



Experiences in meander restoration in Kopački rit nature park

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SUMMARY: Kopački Rit Nature Park (area 18.000 ha) is a part of Danube river at the mouth of Drava river to Danube. This unique area consists of naturally flooded forest and numerous meanders and tributaries from previous Danube river bed. Natural river flow followed by river erosion processes and river bed moving is still present in the area. Still minor human impact was present at several locations basically by constructing barriers in Hulovo and Vemelj canals to ensure transport communication for tractors and tracks for wood exploitation. This barriers changed river regime, and erosion/deposition processes in this canal. Kopački Rit Nature Park decided on the basis of water management plan for whole Nature Park to remove this barriers followed by monitoring program. By the government of the Netherlands through ECNC, some initial financing support was established and first barrier at Vemeljski Dunavac was removed.

Paper presented topics of this problem, expected results and monitoring program which will verify this action.

KEYWORDS: Kopački Rit, Nature Park, Meander restoration, Natural flow program

1. General

Nature Park Kopački Rit area is a part of the Danube flooding area situated at the mouth of the Drava River into the Danube and as such it is one of the last significant wetlands in Europe.

Complete looks of the area shows us that everything in Kopački Rit was, is and will be either created or destroyed by the water. Dynamics of floods and droughts, bed changes of the Danube and Drava River along with the movement of the mouth of Drava into Danube gave the distinctive look to the Kopački Rit area. Pieces of land and water surfaces of different shape and size are creating a beautiful mosaic that varies in shape, size and function depending on the water regime. Despite to the fact that if observed on larger scale the landscape of Kopački Rit is flat the smaller scale reveals the complex landscape with variety of water surfaces (lakes, puddles, canals).

It took thousands of years and thousands of droughts and floods for waters of the Danube and Drava to create unique morphology of the Kopački Rit. The landscape created presents home for various species. Water regime of the Danube and Drava gave the basis for the biodiversity of the Kopački Rit area that speaks of great value.

Since the area is well preserved as wetland ecosystem, the vast biodiversity and enormous scientific and ecological value the area of Kopački Rit was protected as Managed Natural Reserve in 1967. The protected area covers 17.730 hectares out of which the 7.220 hectares in 1976 gained status of Special Zoological Reserve and the wider area if 10.510 hectares gained status of Nature Park. International importance of the Kopački

Rit area was acclaimed in 1993 when the area was placed on the list of internationally important wetlands in accordance to the Ramsar convention.

