

Information Sheet on Ramsar Wetlands (RIS) – 2006 version

Available for download from http://www.ramsar.org/ris/key_ris_index.htm.

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

Notes for compilers:

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

1. Name and address of the compiler of this form:

Mihajlo Marković
Institute of Agroecology and Soil Sciences,
The Faculty of Agriculture-Banja Luka
Tel: + 387 65 547 707
E-mail: mmarkovic@blic.net

FOR OFFICE USE ONLY.

DD MM YY

--	--	--

Designation date

--	--	--	--	--	--

Site Reference Number

2. Date this sheet was completed/updated:

31. 01. 2007

3. Country: Bosnia and Herzegovina, Republic of Srpska Entity

4. Name of the Ramsar site:

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

Bardaca Wetland (Bardača-močvarni kompleks)

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

This RIS is for (tick one box only):

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

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

a) Site boundary and area

The Ramsar site boundary and site area are unchanged:

or

If the site boundary has changed:

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

and/or

If the site area has changed:

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

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

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

7. Map of site:

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

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

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

b) Describe briefly the type of boundary delineation applied:

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

Wetland Bardaca is located in the north of Republic of Srpska in Bosnia and Herzegovina, on the border with Republic of Croatia, in flooded area (delta of the Vrbas river), between right bank of the Sava river and left bank of the Vrbas river. The southeast and the south side are bounded with the channel Osorna - Borna - Ljevčanica. On the southwest and west, boundary extends along with agricultural land and course of the river Matura. In the north is bounded by the Sava river, in the northeast and east extends along with the bank of the Vrbas.

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

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

45° 4' - 45° 8' N
17° 24' - 17° 30' E

9. General location:

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

Wetland complex Bardaca is located in the north-west part of Bosnia and Herzegovina, in the vicinity of the governmental border with Croatia. The distance from the largest administrative

center Banja Luka is 50 km in the direction north north-east. It belongs to the Community of Srbac, and the distance from the administrative center Srbac (22 000 inhabitants) is 7 km.

10. Elevation: (in metres: average and/or maximum & minimum)
85 – 95 m asl

11. Area: (in hectares): 3.500 ha

12. General overview of the site:

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

The Bardaca wetland is situated in the floodplain between the right bank of Sava river and the left bank of Vrbas river in Republic Srpska (Bosnia and Herzegovina).

Bardaca is one of two IBA areas in Bosnia and Herzegovina. This area is very significant for birds in migration period, but also for some endangered species which nest on Bardaca.

It was a natural wetland, significant habitat for wild life (including endemic species) and a station for migratory birds. In the beginning of the previous century, part of it was covered with fishponds and channels have been built to divert water from the Kozara mountain catchment to balance the shortage in some period of the year. The fishponds have been enlarged in the sixties while irrigation projects have been conceptualised and carried out. This resulted in drying out significant parts of natural swamps for agricultural purposes. A new activity was introduced in the seventies in the form of commercial hunting, including pheasant and wild mallards, bred on site for this purpose. The wetland has served as a centre for cultural activities such as a Summer Painters' Ecological Colony, an activity that was continuously practiced, as well as commercial activities including agriculture and tourism. Research studies on the ecology of the area have been carried out on a rare sporadic basis.

13. Ramsar Criteria:

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

1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9

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

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

Criterion 1:

In hydrological sense, by anthropogenic influence (building of embankments, channels, pump stations) has been established balance. Hydrological balance enables presence of humidity during the year, which give favorable conditions for wetland eco-system development.

Surface water represent the source of inflow to ground water in one part of Lijevice polje, and in the other one, ground water represent the source of inflow to surface water. In regard to surface and ground water oscillations, this function can change in dependence of hydrological period.

Current commercial use of fishponds clashes with eco-system development, while direct connection and dependence of surface and ground water from rainfall enables.

Area of Bardaca by its hydrogeological structure and hydrological function represents the rarity on the area of Bosnia and Herzegovina. According to its characteristic, Bardaca represents the wetland of continental type, unique in Bosnia and Herzegovina.

Bardaca represents the significant habitat of the large number of organic species, more exactly of significant percentage of total world biodiversity, which is used by large percentage of human population, whose existence is directly or indirectly leaned on wetlands. The whole area of Bardaca fishpond, including surrounding rivers, flooding areas and marshes, are rare asylums of aquatic plants flora and lowland hygrophytæ in the whole southeast Europe. Their significance is large or it can be told invaluable having in mind that great number of rare and endangered representatives of fauna live in those habitats. Fishpond Bardaca represents one of the richest habitats of *Marsilea quadrifolia*, and in general, rare aquatic fern on the area of ex Jugoslavija.

Criterion 2:

Ichthyofauna of Bardaca according to International IUCN Red List:

No.	Species	IUCN Red List
1.	<i>Acipenser ruthenus</i>	VU
2.	<i>Carassius carassius</i>	LR
3.	<i>Chalcalburnus chalcoides danubicus</i>	DD
4.	<i>Cyprinus carpio</i>	DD
5.	<i>Gymnocephalus schraetzer</i>	VU
6.	<i>Leuciscus idus</i>	LR
7.	<i>Misgurnus fossilis</i>	LR
8.	<i>Rutilus pigus</i>	DD
9.	<i>Vimba vimba</i>	LR
10.	<i>Zingel streber</i>	VU

Bardaca has the important role for some endangered plant and animal species.

