



# FIRST INTERNATIONAL WORKSHOP ON DINARIC KARST POLJES AS WETLANDS OF NATIONAL AND INTERNATIONAL IMPORTANCE

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Abstract book



Livno, 30 September – 02 October 2013

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**Livno, 30 September – 02 October 2013**

## AGENDA OVERVIEW

### 30/09

18:00 – 19:00	Open Public Presentation (in local language)
19:00 – 21:00	Buffet and Informal Get-Together in Hotel Dinara

### 01/10

08:30 – 09:00	Registration of Participants
09:00 – 09:45	Welcoming
	Coffee Break
10:15 – 11:45	Plenary Presentations
11:45 – 13:00	Session 1 – Characterizing karst poljes
	Lunch Break
14:00 – 15:00	Session 2 – Site specific aspects
	Coffee Break
15:30 – 16:30	Session 3 – Sustainable use and management
16:30 – 19:30	Excursion to Buško Jezero
19:30 – 20:30	Dinner in Eco-village Grabovica
20:30	Karst Movie Presentation

### 02/10

09:00 – 09:45	Session 4 – Fauna, flora and vegetation
09:45 – 10:45	Session 5 – Karst poljes of Bosnia and Herzegovina
	Coffee Break
11:15 – 13:00	Poster presentations
	Lunch Break
14:00 – 15:30	Workshops
	Coffee Break and Snacks
15:45 – 16:15	Reporting about Workshop Outcomes
16:15 – 19:30	Excursion to Livanjsko Polje
19:30 – 21:00	Opening of Karst Exhibition in Tomislavgrad
21:00	Dinner in Tomislavgrad

### 02/10

09:00 – 16:00	All day side-event on free ranging livestock
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## DAY 1 – 30 SEPTEMBER 2013

18:00 – 19:00: Open Public Presentation

- Location: Conference room in Hotel Dinara
- Language: the presentation will be held in local language (Local language)
- Title: *Zaštita i razvoj krških polja za budućnost - primjer Livanjsko polje* (Future conservation and development of karst poljes - Example Livanjsko Polje), Borut Stumberger (SI)

19:00 – 20:00: Dinner

- Hotel Dinara

20:00 – open end: Get Together

- Chance for discussions and exchange in informal atmosphere in the Hotel Bar

## DAY 2 – 01 OCTOBER 2013

08:30 – 09:00: Registration of Participants

09:00 – 09:45: Welcoming and Opening Remarks

- Jaroslav Vego (NFP Ramsar Convention of (BA), Dražen Kotrošan (Naše ptice) (BA), Gabriel Schwaderer (EuroNatur), Mirko Šarac (Naša Baština) (BA)
- *Memorial Martin Schneider Jacoby*, Borut Stumberger (SI) & Gabriel Schwaderer, EuroNatur (DE)
- *10 Years of Ornithological Society Naše ptice*, Dražen Kotrošan (Naše ptice) (BA)

09:45 – 10:15: Coffee Break

10:15 – 11:45: Plenary Presentations

- *Wetlands in drylands: the global importance of karst poljes*, Tobias Salathé, Senior Advisor for Europe at the Ramsar Secretariat (CH)
- *Karst poljes as hotspots for fish biodiversity*, speaker will be defined
- *Activities of the UNDP energy and environment sector in Bosnia and Herzegovina*, Sanjin Avdić & Amila Selmanagić Bajrović, UNDP Sector Leader Energy & Environment (BA)

11:45 – 13:00: Session 1 - Characterizing karst poljes

- *Flooding analysis of the karst poljes in Bosnia and Herzegovina*, Ulrich Schwarz, Fluvius (AT) & Borut Stumberger (SI)
- *General aspects of the karst poljes in the Dinaric karst*, Ivo Lučić, Speleological Society Vjetrenica - Popovo polje (BA)
- *The ecohydrology of karst poljes*, Ognjen Bonacci, Faculty of Civil Engineering, Architecture and Geodesy, University of Split (HR)

13:00 – 14:00:	Lunch Break
14:00 – 15:00:	<b>Session 2: Site specific aspects</b> <ul style="list-style-type: none"> <li>• <i>Monograph of the natural-history heritage of Tomislavgrad</i>, Roman Ozimek, Naša Baština and Croatian Society for Natural History Diversity Research &amp; Conservation (ADIPA) (HR)</li> <li>• <i>Krbavsko polje, importance and problems</i>, Ivan Budinski, Association BIOM (HR)</li> <li>• <i>Peštersko polje - Ramsar site in Serbia</i>, Nikola Stojnić, Institute for Nature Conservation of Vojvodina Province &amp; Predrag Lazarević, Institute for Nature Conservation of Serbia (SR)</li> </ul>
15:00 – 15:30:	Coffee Break
15:30 – 16:30:	<b>Session 3: Sustainable use and management of karst poljes</b> <ul style="list-style-type: none"> <li>• <i>An ecological approach to management of the Dinaric karst renewable natural resources</i>, Jozo Rogošić &amp; Branka Perinčić, Department of Ecology, Agronomy and Aquaculture, University of Zadar (HR)</li> <li>• <i>The ecological value of free ranging livestock</i>, Waltraud Kugler &amp; Elli Broxham, SAVE Foundation (CH)</li> <li>• <i>The importance of indigenous domestic animal breeds for the conservation of karst polje grassland habitats</i>, Roman Ozimek, Naša Baština and Croatian Society for Natural History Diversity Research &amp; Conservation (ADIPA) (HR)</li> </ul>
16:30 – 19:30:	<b>Excursion to Buško Jezero</b> <ul style="list-style-type: none"> <li>• <i>Ornithological excursion to Buško Jezero</i> guided by Peter Sackl (Curator of Ornithology at Universalmuseum Joanneum, Graz)</li> </ul>
19:30 – 21:00:	<b>Dinner and Karst Movie Presentation</b> <ul style="list-style-type: none"> <li>• Dinner will be served at 19:30 in Eco-village <i>Grabovica</i></li> <li>• <i>“Karst poljes of Bosnia and Herzegovina the wetlands of national and international importance”</i> (author Ilhan Dervović) will be presented in the restaurant of Eco-Village.</li> </ul>
<b>DAY 3 – 02 OCTOBER 2013</b>	
09:00 – 09:45:	<b>Session 4 – Fauna, flora and vegetation</b> <ul style="list-style-type: none"> <li>• <i>The olm, <i>Proteus anguinus</i>, as an umbrella species for the conservation of the Dinaric karst’s underground</i>, Dušan Jelić et al., Croatian Institute for Biodiversity, Croatian Herpetological Society HYL A (HR)</li> <li>• <i>Endangered proteus: combining DNA and GIS analyses for its conservation</i>, Gregor Aljančič et al., Society for Cave Biology, Tular Cave Laboratory (SI)</li> <li>• <i>Botanical aspects of the protection of the Cetina karst poljes in Bosnia and Herzegovina</i>, Đorđije Milanović, Arbor Magna – Natural Heritage Protection Society (BA)</li> </ul>

