
PROJECT OF REVITALIZATION OF THE SPECIAL NATURE RESERVE KOVILJSKI RIT (KOVILJ WETLAND)

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ABSTRACT

Together with Petrovaradin wetland positioned on the opposite banks of the river Danube, named in Serbian "Koviljsko-Petrovaradinski rit" (Kovilj-Petrovaradin wetland), this area has been proposed for the registration of wetland areas of international significance according to the Ramsar Convention. The Kovilj-Petrovaradin wetland is being registered as the Natural treasure of special significance and is being classified into I category of protection as the Special Nature Reserve. The protection and conservation of this wetland area is in agreement with Action Plan of protection of rivers and accompanied wetlands in the frame of Paneuropean Strategy for the protection of biological and landscape diversity, accepted at the Strasburg Conference (1995). Being of such importance, this project should contribute to the raising of awareness of this special wetland value as well as to the importance of protection, conservation and improvement of this kind of ecosystems in general. Also, the objectives and results should contribute to the achieving of the wise use of this special wetland and of natural resources as a whole.

Key words: environment, wetland, revitalization

NATURAL VALUES OF THE KOVILJ WETLAND

General characteristics of Kovilj wetland (Koviljski rit), which contribute to the special natural values of this area are:

1) Authentic and preserved typical and specific values of wetland environments, from the point of view of fundamental sciences:

a – preserved variety of orographic and hydrographic features of wetlands (islands, canals and by-channels, meanders, pools, lakes, swamps and marshes;

b – preserved abundant autochthonous wetland plant associations (swampy woods, meadows, shrubberies and reed-covered areas);

c – preserved biodiversity of flora and presence of rare and thin out plant species (white and yellow water lily, etc.); preserved wealthy fauna, especially ornito- and ichthyofauna, as well as thin out species of other animals;

d – remarkable beauty and romantic landscapes, etc.;



Typical Kovilj wetland landscape (Arkanj, famous "The End of the World" vacation area – summer aspect

2) Representative environment, being one of two the largest wetlands in the Yugoslav part of the Danube basin, dieing out under the pressure of anthropogenic factors, and representing the disappearing remains of former great, dense and almost impassable marshes;

3) Biodiversity. The Kovilj wetland represents mosaic of ecosystems: forest, bush meadow, swamp, marsh, and water ecosystems, tightly interconnected in a unique entity. On a whole, being unique natural environment in Vojvodina, this area has a much wider significance from the scientific, pedagogical, cultural, historical, tourism and economical view.

4) Functional connection of aquatic and terrestrial ecosystems of this wetland, reflecting in wide variety of ecological niches for numerous species of wild fauna, has been giving specific feature to this area. The vegetation of this wetland directly depends on the level of surface and ground waters. Depending of water level fluctuations, and on terrain micro relief, the plant community has been differentiated into variety of phytocenoses, which, following the ecological conditions, develop in regular ecological chains, forming an unique composition characteristic for this area;

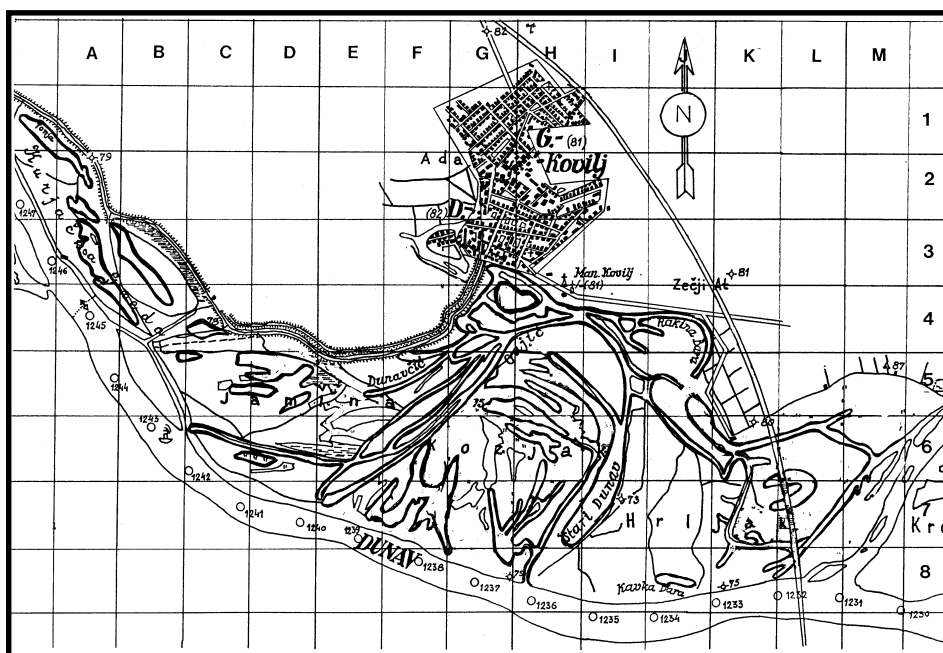
5) Landscape values as attractive natural beauty, as a consequence of mosaic shift of aquatic and terrestrial ecosystems, have also great esthetical values. In such diverse, rich