Ixobrychus minutus, (Annex I Bird Dir.),
Nycticorax nycticorax, (Annex I Bird Dir.),
Ciconia ciconia, (Annex I Bird Dir.),
Aythya nyroca, (Annex I Bird Dir.),
Crex crex, (Annex I Bird Dir.),
Lanius collurio, (Annex I Bird Dir.),

In the list are included only bird species which have been registered while nesting in the last 6 years, and which are included in Annex I Bird directive.

According to IUCN Red list, amphibians are classified:

No.	Species	IUCN Red List
1.	<i>Triturus vulgaris</i>	VU
2.	<i>Triturus cristatus</i>	VU
3.	<i>Salamandra salamandra</i>	VU
4.	<i>Bombina bombina</i>	VU
5.	<i>Bombina variegata</i>	VU
6.	<i>Rana ridibunda</i>	LR
7.	<i>Rana kl. esculenta</i>	LR
8.	<i>Rana dalmatina</i>	VU
9.	<i>Rana temporaria</i>	LR
10.	<i>Bufo bufo</i>	VU
11.	<i>Bufo viridis</i>	VU
12.	<i>Pelobates fuscus</i>	VU

Besides amphibians, certain reptiles exist in Bardaca area:

No.	Species	IUCN Red List
1.	<i>Emys orbicularis</i>	VU
2.	<i>Lacerta vivipara</i>	LR
3.	<i>Natrix natrix</i>	LR
4.	<i>Natrix tessellata</i>	DD
5.	<i>Vipera berus</i>	EN

Criterion 3:

Following endemic fish species occur in Danube River Basin (according to IUCN List - Croatia):
Gymnocephalus schraetzer, *Zingel streber*, *Rutilus pigus*.

Their presence has been registered on Bardaca, but because of lack of data regions where they still occur can't be stated precisely.

Criterion 4.:

In the last 50 years, 202 bird species have been registered. In the last 6 years, according to available data, 111 species have been registered. In the period from 1960-1983, 86 bird species nested on Bardaca, while today, according to available data, it is known that nest around 45 species.

Species are marked as endangered according to local proposal of endangered species (Obratil, Matvejev, 1998) and IUCN or Birds Directive (Annex I i II), and in the period from 2000-2006 registered while nesting on Bardaca (numerical data do not exist):

Species
<i>Tachybaptus ruficollis</i>
<i>Podiceps nigricollis</i>
<i>Ixobrychus minutus</i>
<i>Nycticorax nycticorax</i>
<i>Ardea purpurea</i>
<i>Ciconia ciconia</i>
<i>Cygnus olor</i>
<i>Anas platyrhynchos</i>
<i>Aythya ferina</i>
<i>Aythya nyroca</i>
<i>Phasianus colchicus</i>
<i>Crex crex</i>
<i>Gallinula chloropus</i>
<i>Fulica atra</i>
<i>Troglodytes troglodytes</i>
<i>Turdus merula</i>
<i>Lanius collurio</i>
<i>Pica pica</i>
<i>Corvus corone cornix</i>
<i>Sturnus vulgaris</i>

Criterion 7.

On Bardaca has been registered presence of certain endemic fish species and ichthyofauna characteristic for wetland eco-systems. On that way, its significance in preventing and conservation of biodiversity is additionally emphasized. In some periods of the year (especially spring), flood appears in the large part of this area (under the influence of the Sava river), so it represents reproduction centres of fish settlements.

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

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

a) biogeographic region: Continental

b) biogeographic regionalisation scheme (include reference citation): Emerald Network of the Berne Convention/ EU Council Directive 92/43/EEC

16. Physical features of the site:

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

Geology

Bardaca area is located in the northeast part of Lijeve polje. Genetically, in geological sense, represents the flooding area. This area represents flat terrain, which belongs to the alluvial plain of the Sava river. Location of Bardaca, as the lowest part of Lijeve polje, predisposed the deposition of tiny particles. These sediments predisposed the genesis of the wetland eco-system.

Soil types

There are the following soil types in Bardaca area: eugley (swamp-gley soils), fluvisols (alluvial soils) and humofluvisols (semi-gley soils).

These are valley soils which in classification terms belong to hydro morph soils, showing excessive moisture in all or only upper and lower part of the soil profile.

Such valley soils have their own water regime which is considerably different from water regime of soils in hilly and mountain areas.

Climate

Bardaca is located in the central part of the temperature climatic zone (45° 08' N and 17° 25' E), in a region characterised by frequent transition of tropical and polar air masses and intensive cyclone type activities in the winter, especially over the Adriatic Sea, due to a specific distribution of high and low atmospheric pressure fields. Therefore, we may say that the general climate of Bardaca is largely determined by the characteristics of macro-scale atmospheric circulation. On the other hand, this area is fully open to the north and, particularly in winter, it is exposed to the air masses arriving from the northern quadrant with the formation of strong Siberian anticyclones, while the high Dinaric Alps in the south obstruct any more significant influence of the Mediterranean Sea on the climate of this region.

