prisotnih že pred 100 leti (Reiser 1939) je še vedno tu, z močnimi populacijami. Poleg kosca *Crex crex* so varstveno pomembne vrste še bobnarica *Botaurus stellaris*, kozica *Gallinago gallinago*, rdečenogi martinec *Tringa totanus*, rjavi lunj *Circus aeruginosus* in močvirski lunj *Circus pygargus*. Nekaj drugih vrst še vedno najverjetneje gnezdi, npr. žličarka *Platalea leucorodia*, dolgorepa raca *Anas acuta*, mali klinkač *Aquila pomarina*, žerjav *Grus grus* in škurh *Numenius arquata*, in imajo na voljo precej primernega habitata. Vpliv ljudi in možne varstvene strategije so na kratko predstavljene v zaključku.

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## APPENDIX / DODATEK

**Table 5:** Spring observations (number of birds) on 8 May 2005 at selected points, not covering the whole Livanjsko Polje.

**Tabela 5:** Spomladanska opazovanja (število ptic) 8.5. 2005 v izbranih točkah (ne na celi površini polja)

| Point in map/ Točka na zemljevidu | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 12 | 14 | 15 | 16 | 17 | 18 | 20 | 23 | 24 | 25 | 26 | 27 | 33 | 34 | 35 | 36 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Water/ Voda (%) | 20 | | 70 | 80 | 5 | 0 | 5 | 10 | 20 | 5 | 10 | 20 | 10 | 15 | 90 | 80 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | |
| *Tachybaptus ruficollis* | | | | | | | | | | | | | | | | | | | | | | | 1 | | | 1 |
| *Podiceps cristatus* | | | | | | | | | | | | | | | 4 | 4 | | | | | | | | | | 8 |
| *Ardea cinerea* | 1 | | | | | | | | | 2 | | | 2 | 1 | | | | | | | | | | | | 6 |
| *Ardeola ralloides* | | | | | | | | | | | | 4 | | | | | | | | | | | | | | 4 |
| *Botaurus stellaris* | | | | | | | | | | | | | | 1 | 1 | | | | | | | | | | | 2 |
| *Anas platyrhynchos* | 18 | | | | | | | | | 3 | | | | | 1 | | | | | | | | 3 | | | 25 |
| *Anas querquedula* | 2 | | | | | | | | 2 | 3 | | | | | 2 | 3 | | | | | | | | | | 12 |
| *Anas acuta* | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 2 |
| *Falco subbuteo* | | | | | | | | | | | | 1 | 1 | | | | | | | | | | | 1 | 3 | 6 |
| *Falco tinnuculus* | | | | | 1 | 1 | | | 1 | | | | | | | | | | | | | | | | | 3 |
| *Buteo buteo* | | | | | | | | | | | 1 | | | | | | | | | | | 1 | 1 | 1 | | 4 |
| *Circus aeruginosus* | 1 | 1 | 1 | | | | | | 3 | 4 | | 3 | | | | | | | | 1 | | | | | | 14 |
| *Circus pygargus* | 1 | | | | | 1 | | | | | | 4 | 7 | 1 | | 1 | | | | | 4 | | 1 | | 4 | 24 |
| *Vanellus vanellus* | | | | | | | 1 | | 1 | | | 4 | | | | | 2 | 1 | | | | | | | 11 | 20 |
| *Fulica atra* | | | | | | | | | | | | 2 | | | 3 | 4 | | | | | | | | | | 9 |
| *Coturnix coturnix* | | | | | | | | | | | | | 1 | | | | | | | | | | | | | 1 |
| *Upupa epops* | 1 | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| *Lanius minor* | 1 | | | | 1 | | | | | | | | | | | | | | | | | | | | | 2 |
| Total | 25 | 1 | 1 | 0 | 2 | 2 | 1 | 0 | 7 | 12 | 1 | 18 | 11 | 3 | 11 | 12 | 2 | 1 | 0 | 1 | 4 | 1 | 6 | 2 | 20 | 144 |

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**Table 6:** Observations (number of birds) of characteristic bird species from points 1 – 32 (see Figure 1) along roads in Livanjsko Polje on 9 Jun and 5 and 9 Jul 2002. For each point the largest of three counts was taken. Observations of Bitterns *Botaurus stellaris*, Corncrakes *Crex crex* and Snipes *Gallinago gallinago* include mainly calling males. The visible water surface and flooded areas in July were estimated at each point to document the wet character of the northwestern part of the area (dark grey) and the transition zone (grey).