09:45 – 10:30:	<b>Session 5 – Karst poljes of Bosnia and Herzegovina</b> <ul style="list-style-type: none"> <li>• <i>Identification of karst poljes as wetlands of national and international importance</i>, Romy Durst, EuroNatur (DE) and Dražen Kotrošan, Naše ptice (BA)</li> <li>• <i>Othmar Reiser (1861–1936) – Ornithological records from the karst poljes of Bosnia and Herzegovina</i>, Dražen Kotrošan, Naše ptice (BA)</li> </ul>
10:30 – 11:00:	Coffee Break
11:00 – 13:00:	<b>Poster presentations</b> <ul style="list-style-type: none"> <li>• <i>An overview of dragonfly diversity of karst poljes in Bosnia and Herzegovina</i>, Dejan Kulijer, National Museum of Bosnia and Herzegovina (BA)</li> <li>• <i>Natural and cultural values of karst poljes of the Shkodra Region</i>, Denik Ulqini et al., Association for Protection of Aquatic Wildlife of Albania (AL)</li> <li>• <i>Grabovica Trail – Rediscovering the natural heritage at the border of Duvanjsko Polje</i>, Denis Radoš et al., Naša Baština/ University of Zadar (HR)</li> <li>• <i>The wintering population of Hen Harrier, Circus cyaneus, in Glamočko, Duvanjsko and Kupreško polje</i>, Ena Šimić-Hatibović, Naše ptice (BA)</li> <li>• <i>Spring migration of Eurasian Crane (Grus grus) using Adriatic Flyway in spring 2013</i>, Goran Topić et al., Naše ptice (BA)</li> <li>• <i>Autumn migration 2012 of Eurasian Crane (Grus grus) along the Adriatic Flyway – migration patterns and population numbers</i>, Borut Stumberger et al. (SI)</li> <li>• <i>The ponors of karst poljes</i>, Jasminko Mulaomerović, Center for Karst and Speleology (BA)</li> <li>• <i>Floristic values of Livanjsko polje</i>, Nermina Sarajlić, Naše ptice (BA)</li> <li>• <i>The significance of endemic and rare plant species for the flora of karst poljes of Bosnia and Herzegovina</i>, Sabaheta Abadžić, National Museum of Bosnia and Herzegovina (BA)</li> <li>• <i>Corncrake (Crex crex) census in the karst poljes of Bosnia and Herzegovina in 2012 and 2013</i>, Ilhan Dervović et al., Naše ptice (BA)</li> <li>• <i>Lesser Grey Shrike (Lanius minor) census in karst poljes of Bosnia and Herzegovina in 2013</i>, Dražen Kotrošan et al., Naše ptice (BA)</li> <li>• <i>Distribution and population numbers of the Black-headed Bunting (Emberiza melanocephala Scopoli, 1769) in Bosnia and Herzegovina</i>, Narcis Dročić &amp; Sumeja Dročić (BA)</li> </ul>
13:00 – 14:00:	Lunch Break
14:00 – 15:30:	<b>Workshops</b> <ol style="list-style-type: none"> <li>1) <i>The ecohydrology of karst poljes</i>                      Moderator: Ognjen Bonacci, Faculty of Civil Engineering, Architecture and Geodesy, University of Split (HR)                      Reporting: Damijan Denac, DOPPS (SL) &amp; Dražen Kotrošan, Naše ptice (BA)                 </li> </ol>



**2) Ecological value of free ranging livestock**

Moderator: Waltraud Kugler, SAVE Foundation (CH)

Reporting: Elli Broxham, SAVE Foundation (CH)

**3) Ornithological importance of karst polje landscapes according to international conventions**

Moderator: Peter Sackl (Universalmuseum Joanneum, Graz)

Reporter: Borut Stumberger (SI) and Dražen Kotrošan, Naše ptice (BA)

15:30 – 15:45:	Coffee Break and Snacks
15:45 – 16:15:	Reporting about Workshop outcomes

**1) The ecohydrology of karst poljes**

**2) Ecological value of free ranging livestock**

**3) Ornithological importance of karst polje landscapes according to international conventions**

16:15 – 19:30:	Excursion to Livanjsko Polje
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- *Landscape excursion to Livanjsko Polje* guided by Dražen Kotrošan, Naše ptice (BA)

19:30 – 21:00:	Opening of Karst Polje Exhibition
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- Cultural Centre of Tomislavgrad

21:00:	Dinner
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- Dinner will be served at the restaurant Smiljanić farm with presentation of traditional cheese production

**SIDE-EVENT, 02 OCTOBER 2013, 09:00 – 16:00:  
Workshop on Ecological value of free ranging livestock**

Facilitated by Waltraud Kugler and Elli Broxham (SAVE Foundation, CH)

09:00 – 16:00:	Workshop
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**Topics**

**1) Feral populations and rare livestock breeds in ecologically important landscapes and wetlands**

Situation analysis

**2) Problems and chances**

Definition of the triggers for diminishing rare livestock breeds and challenges for nature conservationists, environmental management and land users

**3) Best practice management plans (for wetlands)**

Ways and opportunities to harmonize livestock keeping and conservation aspects in karst polje wetlands

**4) Benefits and problems**

Lessons learned, outlook, ideas for new activities, networks

16:30 – 17:00:	Presentation of Workshop outcomes
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*Coffee Breaks and Lunch time correspond to the schedule of the Karst Workshop Agenda*



# ORAL PRESENTATIONS

## **WETLANDS IN DRY LANDS: THE GLOBAL IMPORTANCE OF KARST POLJES**

**Tobias Salathé**

Ramsar Convention Secretariat, 28 Mauverney, CH - 1196 Gland, Switzerland, E-mail: [salathe@ramsar.org](mailto:salathe@ramsar.org)

Wetlands take care of water. This is particularly visible and tangible in karst poljes. First on a spatial scale: karst poljes fill up with water at regular intervals and become huge wetlands. Doing so, they provide above-ground evidence of their underground water connections. Connections that are often little understood or ignored. Specially in non-karst wetlands. This makes karst polje wetlands particularly good examples to demonstrate that wetlands are the fundamental regulators of water regimes: storing, regulating, releasing, providing the precious resource for humans and all other life on earth. Sustainable management of the water-related ecosystems is therefore essential, particularly so in karst poljes, where our agriculture, transport, energy and urban infrastructure so directly depend on them. Without the appropriate management of wetlands, there is no water of the right quality and quantity, where and when it is needed. Water resources are delivered by and through wetlands to our society. We are all water managers and therefore also responsible for the management of wetlands. Wetlands should not be viewed as competitors for water, because they are essential elements of water infrastructure, within water management. Water management is complex. Water scarcity during dry seasons in karst poljes is increasing water stress. Such stress needs to be addressed through inter-sectoral and multidisciplinary cooperative approaches. Otherwise the karst polje wetland ecosystems will not be able to deliver any longer many essential services for sustainable water management. Where karst poljes and their underground aquifers spread across administrative and national borders, transboundary water management is essential. Any sustainable approach of modern integrated karst polje landscape management is actually about wetland management, and it needs to focus on the nexus (i.e. the connexions) between food (agricultural practices), energy (solar, hydro, other renewable energy sources), water (for drinking and irrigation) and ecosystems (wetland services and their biodiversity). This is the focus of the work of the Ramsar Convention on Wetlands.

## **FLOODING ANALYSIS OF THE KARST POLJES IN BOSNIA AND HERZEGOVINA**

### **Ulrich Schwarz**

FLUVIUS - Floodplain Ecology and River Basin Management, Hetzgasse 22/7, A-1030 Vienna, Austria  
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The karst poljes of the Dinarides and, in particular, in Bosnia and Herzegovina are the subject of long-lasting and regular floods which characterize the habitat conditions of these unique landscapes. The present study tries to summarize the potential flooding situation of the karst poljes in Bosnia and Herzegovina for highlighting the most sensible habitat areas and to identify the potential flood risk for adjacent settlements and infrastructure. Because few and very scattered data, in particular hydrological data, are currently available, the applied approach is based on the freely available ASTER2 elevation model, documentations of floods from the field and secondary information, such as historic maps.

## **GENERAL ASPECTS OF THE KARST POLJES OF THE DINARIC KARST**

### **Ivo Lučić**

Speleological association Vjetrenica - Popovo polje, Ravno bb, 88370 Ravno, Bosnia and Herzegovina  
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In the languages of the Dinaric countries the term “polje” has different meanings and wide uses. In its broadest way, it means “field”: flat and open land, often in the sense of living space and the source of goods. However, for the people who live in the Dinaric Karst its most commonly use, and most peculiar meanings are related to karst poljes. In general, typical karst poljes are elongated closed depressions with bottoms that has been leveled and covered with arable soils, and with constant or intermittent water courses. According to literature, more than 130 poljes exist in the Dinaric Karst, about 50 larger ones. Thus, the Dinaric Karst harbours the largest number of poljes worldwide. Most descriptions of the Dinaric Karst point out the larger depressions of the karst landscape. By integrating almost all other karst features, the poljes of the Dinarides may be the most complex of any karst forms. The poljes are different in origin, size, shape and hydrology. There are dry as well as occasionally or permanently flooded poljes. The location of the Dinaric Karst between the Adriatic Sea and the central Balkans, the highly diverse hydrological conditions and some other characteristics favour the high biodiversity of the poljes. The Dinaric Karst is characterized by a diverse, rare and endemic flora and fauna. In particular, the subterranean fauna of the Dinaric Karst is the richest and the most diverse in the world. According to these features the karst poljes sharply contrast to the surrounding landscape which is often covered by bare rocks, and give them a special place in local history. Evidence for the latter is the rich and unique cultural heritage. The karst poljes of the Dinaric Mountains played an important part for the development of karst science (karstology). In particular, Livanjsko Polje has a prominent position. This could be seen in the fact that the international technical term “polje” was derived from its name. Recently, in many karst poljes large-scale hydrotechnical projects have been realized which radically changed the environment by removing the seasonal hydrologic rhythm, characteristic for poljes, and resulting in heavy losses of their natural values. Although, according to Panoš (1995), karstology is an integrated scientific system that covers all aspects of karst, so far most investigations on karst poljes focused on geographical, geological, hydrological and similar aspects. While up to now human impacts and damages to karst environments were largely ignored. Therefore, it is necessary to develop a holistic karstology, that will recognize all values of the karst poljes –

natural, cultural and economical – and to consolidate them to a single, refined and more credible picture of the karst environment. Following to the close association of birds, other animals and plants to key environmental factors, biologists investigating the flora and fauna of the poljes have to take the specificities of karst areas into account. According to the broad approach of karstology, by doing so, biologists will heavily contribute to the scope and competence of karst sciences. Particularly, due to the wide acceptance and international regulations for bird conservation, ornithological research will produce potentially significant contributions towards the conservation of the karst poljes of the Dinaric Mountains.