Along with its landscape and geographical position, the climate of Bardaca, especially its mezzo- and micro-climatic characteristics, is affected by its complex of green areas and the water of its swamps, lakes and the Sava and Vrbas rivers.

Hydrogeology

Bardaca area is formed of Quaternary sediments. This geological structure predisposed hydrogeological environment, characterised by confined aquifers, complex hydraulic mechanism. Watertight clay, which are forming top part of terrain, represent upper layer of confined aquifer. It is formed in clay and silt beds. Having in mind that this aquifer is confined by upper and lower watertight layers and the rivers Sava in north and Vrbas on east, it is regularly under artesian or sub-artesian pressure.

17. Physical features of the catchment area:

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

Geographically, Bardaca area belongs to the Vrbas river basin.

The Vrbas river is right tributary of the river Sava and is draining the central part of the north slopes of Dinaric Mountains. Water current is appearing on the south slope of Vranica mountain on about 1'530 mnm and flowing into the Sava near Srbac on about 90 mnm. The average fall of the main current is about 6 m/km, which makes this river very attractive for energy use.

Catchment area is extended, length is about 150 km, and width to 70 km. Average height above sea level is about 690 mnm. Total catchment area is about 6 386 km². The Vrbas is fast mountain river, which by one part flowing through plains and valleys. On this part of flow, it leaves the riverbed, making the big number of stagnant tributaries.

Hydrographic system is developed in the upper and lower part of basin. The most significant tributaries are Pliva, Ugar, Crna and Vrbanja.

Catchment area of the Vrbas has moderately continental, mostly mountain humid climate. The average annual temperatures of air mostly depend from height above sea level and morphologic characteristics of the area and are moving from 5.6°C to 10.4°C. Average rainfall are moving from 800 l/m² near estuary of the Vrbas into Sava to 1 500 l/m² on the south part of the catchment, and the average amount is about 1 090 l/m²

The Sava river, forms the biggest river of ex Socialistic-Federative Republic of Yugoslavia SFRJ rises in Slovenia, flows through Croatia, Republic of Srpska, north part of Serbia and in Belgrade empties into the Danube river. Practically, the Sava originates from two rivers Sava Dolinka, which rises in low part of Julian Alps and the Sava Bohinjka.

The Sava catchment is unsymmetrical and extended, and it surrounds the north and north-west part of ex SFRJ. Catchment surface is about 96.400km², and river length is 950 km.

In the area of Bardaca eco-system, the Sava is already a lowland river, surrounded by arable land protected from flooding by embankments, though flood can appear in the rainy period.

The wetland of Bardaca itself encloses around 3.500 ha, and it is divided into the categories where 765 ha belongs to the natural eco-systems and 2744 ha to artificial eco-systems.

Climatic features

Surrounding area of the Vrbas river, in the middle and upper course is encircled by mountains from all sides, which height rises toward watershed of Black Sea and Adriatic basin on the south, where are formed high Herzegovinian mountains. Lower course belongs to low Peripannonic area. So, local relief conditions, openness toward Pannonic valley in the north and relatively large height above sea level of broaden valleys in the Vrbas catchment, with weakly expressed influence of Adriatic Sea and parameters of general atmosphere circulations under Europe, causing moderately-continental climate in lower areas, while hilly-mountain areas are characterised with sub-mountain or mountain climate.

18. Hydrological values:

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

On the area of Lijevece polje the hydrological system is very developed. The area is confined with two big rivers from two sides, Vrbas in the east and Sava in the north, while the field is intersected by small rivers network. Significant rivers are Matura, Stublaja, Aržaba and Kraljica. Watercourses are intersected by building of channel Osorna-Borna-Ljevcanica, and only Matura inflow into channel, while other courses sink into the underground and coming to the surface again, north from the channel. Therefore, the riverbed of Matura, downstream of the channel, is never empty. The rivers Osorna and Borna have there headwaters on Kozara mountain and at the foothill there are conducting into channel and continue to flow as the channel Osorna-Borna-Ljevcanica. These two rivers do not belong to Lijevece polje, but there are the main sources of water in channel. That is the reason why they are so significant for this area. Ljevcanica-Dugo polje channel served as a supply channel for filling of fishponds, conducting them with the channel Osorna-Borna-Ljevcanica, channel Brzaja (which is currently used for supplying the fishponds with water) and channel Bardaca. The role of these channels is water concentration and protection from flooding. The current water supply of Bardaca is from the river Matura and Brzaja.