and wealthy natural forms and phenomena, in their interconnections, and harmonically intertwine, the primordial natural beauty which refine the human spirit, has been preserved;

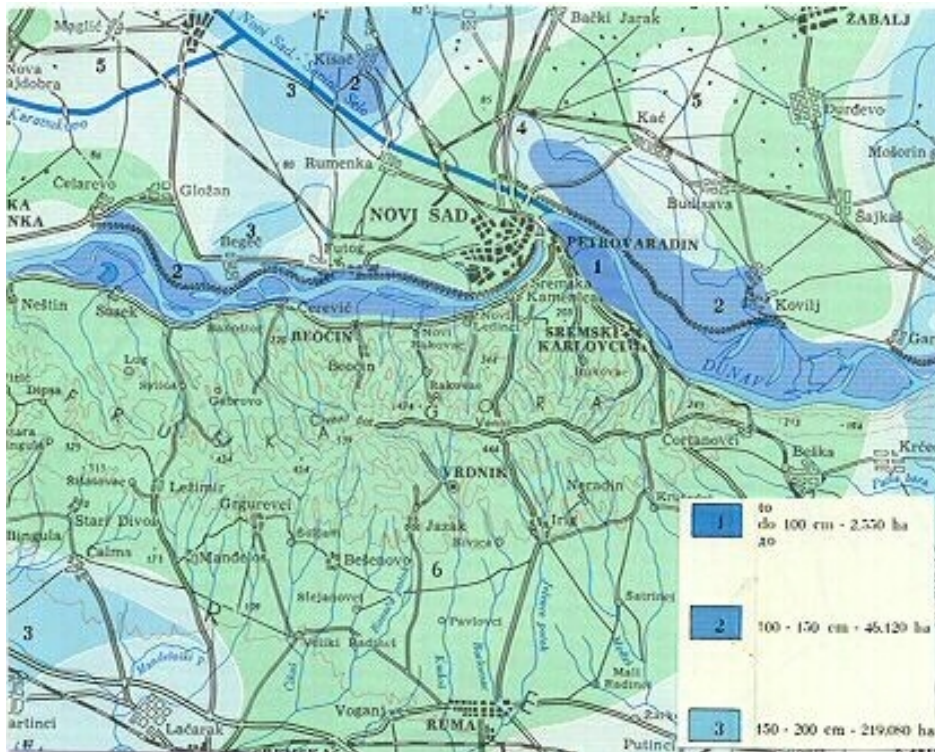
6) Endangered ecosystem. The diversity of flora and fauna of this area has been brought to the critical point of survival. Exceeding this limit could lead to such negative processes, which could reduce the possibilities of reestablishing of former status, or totally prevent them.



Historical maps (the end of XVIII. century) of Kovilj wetland area



The position map of canals and by-canals of the Kovilj wetland – summer situation (1 : 1000)



The distribution of ground waters of Novi Sad city surroundings with Kovilj - Petrovaradin wetland as the main aquifer of the whole town area

7) Ratno ostrvo nearby Novi Sad as the main actual aquifer for the town water-supply is an integral part of this wetland, which could be conditionally considered as the main groundwater resource for the water supply of the whole region in the future. Being of such importance, this project should contribute to the raising of awareness of this special wetland value as well as to the importance of protection, conservation and improvement of this kind of ecosystems in general. Also, the objectives and results should contribute to the achieving of the wise use of this special wetland and of natural resources as a whole.