## THE ECOHYDROLOGY OF KARST POLJES

### Ognjen Bonacci

Faculty of Civil Engineering, Architecture and Geodesy, University of Split, Matice hrvatske 15, 21000 Split, Croatia, E-mail: obonacci@gradst.hr

In karst sciences the geomorphological term “*polje*” refers to large closed depressions with flat bottoms which have been developed in karst rocks. The surface area of poljes varies from lesser than 0.5 km<sup>2</sup> to more than 500 km<sup>2</sup>. The ecological and economical importance of karst poljes derives from the fact that they often form the only larger, fertile, and habitable oases in karst landscapes. In general, poljes provide conditions for the development of rich ecosystems which are favourable for human beings. Therefore, the ecological functions of poljes are crucial for a sustainable economical development of the valuable, but highly vulnerable karst environment. Ecohydrology can be defined as the science of integrating hydrological and biological processes over different spatial and temporal scales. In karst poljes there is a strong and direct interaction between the circulation and storage of ground- and surface water. These fluxes, in turn, affect the spatial distribution of organisms in surface and underground habitats. Karst poljes are characterized by different, often very complex hydrological and hydrogeological features, like permanent and temporary springs and rivers, losing and sinking rivers, swallow holes and estavelles. Generally, karst poljes are regularly flooded during cold and wet periods of the year. Consequently, they have to be recognized and should be protected as wetland habitats. In the Dinaric Karst under natural conditions poljes are flooded annually between 3 and 7 months. The importance of seasonal flooding for the hydrology and ecology of karst poljes is discussed. Many engineering attempts have been made to prevent the flooding of poljes. In most engineering projects resulting benefits were smaller than the ecological damages they have caused. Anthropogenic interventions in karst regions may disrupt the natural ecological equilibrium. Environmental effects of interventions can be very serious, and potentially dangerous and threatening. By combining hydrological and biological data it will be possible to develop better strategies for the protection of the valuable and vulnerable poljes in karst ecosystems. The aim of the present paper is to move the discussion between different disciplines forward and to promote a closer cooperation between engineers, biologists and ecologists for the protection of karst poljes. The best strategic objective for the conservation of surface and underground ecosystems in the Dinaric Karst region will be to preserve the present character of the landscape, the rich biodiversity of the karst poljes as a global natural heritage and by securing a balanced management of their natural resources.

## MONOGRAPH OF THE NATURAL-HISTORY HERITAGE OF TOMISLAVGRAD

**Roman Ozimec<sup>1,2</sup> & Marko Radoš<sup>1</sup>**

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A *'Monograph of the Natural-history Heritage of Tomislavgrad'* is a project led by the Society Naša baština (Our heritage) from Tomislavgrad (Bosnia and Herzegovina) and Zagreb (Croatia), started at the end of 2009 and finished in August 2013. The basic idea was to establish an expert team of natural-history researchers, who can create a synthesis of all aspects of the natural history heritage for a region, which is in this regard almost unknown. The region of Tomislavgrad County covers 969 km<sup>2</sup> and belongs partly to the Mediterranean, partly to the Alpine Biogeographical Region. The county is occupied by two big karst poljes, i. e. Duvanjsko polje (112 km<sup>2</sup>) and Buško blato, part of Livanjsko polje (405 km<sup>2</sup>), as well as several smaller karst poljes: Šujičko polje (2,7 km<sup>2</sup>), Viničko polje (2,2 km<sup>2</sup>), Roško polje (3,9 km<sup>2</sup>), Dugo polje (19,1 km<sup>2</sup>). The region is also bordered or occupied by 11 mountain massifs: Čvrsnica (2228 m), Vran (2074 m), Cincar (2006 m), Kamešnica (1856 m), Ljubuša (1797 m), Tušnica (1700 m), Jelovača (1527 m), Zavelim (1346 m), Lib (1328 m), Gvozd (1304 m) and Grabovica, with Midena (1224 m). Furthermore, in the Tomislavgrad region two lakes - Buško and Blidinjsko jezero – and as part of the Cetina river system a hydrological system of several small rivers which flow into the sinkhole river Šujica, exist. The monograph is the result of the work of a team of four editors, two chief-editors and 24 experts, supported by more than 50 photographers, 3 reviewers and a technical team of graphical designers, lecturers, correctors and translators. As the final result of the project the monograph is published on over 600 pages with more than 1200 photos in August 2013. Almost 15 archives were used during the work. The monograph was financially supported by EuroNatur, Croatian and the cantonal and regional authorities as well as almost 20 other supporters from Bosnia and Herzegovina, and Croatia. Contents are divided in 15 chapters: History; Geography; Geology and Geomorphology; Palaeontology; Speleology; Fungi, Lichens, Algae and Mosses; Flora; Fauna; Agrobiodiversity; Forestry; Hunting and Fishery; Livestock; Dog Breed Tornjak; Mountaineering and, finally, Tourism. Generally, each chapter is organised in introduction, a historical part, synthesis, conclusions, list of references and, finally, abstracts in three languages, i. e. in Croatian, English and German. At the end of the book two obituaries for two great scientists, one for the botanist Dr. Sc. Čedomil Šilić and the second for Dr. Sc. Martin Schneider Jacoby, the latter one of the potential reviewers, are included. The monograph gives an extensive synthesis of all fields of the natural history sciences for one of the ecologically most important regions in Bosnia and Herzegovina. It will be an important source of information and education for the inhabitants of the region and future generations. Finally, *'The Monograph of the Natural-history Heritage of Tomislavgrad'* represents an example for the promotion of nature conservation and will give us the direction for further research and the protection of Duvanjsko and Livanjsko polje.

## PEŠTERSKO POLJE - RAMSAR SITE IN SERBIA

**Nikola Stojnić<sup>1</sup> & Predrag Lazarević<sup>2</sup>**

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Peštersko polje is situated on the Pešter Plateau, at altitude of approx. 1150 m above mean sea level. It is the largest karst polje in Serbia, covering a surface area of approx. 50 km<sup>2</sup>. It is considered to be one of the most elevated karst poljes on the Balkan Peninsula. In the recent geological era the whole plateau (Peštersko polje) was filled with water. After the former lake was drained through shafts, flood zones remained only in the lowest depressions in the NE and SE parts of the polje. Peštersko polje represents an excellent example of a complex of water-bodies, marsh and peatland habitats, which are rare and endangered in this biogeographic region. It is a outstanding example for a conserved peatland habitat in Serbia. The Boroštica river which disappears to the underground, flows through the typical karst polje with many shafts, along the course of which mineral-marshy soil and peat are being formed. Peštersko polje harbours the most extensive continuous peatland, situated at altitudes between 1156 m and 1162 m a.s.l., of Pešter Plateau. Besides mineral-rich marshy soils, large areas of Peštersko polje are covered with peat. Pešter is distinguished by a specific temperate-continental climate, modified with elements of the mountainous climate which is unique for the Balkan Peninsula. With a recorded minimum winter temperature of -39°C, it is the coldest region in Serbia. Therefore the area is also called the “*Balkan Siberia*”. Aquatic vegetation grows in the new, artificially-formed lake, channels and watercourses, and the fossil riverbed of the Boroštica River has a particular significance, with parts that are covered with water for most time of the year. In low waters along the shoreline of the lake and along channels, levees, pools etc. emerged water-plants are growing. The vast peatland area represents a particular feature of Peštersko polje. It is probably the largest peatland in Serbia. Endangered plant species, found in the area, include: *Menyanthes trifoliata*, *Pedicularis palustris*, *Utricularia minor*, *Equisetum palustre*, *Salix rosmarinifolia*, *Galium boreale*, *Valeriana simplicifolia*, *Ranunculus lateriflorus*, *Carex davalliana* etc. To this list following orchid species should be added: *Orchis morio*, *O. tridentata*, *O. laxiflora*, *O. coriophorus*, *Dactylorhiza incarnate* etc. The most important representatives of endangered animal species are Corncrake (*Crex crex*), Montagu’s Harrier (*Circus pygargus*) and White Stork (*Ciconia ciconia*) which are breeding in the area, and, during migration, Common Crane (*Grus grus*) and Glossy Ibis (*Plegadis falcinellus*). Due to the natural characteristics of the area, the existence of the local people in Pešter is entirely based on traditional cattle breeding. The best pastures and meadows for fodder are found in Peštersko polje, while the water level of the polje determines the productivity of the pastures in its wider hinterlands. The local culture of the Sjenica-Pešter Plateau is determined by several principal characteristics. These are isolation, the economy based on cattle breeding, and Islam and Christianity as the dominant confessions. Negative anthropogenic influences are commercial exploitation of peat and the removal of surface water, for flood control and water supply purposes. In 2006, Peštersko polje was designated as a Ramsar site, the first in Serbia south of the Sava and Danube rivers.