19. Wetland Types

a) presence:

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

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

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

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

b) dominance:

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

Roughly

4 is around 28,5%

1 is around 24%

N is around 15%

9 is around 15%

W is around 100 ha

Xf is around 100 ha

Tp is 8 ha

20. General ecological features:

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

Central point within Bardaca complex belongs to the swamp vegetation. By fitocenotic research of Bardaca, abundant and specific aquatic and semiaquatic vegetation have been registered. Specific vegetation classes are: *Lemnetea* W. Koch et Tx. 1954, *Potametea* R. Tx. et Prsg. 1942, i *Phragmiteta* R. Tx. et Prsg. 1942. By syntaxonomic review, 11 clear differentiated associations are included:

1. Ass: *Salvinio- Spirodeletum polyrrhizae* Slavnić 1958
2. Ass : *Ceratophylletum demersi* (Soó 1927) Hild.1956
3. Ass : *Myriophyllo-Potametum* Soó 1934
4. Ass : *Najadetum marinae* Fukarek 1961
5. Ass : *Nymphaetum albo-luteae* Nowinski 1928
6. Ass : *Nymphaetum albae* Vollmar 1947
7. Ass : *Hydrochari-Nymphoidetum peltatae* Slavnić 1956
8. Ass : *Nymphoidetum peltate* (Allorge 1922) Oberd. et Müller 1960
9. Ass : *Trapetum natantis* Müller et Görs 1960
10. Ass : *Scirpo- Phragmitetum* W. Koch 1926
11. Ass : *Typhetum angustifoliae* Pign 1953
12. Ass : *Sparganietum erecti* Roll 1938

Weed and ruderal vegetation which is growing along the roads, in shallow marshes, at the water pool banks is consisted of associations: *Polygono-Bidentetum tripartitae* (W. Koch 1926) Lohm. 1950, *Lolio-Plantagnetum majoris* Beger 1930, *Panico-Galinsogetum* Tüxen et Becker 1942, *Polygonetum avicularis* Gams 1927, *Arctio-Artemisietum vulgaris* (Tüxen 1942) Oberdorfer et al. 1967, etc. Meadow vegetation is characterised by the presence of *Agropyro-Rumicion* Nordh. 1940, and *Deschampsietum caespitosae* Horvatić 1930. Forest vegetation is defferentiated in few associations. Community of Pendunculate oak and gorse (*Genisto elatae-Quercetum roboris* Horv. 1938) are present at the swamp-gley soil, with lower level of ground water. At the eugley soil, which is under the influence of ground water, dominant community is *Leucojo-Fraxinetum angustifoliae* Glavač 1959. Following communities are *Salici-Populetum* (R. Tüxen 1931) M. Drees 1936 and *Populetum nigrae-albae* Slavnić (1942) 1952, at alluvial soils.

21. Noteworthy flora:

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

According to the list for the future Red book (Šilić, 1996) vulnerable species (*Vulnerabre - V*), in Bardaca region are as follows:

- Acorus calamus* L. (V)
- Butomus umbellatus* L. (V)
- Carex acutiformis* Ehrh. (V)
- Convallaria majalis* L. (V)
- Galanthus nivalis* L. (V)
- Hepatica nobilis* Mill. (V)
- Hydrocharis morsus-ranae* L. (V)
- Marsilea quadrifolia* L. (V)
- Nuphar lutea* (L.) Sm. (V)

Nymphoides peltata (Gmel.) Ktze. (V)
Pedicularis palustris L. (V)
Prunus avium L. (V)
Ruscus aculeatus L. (V)
Sagittaria sagittifolia L. (V)
Salvinia natans (L.) Allioni (V)
Trapa natans L. (V)
Utricularia vulgaris L. (V)
Wolffia arrhiza (L.) Wimm. (V)

It should be emphasized that wetland region Bardaca has relic representatives of tertiary flora: *Nymphaea alba* L., *Nuphar lutea* (L.) Sm., *Najas marina* L., *Hydrocharis morsus-ranae* L., *Ceratophyllum demersum* L., *Myriophyllum spicatum* L., *Trapa natans* L., *Butomus umbellatus* L., *Vallisneria spiralis* L., which deserve special attention (Kovačević, 2005).

It is important to mention that Bardaca is the first known locality of *Potamogeton rutilus* Wolfg. in Bosnia and Herzegovina, and it is one of few known localities at Balkans peninsula (Montenegro) till now. This submerse macrophyte is registered only in Rakitovac basin, where in large groups grow in deep water of this basin (Davidović et al., 2006).

22. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 12. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Fish

Three endemic fish species have been registered in the frame of water eco-system Bardaca (see justification for Criterion 3.).

Amphibians

The most well-known amphibians on Bardaca are as follows: *Triturus vulgaris*, *Triturus cristatus*, *Salamandra salamandra*, *Bombina bombina*, *Bombina variegata*, *Rana ridibunda*, *Rana kl. esculenta*, *Rana dalmatina*, *Rana temporaria*, *Bufo bufo*, *Bufo viridis*, *Pelobates fuscus*.

Reptiles

Emys orbicularis, *Lacerta vivipara*, *Natrix natrix*, *Natrix tessellata*, *Vipera berus*.