GEOGRAPHICAL POSITION, MORPHOLOGICAL FEATURES AND STATUS OF PROTECTION

Together with Petrovaradin wetland positioned on the opposite banks of the river Danube, named in Serbian "Koviljsko-Petrovaradinski rit" (Kovilj-Petrovaradin wetland), this area has been proposed for the registration of wetland areas of international significance according to the Ramsar Convention. Kovilj wetland has been situated at the territory of Autonomous Province of Vojvodina, Republic of Serbia, Federal Republic of Yugoslavia, in the South Bačka region (45°11' north geographical width, and 22°02' east

geographical length), from 7 to 25 km downstream of the Novi Sad town. It includes a huge wetland area settled at the left inundation bank of the River Danube (1249 – 1230 river km) and belongs to the River Danube middle flow. From the northwest (Kuryachka greda) the wetland has been widening to the southeast, reaching the width of about 5 km). Total Kovilj wetland area reaches around 4282 ha.



**The satellite photograph ("Salyut" orbital station, 320 km height)
of Kovilj wetland, northwest of Belgrade**

Kovilj wetland itself consists from numerous by-canals, canals and remains of earlier flows of the River Danube, which, in this part of its flow has very small fall and make numerous meanders. On the basis of the Proposal of Institute for nature protection of Serbia, The Government of Republic of Serbia proclaimed a Decree of the protection of Special nature reservation of Kovilj-Petrovaradin wetland (Slu`beni glasnik Republike Srbije - Official herald of Republic of Serbia, No 27/98). The Kovilj-Petrovaradin wetland is being registered as the Natural treasure of special significance and is being classified into I category of protection as the Special Nature Reserve. The protection and conservation of this wetland area is in agreement with Action Plan of protection of rivers and accompanied wetlands in the frame of Paneuropean Strategy for the protection of biological and landscape diversity, accepted at the Strasburg Conference (1995).

First data concerning attempts of the Kovilj wetland protection date from 1970, when the Novi Sad Assembly accepted the Decree about the conservation of one part of Kovilj wetland as a scientific reservation "Kozjak". Today, area of the Special Reservation of Nature Kovilj-Petrovaradin wetland consists of three areas with three levels of protection:

- 1) Kozjak, under the first degree of protection (508.98 ha);

2) Hrljak, Arkanj and Petrovaradinski rit (Petrovaradin wetland), under the second degree of protection (2082.23 ha);

3) Dunavac, belonging to Kalište and Kurjačka greda (Ada Jamina 1, Ada Jamina 2), under the third degree of protection (2249.38 ha).

Such a complex of water surfaces, partly regulated by irrigation system of canals, serving for a long period as a reservation of nature, especially as a swamp bird refugium, in our opinion deserves a special attention as the potential biodiversity reservation in general.



Typical landscape in Hrljak area of the Kovilj wetland

ENDANGERED NATURAL TREASURE

Flora and fauna of Kovilj wetland have been threatened first of all by changes in surface flooding and ground water regime. As a consequence of neglected activities of cleaning and maintenance of canals, the main by-canal of the Danube River that was serving for supply of the whole wetland area by surface water, has been filled in by sand and water debris. The long-term drought during the bigger part of year, contributed also to disturbance of water supply of this area. Especially the level of ground water was considerably low, what endangered hydrophilic ecosystems: swampy meadows and wetland vegetation, directly influenced by high level of ground water or by periodical flooding.

This area has been also endangered by the influence of constant influx of non-purified wastewaters loaded by organics and other harmful ingredients that through drainage canals and using pumps for irrigation of surrounding agriculture soil reach wetland waters.

In Kovilj wetland area during last few years as a consequence of non-controlled felling of autochthonous woods and other anthropogenic activities, the considerable ecological changes could be noticed. Main contribution to these changes gives poplar plantation, and water flows blocked by naturally or artificially formed dams. These changes unavoidable direct to changes in biocenoses, what cause very negative consequences to the fauna of this area. One of significant factors that endanger the intrinsic flora and fauna of this wetland turned to be also excessive grazing by domestic animals, what finally direct to changes of sinecological properties of this ecosystem.



Typical landscape nearby the Kovilj village (Šlajz)

From reasons stated above, in the whole Kovilj wetland area highly forbidden are:

1) Building of any objects or hydrotechnic activities that could prevent periodical flooding and what could contribute to the decreasing of the ground water level, especially by the Renny-wales building. Also all measures that could lead to the orographic and hydrographic changes, transforming of wetland ecosystems to the terrestrial, what would endanger natural spawning places;

2) Emptying of any nonpurified wastewaters, burning of plant residues, making landfills and throwing away any kind of solid wastes;

3) Plantation of euroamerican poplar closer than 30 m far from water flow recorded under the circumstances of the river Danube water level of 150 – 300 cm at the peak elevation 71.73 in Novi Sad.