**Tabela 6:** Opazovanja (število ptic) značilnih vrst ptic s točk 1 – 32 (glej sliko 1) vzdolž cest na Livanjskem polju, dne 9.6., 5.7. in 9.7.2002. Upoštevan je maksimum treh štetij v vsaki točki. Opazovanja bobnaric *Botaurus stellaris*, koscev *Crex crex* in kozic *Gallinago gallinago* vključuje pretežno kličoče samce. Vidna vodna površina in poplavljene površine v juliju smo ocenili v vsaki točki zaradi ocene vlažnosti sevrozahodnega dela polja. Vodna površina je označena s temno sivo barvo, prehodno področje pa s svetlo sivo.

| Point in map / Točka na zemljevidu | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Water / Voda (ha) | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 10 | 20 | 30 | 20 | | 1 | 1 | | | | 10 | 10 | 10 | | 1 | | | 116 |
| *Tachybaptus ruficollis* | | | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | | | | | | | | 4 |
| *Podiceps cristatus* | | | | | | | | | | | | | | | | | | | | | | 8 | 1 | | | | | | | | | | | | | | 9 |
| *Ardea cinerea* | | | | | | | | | | | 14 | | | | 2 | | | | 1 | 2 | 1 | 5 | | | | | | | | | | | | | | | 25 |
| *Ardea purpurea* | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | 1 |
| *Botaurus stellaris* | | | | | | | | | | | | | | | | | | | | 1 | 1 | 3 | 1 | | | | | | | | | | | | | | 6 |
| *Anas platyrhynchos* | | | | | | | | | | | | | | | | | | | 4 | 1 | | 2 | | | | | | | | | | | | | | | 7 |
| *Anas querquedula* | | | | | | | | | | | | | | | | | | | | 1 | | 9 | | | | 1 | | | | | | | | | | | 11 |
| *Anas crecca* | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | 1 |
| *Falco subbuteo* | | | | | 1 | | | | | | | | | | | | | | | | | | | | | 1 | | 2 | | | 1 | 1 | | | | | 6 |
| *Falco tinnunculus* | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | 1 | 1 | 1 | | | | | 4 |
| *Buteo buteo* | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 3 | 3 | | | 2 | | | | | | | 9 |
| *Circus aeruginosus* | | 1 | | | | | | | | | | | | | | | | | 3 | 3 | 4 | 5 | 2 | | 2 | | | | | 14 | 4 | 5 | | | | | 43 |
| *Circus pygargus* | | 5 | 1 | 1 | | | | | | | | | | | | | 3 | | 5 | 2 | | 2 | | 2 | 7 | 2 | | 1 | | 6 | 4 | 4 | | | 2 | 2 | 43 |
| *Gallinago gallinago* | | | | | | | | | | | | | | | | | 1 | | | | 1 | 4 | | | | | | | | | | | 1 | 1 | | | 8 |
| *Numenius arquata* | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | 1 |
| *Vanellus vanellus* | | | 4 | | | | | | | | | | | | | | 20 | 2 | | 4 | 1 | 12 | | | 3 | | | | | | 8 | | 1 | | | | 55 |
| *Tringa totanus* | | | | | | | | | | | | | | | | | 2 | | | 4 | 1 | 6 | | | | | | | | | 1 | | | | | | 14 |
| *Fulica atra* | | | | | | | | | | | | | | | | | | | | 4 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | 8 |
| *Crex crex* | | | | | | | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 4 | 3 | 3 | 5 | 4 | 3 | 1 | 3 | 1 | 2 | 1 | | | | | | | | 1 | 1 | 45 |
| *Coturnix corturnix* | 1 | 1 | 2 | 1 | 1 | | | 1 | | 1 | | | | | | | | | | | | | | | | | 17 | | 1 | | 1 | | | | | | 27 |
| *Perdix perdix* | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | 1 |
| *Merops apiaster* | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | 10 | | | | | 11 |
| *Upupa epops* | | 1 | 3 | 1 | 1 | | 2 | | | | 1 | | 1 | | 1 | | 1 | 1 | 1 | 3 | 1 | 1 | 2 | 1 | | 1 | | 3 | | | | | 2 | | | | 28 |
| *Lanius minor* | | | | | | | | | | | | | | | | | | 2 | 1 | 1 | 1 | 1 | | | | | | | 5 | 2 | 1 | 2 | | | | | 16 |
| Total | 1 | 8 | 10 | 3 | 3 | 0 | 3 | 2 | 2 | 2 | 16 | 2 | 2 | 1 | 4 | 2 | 32 | 8 | 18 | 33 | 16 | 65 | 8 | 7 | 14 | 11 | 22 | 6 | 6 | 25 | 12 | 22 | 11 | 4 | 1 | 1 | 383 |