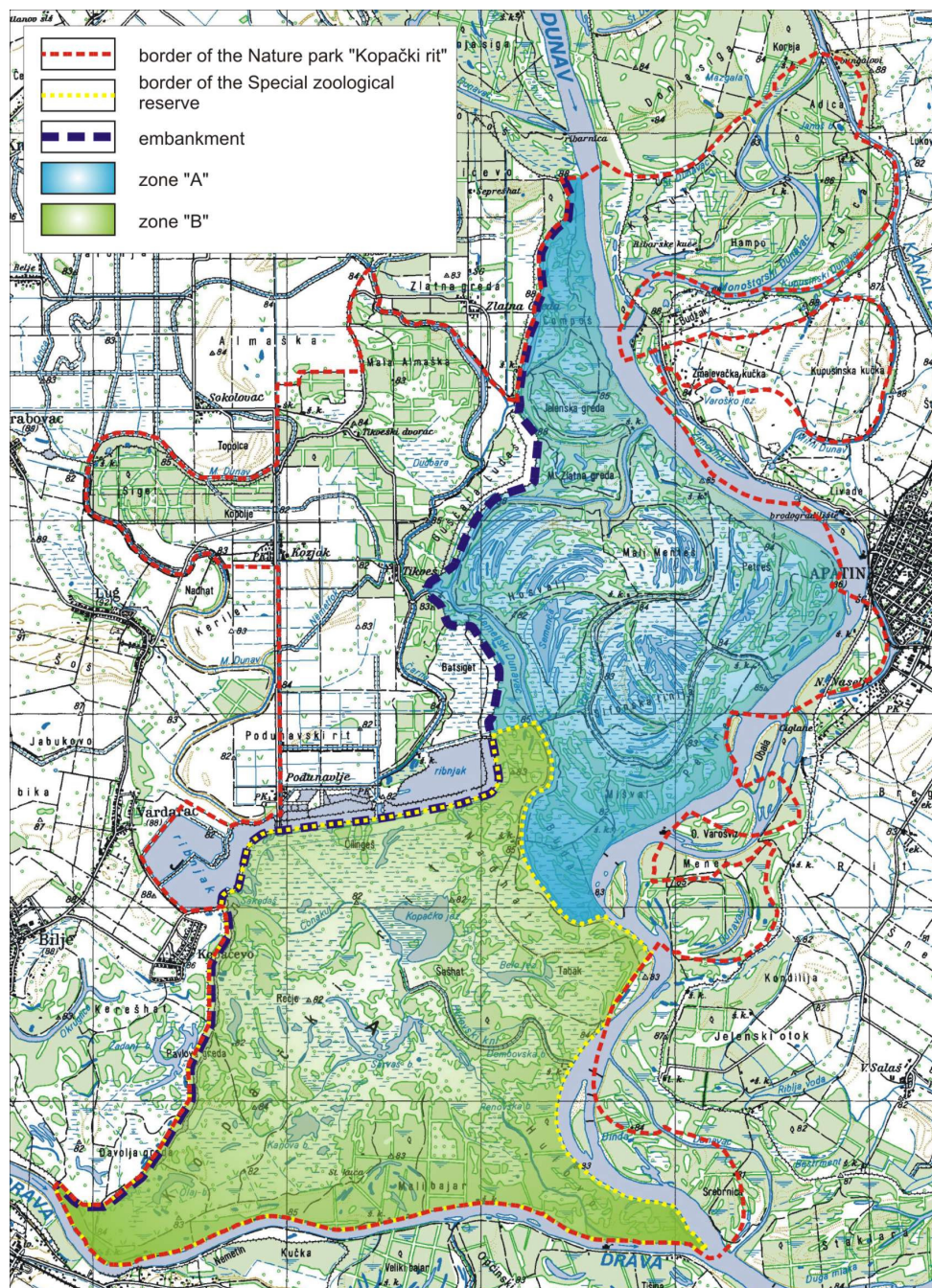
Biodiversity and preserved nature greatly depend on existing hydrological regime on the Kopački Rit area. Hydrological regime of the area is dominantly influenced by the hydrological regime of the Danube and is far less influenced by the hydrological regime of the Drava River. In the past decades negative morphological processes were observed in the Kopački Rit area as well as on the Danube and Drava rivers, i.e. sediment deposition in the Kopački rit area was observed along with the deepening of the Drava and Danube beds. The addressed processes are partially natural yet to a larger extent they have anthropogenic roots and they result in water shortages in the Kopački Rit Nature Park. If such a trend in sediment deposition and bed deepening is to continue it will result in undesirable morphological changes that would lead to decrease in biodiversity. It is impossible to have impact on the hydrologic regime of the Danube and Drava river due to the character of those large rivers the intent was to remove the anthropogenic influence in the Kopački Rit area through barrier removal on the main canals of the area.

Kopački Rit Nature Park area in the Danube inundation has 17.730 hectares (picture 1) and is consisted of the Special Zoological Reserve and upstream part of area that follows previous Danube beds with stressed and visible meander forms.

Northern part – zone “A” is characterised by the permanent water flow parallel to the flow direction of the Danube. The area is characterised by the levees and ponds that are indicating constant movement of the Danube. Water is flowing through numerous natural canals (parts of the old Danube bed) and some artificial canals. The flow direction is from north to the south towards the lower (south) part of the Kopački Rit. Main canal of the zone “A” is Vemeljski Dunavac. The sedimentation processes in the zone “A” are not too intense and the dominant changes are in relation to the deposition of the sand mainly on the Vemeljski Dunavac canal.