It is made possible:

1) Recording of conditions and characteristics of all types of environments, plant associations, biocenoses, plant, fungi and animal species, especially natural rarities, as well as institution of regular and permanent system of monitoring;

2) Preservation of natural, autochthonous woods, plant associations, further investigations with a general goal of replacement of recent monocultures of *Populus euramericana* by autochthonous woods associations.

3) Preservation and improvement of natural rarities, especially environmental and other conditions for the ornitofauna and ichthyofauna protection.

GOALS

In order to provide optimal functioning of protected area of Kovilj wetland to institute the next activities would be necessary:

1) First of all, the appropriate water regime in this area should be provided. It means that by cleaning of filled in canals and by-canals, the optimal water flow through canals of wetland should be established. In the frame of first stage of this activity, the most important would be reinforcing the capacity of canal Dunavčić that with his water flow supplies the majority of other canals and by-canals. This could be achieved by cleansing of the entrance of the river Danube water into the Dunavchicy, which is connected with Dunavac through the Šlajz, and through the Dunavac with the Stari Dunav (The Old Danube).

Recent situation of the level of the bottom of the entrance of the river Danube into the canal Dunavčić, being around 100-150 cm higher than the level of the bottom of canal serving for emptying the wetland waters into the river Danube, several kilometers downstream, prevent refreshing wetland area with the Danube water during the longer part of the year, especially during dry seasons. Also, mud or river debris, which formed dams and barriers, must be cleared away in number of canals and by-canals. That would be done by existing equipment and qualified staff of DTD (Danube-Tisa-Danube Canal Network Authorities) from Novi Sad.

2) The recent status of the water quality of the Kovilj wetland complex should be also evaluated, a sources of pollution should be identified, and afterwards an autopurification capabilities of aquatic ecosystem should be estimated. Also, the degree of pollution of soil and water by oil and derivatives spilled from, by NATO bombing destroyed Novi Sad oil refinery, should be ascertained. Since in the most of his activities a man is being directed more and more to the exploitation of surface freshwater resources, a need of the protection and improvement of the water quality of this resources becomes more and more imperative. The fact that aquatic microorganisms, by their qualitative and quantitative composition, reflect conditions of their habitat, gives us the opportunity to use them as bioindicators of type and degree of water pollution.

Water microorganisms, especially bacteria and microfungi, represent the most important factor of the organic matter decomposition in aquatic ecosystems. By their polyenzymatic nature, metabolic diversity and adaptation ability, microorganisms successfully degrade all kinds of natural organics, and the most of human made ones. This is a reason that they appear to be good indicators as well as active factors of the water autopurification processes. The nature and the pollution degree of the surface freshwater, the level of saprobity and the eutrophication degree, as well as the potential autopurification capability of water ecosystem could be estimated using various microbiological parameters such as quantitative

and qualitative composition of specific groups of bacteria, fungi and algae, as well as using data considering their metabolic (enzyme) activity. In the frame of this first step, as a priority we propose investigation of qualitative and quantitative composition of plankton communities, as a water condition indicators, as well as a qualitative and quantitative composition of mosses, macrofungi and lichens of bank region as a specific air pollution indicators.



***Populus euramericana* monoculture woods along some canals**

It is also known that the aquatic and semiaquatic vascular macrophytes play a significant role in a water ecosystems. They represent the most important autotrophic organisms being the main, primary producers of organic matter, as well as being responsible for the production and the water enrichment by oxygen. Besides of that, they serve as a very powerful antierosive factor and their underwater parts serve as suitable ecological niches for numerous organisms (perifiton). Also, by their specific construction and composition, the vascular water plants act as excellent mechanical and biochemical biofilters, since they have ability to absorb different (even toxic) matter from water.

From a reasons stated above we propose the investigation of quantitative and qualitative composition of ambiental (aquatic) microorganisms and their metabolic (enzyme) activity, as well as the presence and distribution of pollutants (radionuclides and heavy metals) in aquatic vascular macrophytes (especially species of a bioindicative values), what would give us the information concerning the level of pollution and degradation of investigated Kovilj wetland ecosystem. From the data obtained we expect to be able to estimate the level of water pollution and to suggest the measures which should be undertaken in order to prevent further degradation of investigated ecosystem. We are also aware that obtained results could serve as a valuable experience in a solving similar problems of other regions.