## **AN ECOLOGICAL APPROACH TO MANAGEMENT OF THE DINARIC KARST'S RENEWABLE NATURAL RESOURCES**

**Jozo Rogošić & Branka Perinčić**

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The Dinaric Karst area of Croatia and Bosnia-Herzegovina is a typical example of Mediterranean ecosystems, as shown by the economy, culture and civilization. The Mediterranean area covers more than one third of the entire territory of Croatia (2.020.000 ha or 35.7 %). Agricultural areas within the Adriatic littoral represent more than a third (34.3 %) of the total agricultural area of Croatia. In contrast, arable lands of the Adriatic Region represent only 16.4 % of the total arable lands of Croatia. Rangelands account for a greater portion of the agricultural and forest lands within the Dinaric Region compared to other agricultural regions of Croatia and Bosnia-Herzegovina. Over 1.7 million hectares are considered as rangelands which represent a significant natural resource for livestock development. Much of these rangeland areas are, for a variety of social and political reasons, partly or completely abandoned today. The lack of grazing has allowed the growth of bushes and small trees that form very dense and almost impenetrable thickets. The fire-prone bushes and small trees increase the risk and the significance of fires, prevent the access of livestock to existing range plants, and suppress the growth of more desirable plant species. Even though livestock production in the Dinaric area has a long tradition, extensive and systematic investigations on the economic values and proper utilization (i.e. grazing systems) of Mediterranean rangelands has not been conducted.

## **THE ECOLOGICAL VALUE OF FREE RANGING LIVESTOCK**

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In many countries and regions in Europe, there are populations of feral domestic breeds ("feral populations"). They are largely ignored by the public, unless they disturb agriculture and rural development. However, feral populations can make an important contribution to the conservation of traditional agro-ecosystems. In many places large herbivores, important for the conservation of the natural environment, are no longer present. This gap can be filled by feral or semi-feral livestock, such as horses or cattle. Furthermore, these populations can be a model for an extensive conservation of important genetic resources. The feral populations, their situation and husbandry conditions and problems have never been researched in Europe. SAVE-Foundation launched a project in 2011 to collect data and information on the occurrence of feral breeds and varieties of livestock, to promote the interdisciplinary networking of key people from in situ/on farm conversation work and nature conservation and to develop best practice management plans. The first phase of the project was the collection of basic data and information especially on large animals. On the website "[www.agrobiodiversity.net/regional](http://www.agrobiodiversity.net/regional) → Feral Populations" more than 100 varieties and occurrences throughout Europe were collected in a database. Additional information about the project, a workshop and a collection of "best practice" information for download completes the page. The terms "feral", "semiferal" and "semidomesticated" were used in the project in accordance with the accepted definitions of the IUCN. Animals living free all year round, but with health and breeding controls, as is the case in many large protected areas, particularly in Central Europe, have been defined as "extensively managed". Large herbivores played a major role in the development of diverse landscapes in Europe. Nature protection bodies view these populations ambivalently: on the one



hand, these livestock populations have a massive impact on the eco-system balance, on the other hand they are put to use as semi-feral populations in the conservation of natural and park landscapes. The interaction between the management of indigenous livestock breeds and the traditional agro-ecosystems are of great importance to conservation of both types of biodiversity – both the wild and the domesticated. A workshop on “Problems, Chances and Pitfalls of Feral Populations in Europe” took place in Seville, Spain, in 2012. Reports of the countries showed how different the situation is in many aspects. In some countries rare breeds are kept under traditional feral or semi-feral conditions. The existing European veterinary and traceability rules are big hindrances to set feral populations into value for the market. The replacement for large herbivores in some nature protection areas is developing. Especially in Mediterranean countries fire protection through (free) grazing with adapted livestock plays an increasingly important role. The side event “Rare Livestock Breeds and Feral Populations (Free Ranging Livestock) in Ecologically Important Landscapes and Wetlands” of the current conference will focus on problems and chances of feral populations especially in the karst regions of the Balkans, best practice management, benefits and problems.

## THE IMPORTANCE OF INDIGENOUS DOMESTIC ANIMAL BREEDS FOR THE CONSERVATION OF KARST POLJE GRASSLAND HABITATS

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After the Neolithic revolution in Europe, most large herbivores became progressively extinct following to the invention and expansion of agriculture and the breeding of domestic animals. Their ecological functions were taken over by domestic animals, predominantly by ruminants (Ruminantia), like cattle, sheep and goats, and odd-toed ungulates (Perissodactyla), horses and donkeys. Indigenous domestic breeds selected by humans in the Dinaric Karst zone are genetically closely related to their wild ancestors, because the breeding selection was determined by harsh environmental conditions and the relative isolation of the area. Their phenotypes were heavily influenced by extreme external factors, in particular the karst relief and climate. During millennia grassland habitats in the Dinaric karst poljes were kept *almost naturally* through millions of specimens of *almost wild* breeds in a traditional nomadic pasture system. At the end of the 18<sup>th</sup> century (1781) only in the region of Dalmatia more than 1,2 million of cattle, mostly sheep and goats, existed, in comparison to only 250.000 inhabitants. According to their sheer numbers and the lack of any other grazing animals, indigenous domestic breeds are crucial elements of grassland habitats which play an important ecological role for the biodiversity of Dinaric Karst. For millennia they have kept alive the grassland habitats and its biodiversity. Cattle are important for the propagation of plant seeds (zoochory), important prey for large predators, like the wolf (*Canis lupus*), the food base for scavengers like Griffon Vultures (*Gyps fulvus*) and necrotrophic insects, same as many other ecological groups of organisms which are directly or indirectly associated with traditional breeds: parasites, pests (Insecta, Arachnida), coprophiles (dung beetles, fungi), saprobionts (fungi), insectivores (many birds, bats, shrews and other Insectivora) and others. After the Second World War, due mainly to the expansion of industry and the industrialisation of agriculture, traditional breeding systems crashed and the numbers of cattle decreased heavily, which had irreversible social consequences: depopulation, the abandonment of villages and agriculture in the karst poljes. In only 50 - 80 years cattle numbers dropped to lesser than 20 % of its former numbers (in Dalmatia lesser than 250.000 cattle in 2011), and this negative trend still continues. But, more important, is the total change of breeding systems: Recently a very low percentage of the animals are kept free-roaming and bred on pastures.



An analysis of the situation in the area of Biokovo Nature Park (Croatia) shows that after 80 years, with nomadic livestock keeping completely abandoned, only 4 % of the previous numbers of cattle remain. Consequently, grassland habitats in the Dinaric region are progressively reforested and lose their biodiversity. Indigenous breeds are the most important natural resources for the maintenance of the cultural landscape in the Dinarids, because they represent the optimal ecological model for environmental conservation which was created over thousands of years through virtually natural selection. The most important advantages of using indigenous breeds in environmental management are: the most economic way for the maintaining of the landscape, prevention of succession, reducing the threat of fire, maintaining habitat diversity, maintaining agro-biodiversity (breeds of domestic animals, species diversity of accompanying fungi, flora and fauna), productions of basic foods, preservation of traditional knowledge and skills, and the maintaining of architectural, cultural and sociological traditions. Urgent interdisciplinary action is necessary to preserve indigenous breeds of domestic animals, to stop a further decrease of the numbers of cattle, and to create a breeding centre, as a basis for the propagation of cattle breeding which, finally, will support and increase the numbers of breeders who use traditional pasture cattle breeding systems.