Birds

202 bird species have been registered on Bardaca area. Many of them nest, but also to many of them Bardaca is significant for feeding, while nesting or during the migration periods. According to local proposal of endangered species (Obratil, Matvejević, 1998), IUCN and Bird Directive, in the period from 2000-2006 following endangered species have been recorded:

Ardeola ralloides, *Egretta garzetta*, *Platalea leucorodia*, *Ciconia nigra*, *Plegadis falcinellus*, *Anser fabalis*, *Anas strepera*, *Anas crecca*, *Anas querquedula*, *Anas clypeata*, *Larus ridibundus*, *Milvus migrans*, *Circus gallicus*, *Circus cyaneus*, *Accipiter gentilis*, *Accipiter nisus*, *Pandion haliaetus*, *Falco vespertinus*, *Rallus aquaticus*, *Pluvialis squatarola*, *Vanellus vanellus*, *Tringa erythropus*, *Tringa nebularia*, *Larus ridibundus*, *Larus cachinans*, *Sterna hirundo*, *Chlidonias hybrida*, *Chlidonias niger*, *Columba palumbus*, *Streptopelia decaocto*, *Streptopelia turtur*, *Alcedo atthis*, *Merops apiaster*, *Dendrocopos medius*, *Riparia riparia*, *Remiz pendulinus*, *Garrulus glandarius*, *Fringilla coelebs*.

Mammals

The groups of mammals are rare in the swamp areas, but they occasionally appear for catching plunder, when water drops. There can be found different species of fieldvoles, small herbivorous animals, foxes, rabbits, moles, hedgehogs and weasels.

23. Social and cultural values:

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

Bardaca area was intensively colonised at the beginning of the 20th century. At that time land reclamation measures and building of fishponds started, but area was colonised from the oldest times. On the locality Donja dolina, which is located near the fishponds, archeological remains from the early classical period have been found, which represent significant value of this area and motif for touristic visits. Settlements of the first inhabitants were pile dwelling type, because the entire area was located in flooding area of the rivers Sava and Vrbas. With building of water defense embankments and fishponds, Bardaca is becoming more attractive area for settling and life with main activities such as agriculture, cattle breeding and fishing.

Human interest for settling in this area was huge, because of natural values such as abundance of water, agricultural land, biodiversity richness especially fish, birds and flooded forests. That represent preconditions for high-quality development of economic activities of this area.

Today, Bardaca area includes fishponds, flooding forests and meadows, agricultural land and settlements with about 1500 inhabitants.

The main economy branch is fish growing which has tradition longer than 100 years. With building of channels and arranging of embankments, besides natural watercourses, preconditions for sport fishing development have been produced. At the old riverbed of Stublaja, at the banks of the river Matura and channels, sport fishermen competitions have been organized. In the last ten years, at the banks of the Stublaja, pile dwelling settlement has been built, which is under management of the Fishermen society Stublaja, which represents significant resource for sport-fishing development.

Since 1983, art-ecologic colony has been organizing on Bardaca, in the aim to address the appeal for nature protection on Bardaca through art expression. Every year, this colony entertain about 10 renowned artists and many visitors, nature and art lovers.

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

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

Water supplying of Bardaca fishponds is solved by pumping of water from the Matura and Brzaja rivers, while connection among fishponds is carrying out through banks. Water supplying of local population is exclusively with underground water of lower layer, through wells.

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

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

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

24. Land tenure/ownership:

- a) within the Ramsar site:

private property Enterprise "Agroimpex"- 497 ha
 public property "Roads"- 35 ha
 public property fishpond "Bardaca"- 382 ha
 public property Municipality and other- 347 ha
 public property water supply "Waters"- 363 ha
 private property of local farmers 1876 ha

- b) in the surrounding area:
private property of local farmers/landowners- 1757 ha
-

25. Current land (including water) use:

a) within the Ramsar site:

Natural eco-systems:

Forests – 9.25 %

Swamps – 0.28 %

Artificial eco-systems:

Agricultural land – 35.98 %

Orchards – 3.99 %

Pastures – 12.31 %

Grass land – 17.53 %

Fish ponds – 18.76 %

Urban surfaces – 5.68 %

b) in the surroundings/catchment:

Pastures – 693 ha, Complex cultivation patterns – 745 ha, Land principally occupied by agriculture with significant areas of natural vegetation – 1014 ha, Broad leaved forest – 100 ha, Transitional woodland-shrub – 53ha, Inland marshes – 211 ha, Water courses – 184 ha, Water bodies – 378 ha.

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

a) within the Ramsar site:

In the aim of better production, un planned and unratioanal measures were conducted in the whole area and causing the destruction of different types of habitats and the natural eco-systems' balance. The most frequent negative factors are: cutting of trees, tinning underbrush and canes, destroying of macrophyte vegetation and killing of birds. Besides permanent and intensive agrotechnic and hydrotechnic measures, numerous activities of local population that live close to Bardaca affect the ecological character. These activities should be empasized: intensive pasture, unratioanal use of artificial fertilizers and pesticides, releasing of waste water from households and farms directly into water streams, throwing out the communal trash on the places which are not provided for such purpose, etc.