3) The analysis of influence of building of any commercial object in the surrounding on this aquatic ecosystem as an obligation has been also established. The investigations of influence of waste waters, originating from closer and broader surrounding region, will be continued. That will be conducted by experts of Institute for

Nature Protection of the Republic of Serbia and by Authorities of Assembly of Autonomous Province of Vojvodina.



One of protected bird species (*Ardea sp.*) nesting in Kovilj wetland



Protected species, *Nuphar lutea* – yellow water lilly, from the Šlajz locality

4) The reevidence of recent faunistic, floristic and vegetational characteristics of this area we find also as potentially useful from the aspect of conservation of such a habitats serving as last refugiums of endangered swamp species, consequently, serving as specific genofond diversity reservations. Conservation, protection, and even an improvement of existing ecological balans of natural environment has been estimated as a main problem of recently proclaimed sustainable economic development in general, considering also the ecosystem of Kovilj wetland. The estimation of feasibility of wise use of wetland area without endangering biodiversity could be done on the basis of obtained results of these investigations.

This is the local problem, but in the same time, the regional problem too, because all countries of the South-eastern Europe, potentially involved in realisation of proposed Project of wetlands conservation, face the same problem – the enviroment endangered and species threatened by increased environmental pollution. The experts from the Institute of Nature Protection of the Republic of Serbia and from the Institute of Biology, University of Novi Sad, would be dealing with this subjects.

A problem of Kovilj wetland ecosystem protection and conservation has a lot in common with the problem of the protection and conservation of another simmilar aquatic ecosystems situated in Serbia, Montenegro, Croatia, Bosnia and Herzegovina, Hungary and Romania, investigated recently with an aim to become a protected swamp birds refugiums. All these aquatic ecosystems (Kovilj wetland, Carska bara and Obedska Bara swamps in Serbia, Skadarsko lake in Montenegro, Kopački rit wetland in Croatia, Bardača in Bosnia and the River Danube Delta in Romania, have in common that they have been situated at the migratory birds north-south routes, what emphasize their significance in the global protection of this group of birds. The problem which also seems to be in common for all of listed wetlands is the threat of ecological balans by pollution caused by human settlements, commercial objects, and agricultural production situated in their surroundings.



Protected species, *Nymphaea alba* – white water lily, from the Arkanj locality

Our team of prominent research workers from the Institute for the Nature Protection of the Republic of Serbia; Faculty of Natural Sciences and Mathematics, University of Novi Sad, has been dealing with this type of research for more than 30 years. With our competence we would conduct the proposed Project with scientific experience, organization of research and supervision of work of young research coworkers organized in NGO “Josif Pančić”, Student biological research society in Novi Sad. Also, technical and research equipment of our institution would cover all needs of research work proposed.



**Small yellow water lilly (*Nymphoides flava*) from the Stari Dunav
(The Old Danube canal)**

In the frame of this first step, as a priority we propose starting of:

- 1) Investigation of qualitative and quantitative composition of bacterioplankton, phyto- and zooplankton communities as well as benthic fauna as a water quality indicators;
- 2) Evidence of vascular aquatic macrophytae cover and phytocenotic composition;
- 3) Evidence of quantitative and qualitative composition of fungia, especially evidence of lignicolous fungi and lichenes as air pollution indicators;
- 4) Investigations of radionuclides and heavy metals content in aquatic vascular flora, in river shells (mollusc), in representative fish species, as well as in the river sediments;
- 5) Investigations of changes in number and pigment content in macrophages of the frog liver as an indicator of environmental pollution by hydrocarbons and pesticides;

6) Investigations of heavy metals in mosses as air pollution indication;
7) Cleansing the filled in canals of mud and debris, especially the main entrance of canal Dunavchicy (Dunavčić) in order to enable watering of the whole wetland area, even during dry season with the river Danube low water level;

8) Evidence of localities polluted by oil and derivatives flowed out from, by NATO bombardment destroyed Novi Sad oil refinery, and biotretability studies (investigations of possibilities of bioremediation by intrinsic microflora).

Comparison of results of investigations obtained before and after cleansing of Dunavčić, Dunavac, the Old Danube (Stari Dunav), and other canals and by-canals participating in wetland area water supply, would give us evidence about effectiveness of undertaken measures of Kovilj wetland revitalization.

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