## **THE OLM *Proteus anguinus* AS A UMBRELLA SPECIES FOR THE CONSERVATION OF THE DINARIC KARST'S UNDERGROUND**

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Is it possible to investigate and conserve animals that live in the underground, while you cannot access their habitats? Can we develop new research methods for distance detection? We are investigating olms (*Proteus anguinus*) by diving into accessible caves and performing transect counts. Transects are visited every two months and the number of individuals, their position in the cave, depth of the location and the behaviour of the animals are recorded. In inaccessible caves we are taking water samples which are later analyzed according to the environmental DNA method (eDNA) for detecting the presence of olms through DNA fragments. We have developed different methods for investigating and the conservation of secretive cave dwelling salamanders. Environmental DNA testing of water samples has shown that olms can be detected by taking only 15 ml of water from outflows of inaccessible caves. Thus eDNA could be a breakthrough for the investigation of inaccessible underground habitats. Data from dive transects show that olms can be quite abundant in some locations, depending on food availability. In Europe water filled caves are one of the last frontiers where you can actually visit places where no one else has ever been before. This kind of research gives us first insights how animals use these habitats and on conservation issues of underground habitats.

## **BOTANICAL ASPECTS OF THE PROTECTION OF THE CETINA KARST POLJES IN BOSNIA AND HERZEGOVINA**

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The most important botanical characteristics and rarities of the Cetina karst poljes in Bosnia and Herzegovina - Kupreško, Glamočko, Duvanjsko and Livanjsko polje - are presented in this paper. Special attention is devoted to endangered and vulnerable plant species. Some of them are discussed

in detail. A short survey of the habitat types of karst poljes is presented, with special attention on Natura2000 habitats.

## IDENTIFICATION OF KARST POLJES AS WETLANDS OF NATIONAL AND INTERNATIONAL IMPORTANCE

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In the last 150 years, more than 76 % of the original wetland cover of the Eastern Adriatic was lost due to river regulation, drainage, water abstraction, urbanisation, agriculture and tourism. With wetland areas and extensive flooded grassland becoming scarcer, the importance of the Dinaric karst poljes situated in the hinterlands of the Eastern Adriatic coast became more crucial in recent years, as they still offer unique resting and feeding sites for migratory bird species. The karst poljes of Bosnia and Herzegovina (BA) are situated within the Adriatic Flyway, a core area of the Black Sea/ Mediterranean Flyway frequented by European bird populations migrating between African wintering sites and breeding grounds in Eastern and North-eastern Europe, including Western Palearctic migrants like Eurasian Spoonbill (*Platalea leucorodia*) or Common Crane (*Grus grus*). While the importance of the karst poljes in Slovenia and Croatia has been already recognized and the major part of these landscapes was integrated into the EU Natura 2000 network, the poljes of BA are still ecologically unknown, unclassified and internationally neglected. However, recent surveys show that the region's most remote and best preserved karst polje landscapes are located in BA today. The aim of the MAVA funded project "Identification of Karst Poljes as Wetlands of National and International Importance" was to give scientific evidence of the ecological importance of the karst poljes of BA according to national environmental laws, as well as international conventions (preparation for EU Water Framework Directive, Flood Directive, EU Birds Directive and Natura 2000, as well as Ramsar, Bern Convention, CMS and Rio Conventions). Having classified the 57 poljes of BA according to their total coverage and site-specific water regimes (flooded > 10 – 15 %, flooded < 10 % and dry), potential and actual flooding areas of the poljes were identified via remote sensing (satellite pictures, elevation models, historical maps) and GIS. Water bird, target bird species, like Corncrake (*Crex crex*), and vegetation data were collected and a dragonfly species inventory was created from 2011 until 2013 for selected poljes (the selection of poljes was based on flood regime and the actual flooded area of the poljes). Based on the evaluation of field surveys a mosaic of 40 new potential Important Bird Areas (IBA) was identified for BA, of which 13 are situated in karst poljes. The data collected in the framework of the project is publicly accessible on a specific homepage and online data base (<http://kraskapolja.ptice.ba/index.php/bs/>). These were established and launched with the aim to provide stakeholders, planning agencies, administrations, scientists, NGOs and GOs with up-to-date ecological data on the karst poljes of BA. The data base and homepage will serve as a consultation platform and as a scientific justification for the designation of new protected areas in the future.

## OTHMAR REISER – ORNITHOLOGICAL RECORDS FROM THE KARST POLJES OF BOSNIA AND HERZEGOVINA

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Othmar Reiser was the leading ornithologist in the former Austro-Hungarian monarchy, and the one who set the foundations for the knowledge of the bird fauna of Bosnia and Herzegovina during his working life in the National Museum in Sarajevo, between 1888 and 1915. His records which he presented in *Ornis Balcanica I'* and in a series of individual publications, related to certain karst poljes (Livanjsko polje, Duvanjsko polje, Kupreško polje, Dabarsko polje, Mostarsko polje, etc.), are of particular importance. Besides these data, Reiser's contributions are represented by his ornithological collection stored at the National Museum in Sarajevo (a collection of birds from the Balkan Peninsula - 9528 skins and a collection of 5000 eggs). In comparison to Reiser's records, the present state of the bird fauna of the karst area and of certain karst poljes, particularly Livanjsko polje, shows the drastic changes over the past 125 years. This primarily refers to the nesting of Common Crane (*Grus grus*) and Eurasian Spoonbill (*Platalea leucorodia*), two species that now can only be seen during migration. The European Roller (*Coracias garrulus*) is also among the extinct breeding species, but it was again recorded in Bosnia and Herzegovina in 2010, after more than hundred years. Among the breeding species of the karst area, which are closely related to the habitats of the karst poljes, but which are not breeding in Bosnia and Herzegovina any more are Bearded Vulture (*Gypaetus barbatus*), Griffon Vulture (*Gyps fulvus*) and Egyptian Vulture (*Neophron percnopterus*). The disappearance of these species is directly related to changes of human lifestyles in the karst areas (decrease of nomadic animal husbandry, etc.). At the same time, the analysis of species associated with karst area wetlands indicates a dramatic decline of some breeding species, such as Great Cormorant (*Phalacrocorax carbo*), and an overall change of the abundances of wetland species. On the other hand, it is necessary to point out that recent research in Popovo polje indicates the likely breeding of Rufous-tailed Scrub Robin (*Cercotrichas galactotes*), a species for which no adequate data for Bosnia and Herzegovina have been available. With the exception of the historic records of Reiser which refer to the old Herzegovina area (in the collection of the National Museum of Bosnia and Herzegovina in Sarajevo is a specimen from Sutorina in Montenegro) which allows the assumption that the species had bred in Herzegovina in the past.

## ENDANGERED *PROTEUS*: COMBINING DNA AND GIS ANALYSES FOR ITS CONSERVATION

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*Proteus anguinus*, an endemic amphibian of the subterranean waters of the Dinaric karst, is restricted to its cave habitat. However, during seasonal flooding, some specimens are washed-out of their subterranean environment. While this may be considered as a highly hazardous way for *Proteus* to

disperse into new habitats, it is obvious that all these individuals present a constant loss to their population. The Tular Cave Laboratory serves as a sanctuary for injured specimens accidentally washed-out of their subterranean habitat during seasonal flooding. Since 2008, 17 cases have been documented in Slovenia, and 7 of these animals were successfully returned to their source populations. Although the periodic loss of individual animals has been well balanced through the evolution of *Proteus*, a concern is raised when possible effects of climate change, large-scale hydrotechnical works and agriculture intensification are considered: the timing, frequency and magnitude of flood events are expected to be changed within a very short period of time. Here we discuss the risks and propose the actions necessary to halt the loss of these rare and highly endangered animals due to man-induced changes in flood regimes of the karst poljes. Firstly, before any animal is returned to nature, the veterinary care and a strict protocol should minimize the transmission of potential infection. Secondly, if washed-out individuals are to be returned to nature, their source population must be accurately identified. Screening for DNA markers powerful enough to detect ongoing gene-flow, such as microsatellites and single-nucleotide polymorphisms (SNPs), should minimize the potential for genetic pollution. Thirdly, the washed-out individuals deposited on karst fields often cannot be returned directly to their local cave system, since only small fragments of *Proteus* subterranean habitat can be accessed by man. We are currently developing a method of detection of traces of *Proteus* DNA in water samples (environmental DNA); when integrated in an accurate distribution Geographic Information System (GIS) model, the potential pattern of its genetic variability within the complex karst landscape will be determined. The resulted database should then be referenced not only to guide the return of washed-out individuals to nature but also to minimize the potential impact of any planned hydrotechnical and water-extraction activities in karst poljes on the genetic integrity of *Proteus* populations.