South part – zone “B” is typical wetland area predominated fluvial landscape. In this area the waters are dominantly still creating swamps and shallow lakes. Vertical component of the water balance is dominant for this area and water exchange depends primarily on water levels of the Danube. The main canal of the area is Hulovski canal which transports the Danube waters in and out from the zone “B”. Deposition of the fine silt muddy sediment is present. Sediment is rich with organic matter and nutrients that provide conditions for development of flora and fauna. On the other side due to the high concentrations of nutrients the zone “B” is potentially endangered by eutrophication.

During the high water levels zones “A” and “B” are connected over the natural barriers Nadhat, Feher, Siladhat and Maticева barrier, while during lower water levels zones “A” and “B” are not connected. Previously zones “A” and “B” were connected by the Nadhat canal yet today this canal is filled with soil and is out of function.



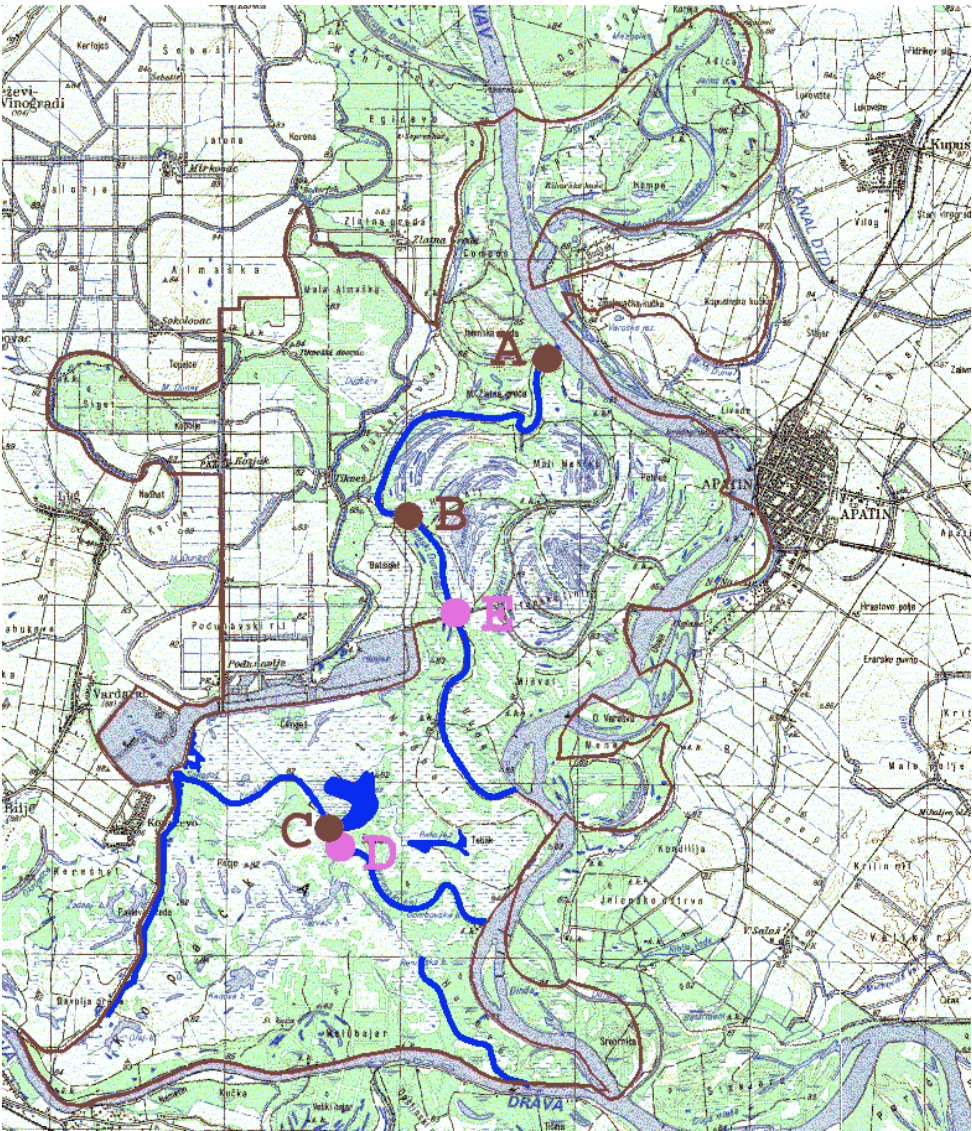
Picture 1: Schematic of the Nature Park Kopački Rit