Swamp complex of Lijevce polje and Bardaca, has been the typical area with mozaical disposition of the flooded forests with different regimes of flooding and water areas with different sizes and depths. Areas under flooded meadows should also be added to this mozaic. Northeast part of Lijevce polje, in the vicinity of the two big rivers, Sava and Vrbas, was transformed into the system of fishponds by anthropogenic activity. There have been under anthropogenic influence almost during one century. By building of pump stations and daming up the streams on the rivers Matura, Stublaja and Brzaja, it has been disrupted not only the hydrological regime of this small rivers, which are in the vicinity of fishpond, then cenotic relations of flora and fauna.

By building of small acumulation on the river Stublaja, its stream has been completely stoped and today it represents swamp eco-system, which is very shallow and surrendered to spontaneous overgrowing by aquatic vegetation. The fact that the communal water, from surrounding households, has been releasing into this acumulation, contribute to the proces of additional eutrophication and potential anoxion.

Pump stations, built on Matura and Brzaja, are causing slow down in their streams and complete overgrowing by aquatic vegetation.

Besides hydrotechnic measures, which bring to creating of new types of habitats and by that favorisation of one, and prevention of other plant and animal species, the invasive species significantly affect on the structure of plant and animal world. They got to this areas in the second half of the last century. Among plant species in the expansion phase are: *Asclepias syriaca*, *Amorpha fruticosa* i *Echinochloa oryzoides*. Invasive fish species are: *Ictalurus (Ameiurus) nebulosus*, *Pseudorasbora parva*, *Carassius auratus gibelio*, *Lepomis gibbosus*.

About hunting on the area of Bardaca there are no concrete data. It is known that this area was visited by groups of foreign hunters, whose target were birds, but there are no data how long was that last.

b) in the surrounding area:

The same negative factors affect the ecological character in the surrounding area as they mentioned above.

27. Conservation measures taken:

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

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

b) If appropriate, list the IUCN (1994) protected areas category/ies which apply to the site (tick the box or boxes as appropriate): Rába valley has no IUCN category

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

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

No, it doesn't exist yet. Within the Ramsar SGF project 2005 a first management plan will be drafted, which will be taken into discussions with spatial development authorities, institutions and communes.

d) Describe any other current management practices:

The site is partly recognised as IBA (internationally important bird area).

Current fishpond management with conducting of agrotechnic measures, which conduct in the warm-water fishponds.

28. Conservation measures proposed but not yet implemented:

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

Management plan doesn't exist, but currently, within the Ramsar SGF Project, we are working on preparation of management plan, as one of the results of that Project.

29. Current scientific research and facilities:

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

The last more systematic research of birds was done, from the beginning to the end of 70's of the last century, by Dr S. Obratil from National museum of Bosnia and Herzegovina.

During 2001, NGO center for the environment (Ex Young researchers of Banjaluka) undertook new birds observation on Bardaca. Although, all seasonal aspects and all habitats were not included, 97 bird species were registered and from that number 5 species haven't been mentioned in previous literature about Bardaca area. Till the end of research, presence of 94 species, which are mentioned in previous findings, was not confirmed, which implicate on total disappearing of some species from this area, such as *Plegadis falcinellus* which nested there. After this research, new extensive research about diversity of bird world hasn't been conducted yet.

In the aim of observing continuation on Bardaca and promoting of sustainable development, Center for the environment was organized the International volunteer Workcamp in 2003, which had the aim to build the capacity for waste water refining (Constructed Wetland) of Scientific-research center on Bardaca. 20 volunteers participated from Spain, Italy, Germany, Switzerland, France, Austria, Slovenia and Bosnia and Herzegovina. Unfortunately, although volunteers

developed this system, which should serve as an example to local population, the same one is not in function, because mentioned objects haven't been used at all.

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

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

A monograph was published, a result of the Project LIFE LICENSE. Besides this, a video movie "Birds of Bardaca" and a Booklet were produced. In the framework of the Ramsar SGF Project "Restoration and rehabilitation of the Wetland Region Bardaca" a video movie dedicated to the value of Bardaca and web-site were produced as one of the main outcomes for public awareness raising work.

31. Current recreation and tourism:

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

In the last ten years, there didn't exist an organised program for tourist activities Bardaca. Reasons for that can be found in devastation of existing touristical capacities, chaos in property rights relations, non-existence of professional and committed staff, many conflicts in the space (fish growing, farming, hunting, fishing, nature protection). All tourist activities, which were conducted, haven't been based on management plan and use of resources of Bardaca for tourism development, but on individual (ad hoc) attempts of organizing of tourist activities which were conducted by the small local innkeepers, fishing and hunting associations. Most of visits have been accomplished through hunting and fishing tourism, that is additionally burdened the environment and endangered the individual animal species. In recent time, existing motel Bardaca has been repaired and brought into function of receiving tourists, which mainly refer on accommodation and restaurant services.