# POSTERS

## **AN OVERVIEW OF DRAGONFLY DIVERSITY OF THE KARST POLJES IN BOSNIA AND HERZEGOVINA**

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The karst areas of Bosnia and Herzegovina are characterised by a high species, habitat and landscape diversity. The karst poljes are one of the most fascinating examples of karst landscapes in the world and areas of high biodiversity value. Many of the poljes, located in Bosnia and Herzegovina, are also important wetland areas with a great diversity of freshwater habitats. Unfortunately, most of these areas are still poorly investigated and insufficiently protected. As with most taxa present in Bosnia and Herzegovina, the study of dragonflies is still in its initial phase. Although some dragonfly studies had been carried out in the last 120 years, large areas of the country remained poorly explored. At the start of the present study relatively little was known about dragonfly fauna in the poljes and only few historical records existed. Field work was conducted from 2009 to 2013. Up to now 55 dragonfly species have been found in the poljes, comprising 87 % of the overall dragonfly fauna of the country. The highest numbers of species were recorded in temporarily flooded poljes with high diversity of freshwater habitats. This presentation summarizes the hitherto known records and gives an overview of the Odonata diversity and richness of the poljes in Bosnia and Herzegovina. The analysis is based on data from the Odonata Database of Bosnia and Herzegovina (BAHOD) which consists of more than 4.000 records. Two of the recorded species (*Coenagrion ornatum*, *Cordulegaster heros*) are mentioned in the Annexes of the European Union's Habitats Directive, one species (*Lindenia tetraphylla*) is listed as Vulnerable in the European Red List of dragonflies and one species (*Cordulegaster heros*) is listed as Vulnerable in the Mediterranean Red List of dragonflies. In addition, several rare and threatened species in Bosnia and Herzegovina were found in the poljes. The country's largest populations of *C.ornatum* occur at slow-flowing streams and ditches in the poljes.

## NATURAL AND CULTURAL VALUES OF THE KARST POLJES OF THE SHKODRA REGION, ALBANIA

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Following to their distribution and ecological and economical services the karst poljes of Albania play a significant role for the local people and for biodiversity conservation. As an example, Lake Shkodra is positioned in a tectonic plain which has been shaped by karst processes. In the main karst polje, Mbishkodra plain, in which Shkodra Lake is located, several large settlements exist. Due to the environmental conditions during its formation a diverse and interesting wildlife developed in the polje. Following the colonization by people settlements expanded. The values which are characteristic for the development and the identity of the local communities living around the Lake of Shkodra, include natural, material, intangible (non-material), scientific, cultural, recreational values etc. In this work the most important values as well as some considerations on their status are presented. The appreciation and valorization of these values will enhance the sustainable development of communities by preventing a further degradation of the natural values of the karst polje.

## GRABOVICA TRAIL – REDISCOVERING THE NATURAL HERITAGE AT THE BORDER OF DUVANJSKO POLJE

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Grabovica, i. e. In local language Grabovica Mountain, is a karst plateau which is situated between Buško blato (nowadays also known as Buško Lake), Duvanjsko polje and Roško polje in the Outer Dinarides of Bosnia and Herzegovina. Except the Midena anticline, the area shows low hypsometric energy. Surely, the most significant features of the relief are sinkholes or dolines. In the area more than 8500 of it exist. The most interesting of the area's sinkholes are the collapsed dolines in the northern part of Grabovica. Gradual changes of the socio-economic situation of the area during the last 50 years resulted in the final abandonment of traditional cattle grazing which was practiced in Grabovica since pre-Roman times. With cattle grazing the stockman's houses in the mountains – locally called *stanovi* – have been abandoned, too, and human life retreated from the mountains back to lower areas at the bottom of the surrounding karst poljes. After the disappearance of people from Grabovica plateau former infrastructure, like houses, trails and puddles, which have been used until recently were overgrown by vegetation. For the Project "Grabovica trail" which was implemented by the local NGO "Naša baština", some of the old trails on Grabovica plateau, in particular those of the northern part, will be reused. By the renovation of old trails the project intends to make the karst phenomena of Grabovica plateau, like the collapsed dolines Veliki Samograd, Mali Samograd and Surdup, accessible for the public. There are also plans for information tables and trail marks which will transform the old trails into a new recreation and education trail which will be suitable for people of all ages.



## **THE WINTERING POPULATION OF HEN HARRIER *Circus cyaneus* IN GLAMOČKO, DUVANJSKO AND KUPREŠKO POLJE**

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The karst poljes of Bosnia constitute hotspots of biodiversity. But the karst wetland habitats of Bosnia and Herzegovina are under threat. Except the largest, i. e. Livanjsko polje, all karst poljes are unprotected. Livanjsko polje has been recognized as a Ramsar site and since 2011 it is designated as an Important Bird Area (IBA). In 2013 it was ranked as a medium threatened IBA site by BirdLife International (2013). Because habitat types and land use practices are similar to that in Livanjsko polje, Duvanjsko, Glamočko and Kupreško polje may, in the same way, harbor a high biodiversity. In particular, the bird fauna appears to be as rich and diverse as in Livanjsko polje. So far the avifauna of the poljes was never systematically investigated and no historic data are available for comparing with recent systematically collected data. The presence and population numbers of Hen Harriers (*Circus cyaneus*) were investigated during a one year period (May 2011 – June 2012). While all karst poljes of western Bosnia seem to fulfill IBA criteria, the three poljes investigated have a big potential for biodiversity and need to be protected urgently. The aim of the present study was to make a preliminary assessment of the wintering population of Hen Harrier in the three karst poljes - Kupreško, Glamočko and Duvanjsko polje. The Hen Harrier is an important indicator species of open, extensively used grassland habitats. The species is listed in Annex I of the European Union's Bird Directive. During one year of field research Hen Harriers were studied by using the point count method in all three karst poljes. The species was present in the poljes between November and March. During the winter 2011/12, due to heavy snow field conditions were unusually bad in January and February and some of the constant observation points were not accessible. In the present paper results of the one year study are presented.

## **SPRING MIGRATION OF EURASIAN CRANE *Grus grus* USING THE ADRIATIC FLYWAY IN SPRING 2013**

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As part of an ongoing monitoring program the paper presents the analysis of data on the spring migration of Eurasian Crane (*Grus grus*) along the Adriatic Flyway in 2013. With 31 people involved in the census, crane migration was studied in Croatia, Bosnia and Herzegovina, Montenegro and Serbia from February till the end of April 2013. In 37 sites which were covered in 2013, a total of 6950 birds were counted: 4101 flying and 2849 resting birds were counted. According to our data, most birds flew over Metković, while Mostarsko blato where more than 1400 birds have been counted, was identified as the most important resting and feeding site Eurasian Cranes. Peak migration was recorded in mid-March. In addition to monitor the migration corridors across the western Balkan Peninsula, the study aims to identify important stop-over sites and main conservation issues for Eurasian Cranes along the Adriatic Flyway.