2. Human impact & changes

Previously mentioned ecological and scientific value of the Nature Park Kopački Rit was the main reason for the making of the Kopački Rit Nature Park Management Plan (Elektroprojekt d.d. Zagreb, 2003). Management Plan was created on the basis of Sector Studies that covered different themes important for the Kopački Rit. During the preparation of the Sector Studies all of the existing relevant data was processed and thorough field surveys were made. After all of the data was processed and analysed the Sector Studies Hydrology and Meteorology, Water Management and Infrastructure were finalised (all created by Hidroing d.o.o. Osijek, 2002). The above mentioned Sector Studies cover all of the water issues in the Nature Park.

Mentioned Sector Studies analyse existing conditions in the Kopački Rit Nature Park. From all of the mentioned Sector Studies one can easily conclude that the anthropogenic influence is present in the area for quite a long time (river regulations and flood prevention going back some 300 years). The second important fact that is mutual in the Sector Studies is that monitoring of hydrological parameters does not exist except on the rivers of Danube and Drava. The Water Management Sector Study has found and defined locations where significant morphological and biological changes occur as a result of devastated water regime. The main problem at those locations is in recognising if the source for the change is natural or anthropogenic. Since there is no observed hydrological data equally significant problems occur when an attempt of restoration is made.

Regarding the addressed problems the Project for the removal of anthropogenic influences was started. The funds for the project are donated by Government of the Netherlands through The European Centre for Nature Conservation (ECNC). Only the locations with clear and unquestionable manmade influence are addressed by the Project. The locations of the artificial barriers on the main canals of Kopački Rit (Hulovo and Vemeljski Dunavac) have been found as the most harmful for the water regime of the Kopački Rit Nature Park. Intention of the project is to remove the artificial barriers that are in the middle of the canals while the barriers on the mouth of the canals to Danube are not to be moved as the removal of those barriers would do more damage then good. Hydrological monitoring was predicted as a part of the Project in order to gain basic knowledge on hydrological parameters on main canals of the Kopački Rit Nature Park. The idea was to monitor hydrological parameters on the canals prior to barrier removal and then again after the removal is made in order to compare the values and use the monitoring to track the changes after removal. Picture 2 shows locations of the barriers and monitoring on the Hulovo and Vemeljski Dunavac canals. Points A, B and C present locations of the barriers that will be removed and points D and E present the monitoring locations.