Next to the main object, there is an open pool, with atypical shape, which serves for the purposes of recreation and daily rest. Eventually, by its size and depth it could be adapted for sport preparations, although for that purpose additional equipment should be provided. In that area and around the pool, there are arranged picnic spaces, which could be adapted as well, for the purposes of camp, with previous rehabilitation and arranging of water crossing, in respect of hygiene, functionality and treatment of waste water, as well. The motel Bardaca has middle-size parking space, which is adapted for amateur sport activities, such as basketball and volleyball.

Except for the motel Bardaca, accommodation organisation is potentially possible in private households (assumed 200 beds) for which is necessary to conduct the education of the small contractors/hostes in organisation and giving services of handycraft. The big number of households has inappropriate water supply and no regulated water sewage system. For handycraft improvement, significant financial resources are necessary, which would be intended for adaptation and education.

Scientific visits, tourist activities in relation with photo-safari, educative excursion and students' picnics are very rare on the Bardaca area.

More than ten years, art colony has been organizing on the locality of Bardaca, on which every year participate around ten renowned artists, whose art works represent cultural and artistic value. Event Savski kotlić, assumes competition in fish soup preparation, when large number of lovers of such type of fun gather on Bardaca. Because of low level of visitors awareness and non-existence of adequate infrastructure, unfortunately this and similar events represent the great pressure on the environment, especially in regard to creating and non-adequate waste disposal.

Currently, tourist activities include organization of celebrations in the hall of motel Bardaca and sporadic, usually non-registered and uncontrolled visits of hunters and fishermen. It is hard to talk about number of tourists, because all inclusive statistics of entering visitors in this area hasn't been conducted, but certainly, that number is not significant for tourism development and economic profit. Seasonal aspect is indefinite and it is exclusively in relation with seasons of allowed hunting and fishing, although there is some evidence of disregard the same one. The biggest chance for the development of Bardaca, regarding the tourism is to improve scientific work, educational excursions, recreation activities, conferences, manifestations as well as rural, agro-tourism and eco-tourism.

32. Jurisdiction:

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

Ministry of Foreign Affairs and Economical Relations of Bosnia and Herzegovina,
Ministry of Urbanism, Civil Engineering and Ecology of Republic of Srpska,
Ministry of Agriculture, Forestry and Water Management of Republic of Srpska,
Ministry of Trade and Tourism of Republic of Srpska.

33. Management authority:

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

Administrative Authority: Ministry of Urbanism, Civil Engineering and Ecology of Republic of Srpska, Bosnia and Herzegovina

Zdravko Begovic, B.Sc. Chem.Technology,

Assistant Minister for Ecology

Tel: + 387 51 348 600, 316 157

Fax. +387 51 316 174

E-mail: mgr@mgrvladars.net

Address: Vladike Platona bb Banja Luka, 78000 Banja Luka, Republic of Srpska, Bosnia and Herzegovina

34. Bibliographical references:

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

Aleksandar Trifkovic (2003). Water sources for Bardaca fisheries-brief description of several project documentation

Boreli M. i ostali (1978): Hidrodinamički model Lijevče Polja, Jaroslav Černi, Beograd Jugoslavija

Dušan Mijević, (2003): Metodologija hidrogeoloških istraživanja u prostornom planiranju i upravljanje podzemnim vodama. Fondovski materijal RGF Beograd, Institut za Hidrogeologiju,

Ireson, A., (2003): Catchment based Environmental Management- A Case Study of the Vrbas Catchment, MSc Thesis, Imperial College, London,

Čedo Maksimovic i ostali (2004) Life project: License- **Local Institutional Capacity Development in Environmental Sensitive Areas** [LIFE TCY/BIH/041]

Mojičević M., Vilovski S, Tomić B. (1976): Osnovna geološka karta, list Banja Luka R 1: 100 000,

Mojičević M., Vilovski S, Tomić B. (1976): Tumač za Osnovnu geološku kartu, list Banja Luka,

Paštar P., i ostali (1988.): Urbanistički plan opštine Laktaši, Urbanistički Zavod, Banja Luka, Republika Srpska

Paštar P., i ostali (1988.): Urbanistički plan opštine Gradiška, Urbanistički Zavod RS Banja Luka, Republika Srpska

Pinjkić J., Peštarac R., (1983.): Hidrogeološke karakteristike Lijevče Polja područja južno od Gradiške, Geoinženjering Sarajevo,

Tomić B. i ostali (1974.): Hidrogeološka istraživanja južnog dijela Lijevča Polja, Geoinženjering, Sarajevo,

Šparica M., Bazuljko R., Jovanović S., (1983.): Osnovna geološka karta, list Nova Gradiška, R 1:100 000,

Šparica M., Bazuljko R., Jovanović S., (1983.): Tumač za Osnovnu geološku kartu, list Nova Gradiška,

Karta hidrogeološke kategorizacije terena SFRJ, R 1:500 000, Beograd, Jugoslavija