## AUTUMN MIGRATION 2012 OF EURASIAN CRANE *Grus grus* ALONG THE ADRIATIC FLYWAY – MIGRATION PATTERNS AND POPULATION NUMBERS

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In autumn substantial numbers of the Baltic-Hungarian population of Eurasian Crane (*Grus grus*) which use the North-east & Central Europe/North Africa Flyway, pass the western Balkans to reach wintering sites in Tunisia, Algeria and Libya via the central Mediterranean basin (Adriatic Flyway). Recently, results of Euronatur's 'Adriatic Flyway' project indicated that wetland habitats in the karst poljes of the Dinaric Karst constitute important feeding and resting sites for Eurasian Cranes which use the Adriatic Flyway during spring and autumn migration. For a better understanding of crane migration, in autumn 2012 a total of 183 observations which concern 32.592 individuals (ind.), have been compiled through a network of observers which covered the countries of the western Balkan Peninsular, between Slovenia and northern Albania. Eurasian Cranes passed the western Balkans and the eastern Adriatic region along two distinct migration routes: (1) in an approximately 120 km wide corridor across the central Dinaric Karst in Bosnia-Herzegovina and Croatia between the catchment area of the Cetina river and the Neretva river valley (31.371 ind.), and (2) across the Slovene Karst and Istria (Croatia/Slovenia) in the northern Adriatic region (1221 ind.). In Slovenia and Istria migration took place between October 21<sup>st</sup> and December 29<sup>th</sup>, with peak numbers between November 12<sup>th</sup> and 18<sup>th</sup>, 2012, when 51 % of all birds which used the northern migration route, were observed. In contrast, between November 2<sup>nd</sup> and December 11<sup>th</sup> Common Cranes crossed the central Dinaric Karst with two very distinct migration peaks. Mass migrations were recorded on November 14<sup>th</sup>/15<sup>th</sup> and between December 7<sup>th</sup> and 11<sup>th</sup>, 2012. In all, during both mass migrations 98 % of the birds, noted along the southern migration corridor, passed Bosnia-Herzegovina and the southern Dalmatian coast within a narrow time period of 2 and 5 days, respectively. Following to the present data and reports on "hundreds and thousands" of migrating cranes near Sipovo in Bosnia and Herzegovina, which are not included in the absolute numbers of individuals, the total population of Eurasian Cranes which passed the central Dinaric Karst in autumn 2012, are estimated

to at least 32.000 ind., with a maximum of up to more than 60.000 birds. Thus, in fall 2012 some 6 – 15 % of the species' global population (400.000 – 500.000 ind.) and a major portion of the North-east & Central Europe/North Africa flyway population, the latter currently estimated by Wetlands International at 90.000 birds, used the Adriatic Flyway.

## THE PONORS OF KARST POLJES

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The ponors of karst poljes have caught the attention of the visitors of our region from the earliest times. In his travelogue Turkish travel writer Evliya Çelebi who visited the region in the mid 17th century, mentions the ponors of Popovo polje and their use by local people for running the corn mills. The Austro-Hungarian government which ruled Bosnia and Herzegovina at the end of the 19<sup>th</sup> century, perceived the regular flooding of the karst poljes as a considerable obstacle for the development of the national economy and attempted to prevent several months long floodings by regulating the outflow of ponors. Consequently, serious hydrotechnical measures were undertaken in many poljes. At the same time ponors became interesting for speleologists, including Czech Karel Absolon, who has visited the "Paleo Trebišnjica" ponor in Vjetrenica cave. Absolon conducted the first relevant speleological research inside the cave. In the period between the two World Wars a group of Belgrade geographers investigated the ponors in eastern Herzegovina. A large hydroelectric project by exploiting the upper horizons of the Trebišnjica river which should also prevent the flooding of the poljes after the construction of a reservoir, was started in the 1960s. For this project a systematic study of the ponors was necessary. In particular, the underground interconnections of sinkholes and spring zones were investigated with different routing methods, some of it used in the karst fields of the eastern Herzegovina for the first time. For these investigations engineers of the Trebinje Institute and two groups of researchers from Energoinvest and the Speleological Society "Bosnian-Herzegovinian Karst" from Sarajevo, particularly Petar Milanović and Izet Avdagić among others, played an important role. This era of engineering research of ponors ceased with the advent of new social and economic systems in the 1990s, because officials were not further interested in large infrastructure projects that require a multidisciplinary and holistic approach. In recent years, due to advanced techniques for cave diving, the ponors of the karst poljes in Bosnia and Herzegovina again receive more and more interest by speleologists.

## FLORISTIC VALUES OF LIVANJSKO POLJE

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With an area of 410 km<sup>2</sup>, Livanjsko polje is the largest periodically flooded karst polje in the world. It is located in the southwestern part of Bosnia and Herzegovina, surrounded by the Dinara and Kamešica mountains in the south, Tušnica mountain in the east, Cincar and Golija mountains in the north and Šator and Staretina mountains in the west. Because of its vicinity to the Adriatic Sea, Livanjsko polje has a moderate Mediterranean climate, with mostly dry and warm summers, but due to the surrounding mountains and the altitude of the polje (approximately 700 - 720 m) during winter a cold continental or subalpine climate prevails. The sharp seasonal change of the climate and the

fact that the polje is flooded during the winter and dries up in summer, allows the development of a diverse and specific floristic composition, from continental forests and hygrophilous grasslands, to thermophilic plant communities that are characteristic for the Mediterranean region. With 429 plant species documented in available literature sources, Livanjsko polje harbours a high species diversity. Among others, there is a significant number of endemic plant species, like *Succisella petteri* (Kern. & Murb.) Beck, *Lilium bosniacum* Beck, *Dianthus sanguineus* Vis., *Scilla litardierei* Breistr., *Helleborus multifidus* Vis. and the recently described *Scabiosa delminiana* Abadžić. In addition, there are a number of medicinal herbs and berries that have been used by the local community for centuries and which have the potential as crops: *Symphytum tuberosum* L., *Hypericum perforatum* L., *Teucrium montanum* L., *Rosa canina* L., *Fragaria vesca* L. For more than a century the area of Livanjsko polje has been under strong anthropogenic influence. The water regime and the ecosystems of the polje have been significantly altered with the construction of Buško jezero reservoir, the excavation of peat, drainage works, uncontrolled burning of scrub, peat and grassland areas in spring and autumn pose considerable threats to marshlands and peat areas. Although Livanjsko polje is a designated wetland of international importance (Ramsar site) as well as an Important Bird Area (IBA) the habitats in the polje are not protected. The aim of the present paper is to give an overview of the floristic values of Livanjsko polje and its potentially nutritional, medicinal and ornamental use by local communities. Additionally, the present status of the flora of Livanjsko polje is analyzed according to criteria for the identification of Important Plant Areas (IPA). This will qualify the area, in addition to its actual status as an IBA and Ramsar site, for another designation as a conservation area of international importance.

## THE SIGNIFICANCE OF ENDEMIC AND RARE PLANT SPECIES FOR THE FLORA OF KARST POLJES OF BOSNIA AND HERZEGOVINA

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In the past century, there was a great interest in studying the flora of Bosnia and Herzegovina. The most prominent botanist researcher of that period was Dr. Günther Beck-Mannagetta (1856-1931) who has managed to collect valuable data on the distribution of plant species throughout Bosnia and Herzegovina during many years of field research. In his major work "Flora Bosne, Hercegovine i Novopazarskog sandžaka" (Flora of Bosnia, Herzegovina and Sanjak of Novi Pazar), among other plant species, he has also listed those distributed in karst poljes. After his death, the publishing of the remaining parts of the "Flora of Bosnia and Herzegovina" was continued through the dedicated work of Karlo Maly, Željka Bjelčić and other botanists. Exactly 60 years ago, in 1953, Dr. Hilda Ritter-Studnička started the more intensive study of the flora and vegetation of karst poljes. The results of her work were published in national and international journals. By recognizing the importance of the studies of Dr. Ritter-Studnička, the botanists of the National Museum of Bosnia and Herzegovina, the Institute of Biology and the Faculty of Natural Sciences and Mathematics continued with field research in a number of sites in karst poljes. Parts of their results were published in the Bulletin of the National Museum of Bosnia and Herzegovina and in other journals. In all, the results of field studies that have been obtained during several decades indicate that the karst poljes have the highest biodiversity and species richness in all Bosnia and Herzegovina. These conclusions are based on the analysis of a number of literary sources (Floras, monographs, studies, etc.), the results of many years of field research, and data from the scientific collection (herbarium) of the National Museum of Bosnia and Herzegovina. At present, the number of plant species recorded in different localities in the country's karst poljes consists of 684 species from 81 families. Among many others, some of the rare and endemic plant species of karst poljes in Bosnia and Herzegovina include: Dalmatian Rockbell

(*Edraianthus dalmaticus* A.DC.), Amethyst Meadow Squill (*Scilla litardierei* Breistr.), Dark-Red Pink (*Dianthus sanguineus* Vis.), Gremlí's Milkvetch (*Astragalus gremlii* Burnat), and Delminian Scabious (*Scabiosa delminiana* Abadžić). Continuing the investigation of the flora and plant communities of the karst poljes should be one of the priorities of science in Bosnia and Herzegovina. Given the fact that it is harbouring one of the country's largest botanical libraries and scientific plant collections (SARA) which is highly recognized by the international scientific community, it is recommended to establish the National Museum in Sarajevo as a center for the study of the flora and plant communities of karst poljes in Bosnia and Herzegovina.