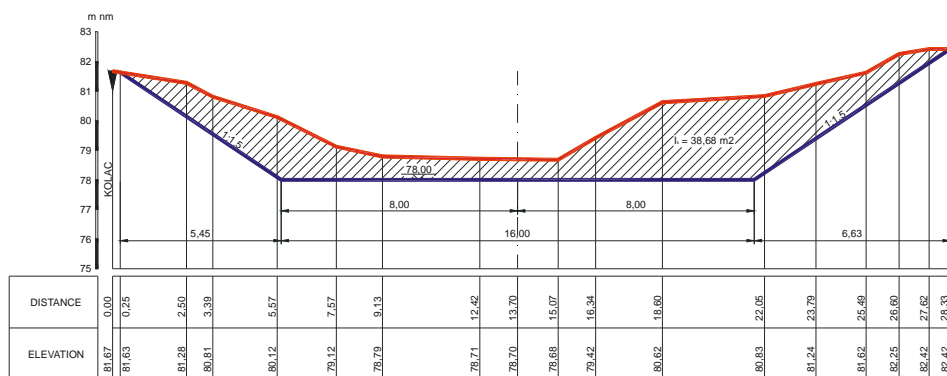


Picture 2: Barrier removal and monitoring locations

3. Monitoring & Barrier removal (channel restoration)

As it was previously stated the Project incorporated the monitoring prior to barrier removal with the intent to follow the changes after the barriers are moved. The Project was intended to provide basic information of the hydrologic parameters on the main canals and to provide better water regime through barrier removal. In the ideal case all of the activities, i.e. Sector Studies, Management Plan, Barrier removal and Monitoring, are to result in better water management in the Nature Park and are to provide environmentally acceptable appearance and more natural water regime.

Actions on the monitoring and the designs for the removal of the barriers started simultaneously in July of 2003. Unfortunately, due to climatic and hydrologic conditions (drought) it was impossible to monitor the hydrological parameters on canals. Documentation for the removal of barriers was designed to remove all of the human made impact and to preserve natural shape of the canal without the use of artificial or natural materials or constructions made out of them. The stability of the banks after the barrier removal is preserved by applying 1:1.5 slopes for the banks (picture 3). The 1:1.5 is natural slope for the canals in the Nature Park Kopački Rit.



Picture 3: Characteristic profile of the Barrier C on Hulovo canal

Designs and tender documentations for barrier C were finished in October 2003. The Barrier C was made out of geotextile and sandbags on the almost on the contact between the Kopačko lake and Hulovo canal. The water surface reduction of the Kopačko lake and changes in Hulovo canal are so significant that it was decided to move the barrier C even without hydrological monitoring. The barrier was successfully removed and all of the work that is left to be done is to remove the geotextile that was left to dry on the banks. Picture 4 shows the Hulovo canal on the location of the barrier before and after the removal.

Design documentation for the barriers A and B on the Vemeljski Dunavac canal was finished in December 2003. The barriers will be removed in 2004 and the Nature Park will try to find additional funds for hydrological monitoring. Principles for the design of the removal for barriers A and B are the same as for the barrier C. Even though those barriers are made out of different materials and for different purposes they all produce negative impacts and therefore have to be removed.



Picture 4: Barrier C location (August 2003 and February 2004)



Picture 5: Barrier “A” (July 2003)



Picture 6: Barrier B (July 2003)

4. Conclusion

Though it seems small and limited human impact causes great changes. Good example to support this theory is barrier B where the barrier was constructed out of timber and brick waste to ensure crossing of Vemeljski Dunavac during low water levels for wood exploitation. This barrier caused significant morphological changes, i.e. deposition upstream and erosion downstream from the barrier, thus creating flow obstruction that deteriorated living conditions for the wildlife downstream.

Barrier C was constructed in order to provide longer water periods in Kopačko Lake, that is to provide more favourable conditions for wildlife. Despite the good intentions the barrier resulted in sediment deposition, i.e. reduction of water surface.

The two examples are the genuine example how not to manage water. This fact should be considered in canal restoration to avoid even greater negative impacts that are, unfortunately, hard to oversee since there is no measured data on hydrological factors in the Kopački Rit Nature Park. To confirm the above mentioned hypothesis it is necessary to implement constant monitoring in the Nature Park.

Gradual removal of the barriers and canal restoration, along with monitoring of the changes on the canals and in hydrological parameters present the right way in efforts of recovering natural regime and look to the Nature Park Kopački Rit.

The question rises: "What is the natural condition of Kopački Rit?"

Natural condition is change, and change in Kopački Rit is constant and independent of humans. The drying processes in Kopački Rit are conditioned by constant lowering of surface waters of the Danube and Drava rivers.

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