- Kovačević, Z. (2005): Vaskularna flora i akvatična vegetacija Bardače. Magistarska teza, Poljoprivredni fakultet, Univerzitet u Banjaluci.
- Kovačević, Z. (2005): Dominantne vaskularne hidrofite kompleksa Bardača, I Simpozijum biologa Republike Srpske, Prirodno-matematički fakultet, Banjaluka.
- Kovačević, Z., Stojanović, Slobodanka (2006): Uloga i značaj vaskularnih hidrofita. Naučno-stručno savjetovanje agronoma Republike Srpske, Proizvodnja hrane u uslovima evropske zakonske regulative, Poljoprivredni fakultet, Banjaluka.
- Kovačević, Z. (2006): Ekološke i fitogeografske karakteristike dominantnih hidrofita kompleksa Bardača. Naučno-stručno savjetovanje agronoma Republike Srpske, Proizvodnja hrane u uslovima evropske zakonske regulative, Poljoprivredni fakultet, Banjaluka.
- Nedović, B., Lakušić, R., Kovačević, Z., Marković, B. (2004): Raznoliki živi svijet. Život u močvari, Monograflja, Urbanistički zavod Republike Srpska, a.d., Banjaluka.
- Šilić, Č. (1996): Spisak biljnih vrsta (*Pteridophyta* i *Spermatophyta*) za Crvenu knjigu Bosne i Hercegovine. Glasnik Zemaljskog muzeja Bosne i Hercegovine, sveska 31, Zemaljski muzej Bosne i Hercegovine, Sarajevo.
- Šumatić, Nada, Topalić, Ljiljana, Pavlović-Muratspahić, Dragana (2001): Zajednica *Polygono-Bidentetum tripartitae* (W. Koch 26) Lohm. 50 na Bardači. Zbornik radova Naučnog skupa "Zasavica 2001.", Sremska Mitrovica.
- Kosorić, Đ. i sar. (1984): Ribolovna osnova rijeke Save, BIUS, Sarajevo.
<http://www.ribe-hrvatske.com/>
<http://www.iucnredlist.org/>
<http://www.fishbase.org/>
- BirdLife, 2001: Important Bird Areas and potential Ramsar Sites in Europa. BirdLife International, Wageningen
- Brežančić, V., 1984: Neke rijetke i ugrožene ptice Bosne i Hercegovine. Naše starine, 16/17: 231-238.
- Gašić, B., 1999: Ptice Republike Srpske, Iz ornitološke zbirke Muzeja Republike Srpske. Muzej Republike Srpske, Banja Luka.
- Gašić, B., 2001: Rezultati novih istraživanja faune ptica Republike Srpske. Ciconia, 10: 108-127.
- Gašić, B., 2006: Crni labud na ribnjacima "Bardača". Bilten "Mreže posmatrača ptica u Bosni i Hercegovini 2 (u pripremi za štampu).
- Kotrošan, D. 2005: Prvi rezultati praćenja gniježđenja bijele rode (*Ciconia ciconia*) u Bosni i Hercegovini. Bilten Mreže posmatrača ptica u Bosni i Hercegovini, 1(1): 12-18.
- Kotrošan, D., Mulaomerović, J. & Habul, A., 2004: Ornithology and bird protection in Bosnia and Herzegovina: situation and perspectives. *Acrocephalus* 25(122): 149-152.
- Obratil, S., 1974: Ornitofauna ribnjaka Bardača kod Srbca. GZM BiH (PN) NS 11-12: 153-193.
- Obratil, S., 1978: Gniježđenje vranca velikog - *Phalacrocorax carbo* (L., 1758) u Bosni i Hercegovini. GZM BiH (PN) NS 18: 343-347.
- Obratil, S., 1982: Ekološki pristup utvrđivanju štetnosti ihtiofagnih ptica u ribnjacima Bardača. GZM BiH (PN) NS 19-20: 139-256.
- Obratil, S., 1983: Avifauna sjeverne Bosne. GZM BiH (PN) NS 22: 115-176.
- Obratil, S., Matvejević, S., 1989: Predlog "Crvene liste" ugroženih ptica SR Bosne i Hercegovine. Naše starine, 18-19:227-235.
- Obratil, S., 1996: O raznolikosti životinjskog svijeta na primjeru faune ptica Bosne i Hercegovine. In: Uravnoteženi razvoj - put u budućnost. Mala Fondeko biblioteka, 69-74. Mozaik knjiga, Zagreb, Velika ilustrovaná enciklopedija "Životinje". Ljubljana 1990., Mladinska knjiga, Veliki atlas životinja. dr.H.Garms i dr.L.Borm, Mladinska knjiga, Ljubljana 1981.,Fauna Evrope. Ekoturizam - principi, postupci i politike za održivost; Megan Epler Wood (CenORT, Beograd 2002). Turizam i zaštita, grupa autora, Novi Sad 2000. Odgovorni i održivi razvoj turizma, Dr Jovan Popesku, CenORT 2001. www.cenort.org.yu Ecotourism Development – A Manual for Conservation Planners and Managers, The Nature Conservancy, Arlington, Virginia, USA, Andy Drumm and Alan Moore, 2002. Guidelines for community-based ecotourism development, WWF International, July 2001.

Telephone: +41 22 999 0170 • Fax: +41 22 999 0169 • e-mail: ramsar@ramsar.org