## CORNCRAKE *Crex crex* CENSUS IN THE KARST POLJES OF BOSNIA AND HERZEGOVINA IN 2012 AND 2013

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The Corncrake (*Crex crex*) is a regular breeding species in Bosnia and Herzegovina, with its population preliminarily estimated at 500 - 800 breeding pairs (bp) in 2012. A first estimate of the Corncrake population in Livanjsko polje which constitutes the first population estimate ever done for the species in Bosnia and Herzegovina, was made for the period prior to 1991. For this period the total population in Livanjsko polje was estimated to at least 1000 calling males (Radović & Dumbović 2001, Proceedings International Corncrake Workshop 1998, Hilpoltstein, Germany). A first census of Corncrakes in Livanjsko polje was conducted in the frame of the Adriatic Flyway project by EuroNatur in 2007 and 2009. During both surveys, at least 314 and 315 calling males, respectively, were counted. Since then, Corncrakes are regularly counted in the area. Till 2012 additional, but irregular counts were performed in other karst poljes (e.g. Vukovsko polje). A first coordinated census in a number of karst poljes in Bosnia and Herzegovina was conducted in 2012 and 2013. The censuses were performed by counting the number of calling males from observation points between 22:00 p.m. and 3:00 a.m. For covering the whole area of the karst polje the maximum distance between points was 1500 meters, while the number of observation points per polje depended on the area and the accessibility of the polje. With a total of 9 observers, in 2012 the census was conducted in the period between 4 and 27 June and in 2013 when 15 observers were involved, from 31 May to 3 July. In 2012 the census covered 19 karst poljes and a total area of 1034 km<sup>2</sup>. 2012 a overall number of 423 calling males was recorded in 17 poljes. The largest numbers of calling males were recorded in Livanjsko polje (141), Duvanjsko polje (62), Glamočko polje (51) and Lušci polje (40). In 2013 Corncrakes were mapped in 42 karst poljes, i. e. on a total area of 1493 km<sup>2</sup>, and a total of 644 calling males were recorded in 27 poljes. Most males were recorded in Livanjsko polje (192), Duvanjsko polje (46), Popovo polje (42), Lušci polje (55) and Podrašničko polje (44). The lowest altitude at which Corncrakes were recorded was 58 m a.s.l. in Rastoka and Ljubuško polje, while the highest altitude was 1157 m at Ravna Mliništa. In comparison to the data from 2007 and 2009 both censuses in 2012 and 2013 indicate a decrease of the Corncrake population in Livanjsko polje. Obviously, the reason for the population decrease in Livanjsko polje was the destruction of 10 km<sup>2</sup> of optimal Corncrake habitat in Ždralovac that was converted into monocultures of arable land in 2011. Although the area is situated within a designated Ramsar site, the project was realized without any assessment of potential environmental impacts, in particular of impacts of the project on biodiversity! Additionally, during the 2012 and

2013 counts no Corncrakes were recorded in Vukovsko polje, while 25 males were present in that area in 2010. Also in this case the original habitat was destructed by ploughing up for the creation of farming areas. Furthermore, in comparison to the previous year, in 2013 numbers of males in some karst poljes have changed considerably. The presence and abundance of Corncrakes in karst poljes probably fluctuates according to the amount of rainfall and water levels of the poljes in the period before and during nesting. On the other hand, a further intensification of agriculture and the destruction of more Corncrake habitats will not allow the species to maintain its population in the future. The present study shows that the Corncrake population in Livanjsko polje constitutes the largest known population in the Western Balkans and one of the most important populations of the species in the Mediterranean basin. The results of our study further indicate that population numbers in Livanjsko polje may have declined heavily since 2007. Overall, the results of our censuses show that Corncrake habitats in the Dinaric Karst should be protected and that farming practices, compatible with Corncrake conservation, have to be established urgently.

## **LESSER GREY SHRIKE *Lanius minor* CENSUS IN THE KARST POLJES OF BOSNIA AND HERZEGOVINA IN 2013**

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The Lesser Grey Shrike (*Lanius minor*) is a regular breeding bird in Bosnia and Herzegovina. In 2012 its population was preliminarily estimated at 200 - 500 breeding pairs (bp). So far, population surveys of the species were conducted only in Livanjsko polje during EuroNatur's Adriatic Flyway project in the period 2007 - 2009 when a maximum number of at least 54 bp were found in the area. For the first time a census of the species was conducted in a number of other karst poljes in Bosnia and Herzegovina between 31.05. and 29.06.2013. Road-side counts with specified observation points were performed in each area and the locations and numbers of all observation points recorded. All individuals observed were recorded and in cases where the nest was found, it was recorded as a single individual. The data collected for each polje were entered in topographic maps. In all the census covered 46 karst poljes with a total area of 1488,63 km<sup>2</sup>. Lesser Grey Shrikes were recorded in 37 poljes. With a total number of 175 individuals (ind.), the largest numbers were recorded in Livanjsko polje (44 ind.) and in Duvanjsko polje (20 ind.). In 10 poljes only 1 ind. per polje were found, 2 ind. per polje in 8 poljes, and on the remaining 17 poljes 3 - 9 ind. per polje were recorded. The highest altitude where the Lesser Grey Shrike was observed, was at 1186 m a.s.l. in Kruško polje. Based on the distribution and the numbers of individuals which were noted during the survey, the population of Lesser Grey Shrike in the covered karst poljes in 2013 is estimated at 90 - 130 breeding pairs.



## **DISTRIBUTION AND POPULATION NUMBERS OF THE BLACK-HEADED BUNTING *Emberiza melanocephala Scopoli, 1769* IN BOSNIA AND HERZEGOVINA**

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In Bosnia and Herzegovina seven breeding species of the genus *Emberiza* have been recorded. The Black-headed Bunting (*Emberiza melanocephala*) is a regular breeding bird in Bosnia and Herzegovina. According to preliminary estimates there are 1500 - 2000 breeding pairs (bp) in Bosnia and Herzegovina. The present study includes published data for Bosnia and Herzegovina, unpublished observations of the species from field research carried out in Bosnia and Herzegovina, 2006 - 2012, and data of breeding bird counts in Herzegovina and western Bosnia from 2011 - 2013. Bird counts were performed in the following karst fields: Popovo polje, Mokro polje, Ljubomirsko polje, Gradac polje, Crničko polje, Ljubuško polje, Hutovo blato, Mostarsko blato and Duvanjsko polje, and outside the karst fields in the following areas: Neretva river valley from HE Salakovac to Višić, the valley of the rivers Buna and Bunica, mountain terrains in the area Stolac - Ljubinje – Popovo polje, as well as mountain terrains in the Mostar region between and on Hum – Orlovac. The present study also reports the only hitherto unpublished findings of *E. melanocephala* outside Herzegovina. Bird counts were performed in the following habitat types: vineyards, orchards, fallow grounds in arable fields, cultivated and uncultivated areas in the mountains. The number of bp was estimated by counts of singing males. Breeding densities which were found during the present study were used for estimating population numbers of the species on the territory of Bosnia and Herzegovina. Our population estimate, thus, is exclusively based on field data from Bosnia and Herzegovina and does not, as former estimates, rely on the status of *E. melanocephala* populations in neighbouring countries. During the census a total of 557 bp have been recorded in 2012 and 2013. The largest population of 174 bp was recorded in Popovo polje in 2012. In Popovo polje also the highest population density of 9.33 bp/km<sup>2</sup> was found in an area dominated by vineyards and orchards in Zavala. Outside of karst poljes the highest population densities were recorded in degraded forests in the area of Stolac, Ljubinje and Hutovo oblato (2.7 bp/km<sup>2</sup>). During our research, 2011 - 2013, an extensive documentary material which includes 500 photographs as well as video and audio recordings from a total of six localities has been collected. Based on the present data, collected during bird counts in the karst areas of the country, population numbers of the species in Bosnia are estimated at 2500 - 2700 bp., i. e. somewhat higher than previous estimates.

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IN MEMORIAM

**DR. MARTIN SCHNEIDER-JACOBY**  
**(1956 - 2012)**

