Forum Meeting of the Project "Preparing FAIRway 2 works in the Rhine-Danube Corridor„

Kopačevo, Croatia / Hrvatska /27. September 2023/

Protection and preservation of water and water-dependent ecosystems in Kopački Rit Nature Park as part of Naturavita Project

Zaštita i očuvanje voda i o vodama ovisnih ekosustava u Parku prirode Kopački rit u sklopu projekta Naturavita

Ivan Tot, dipl.ing.geol.

HRVATSKE VODE

NATURAVITA

EUROPSKI STRUKTURNI I INVESTICIJSKI FONDOVI

Europska unija
Zajedno do fondova EU

- NATURAVITA - Demining, restoration and protection of forest and forestland in protected and Natura 2000 sites in Danube-Drava regions

- Total project value is EUR 49,971,620.31, of which 85% is co-financed by an EU Cohesion Fund grant

- The project is in its entirety implemented on the territory of Osijek-Baranja County and covers forests and forestland in Natura 2000 and protected areas

- Project implementation period: 23 June 2015 – 30 November 2023

PARTNERS

KOPAČKI RIT Park prirode Nature Park

HRVATSKE ŠUME

REPUBLIKA HRVATSKA
Ministarstvo unutarnjih poslova
Ravnateljstvo civilne zaštite

HRVATSKE VODE

REPUBLIKA HRVATSKA
Ministarstvo regionalnoga razvoja
i fondova Europske unije

Project objectives

- General project objective: demining, restoration and protection of forests, forestland and water resources in the Naturavita project area
- Specific objectives:
  - Demine forests and forestland in the project area degraded as the result of the Homeland War
  - Restore forests and forestland in the project area in order to improve beneficial forest functions
  - Improve the protection of forests and forestland in the project area and mitigate adverse effects of biotic and abiotic factors on forest ecosystems
  - Improve education and raise public awareness about biodiversity and values of ecosystem services and the importance of sustainable management of forests, forestland, water and water-dependent ecosystems

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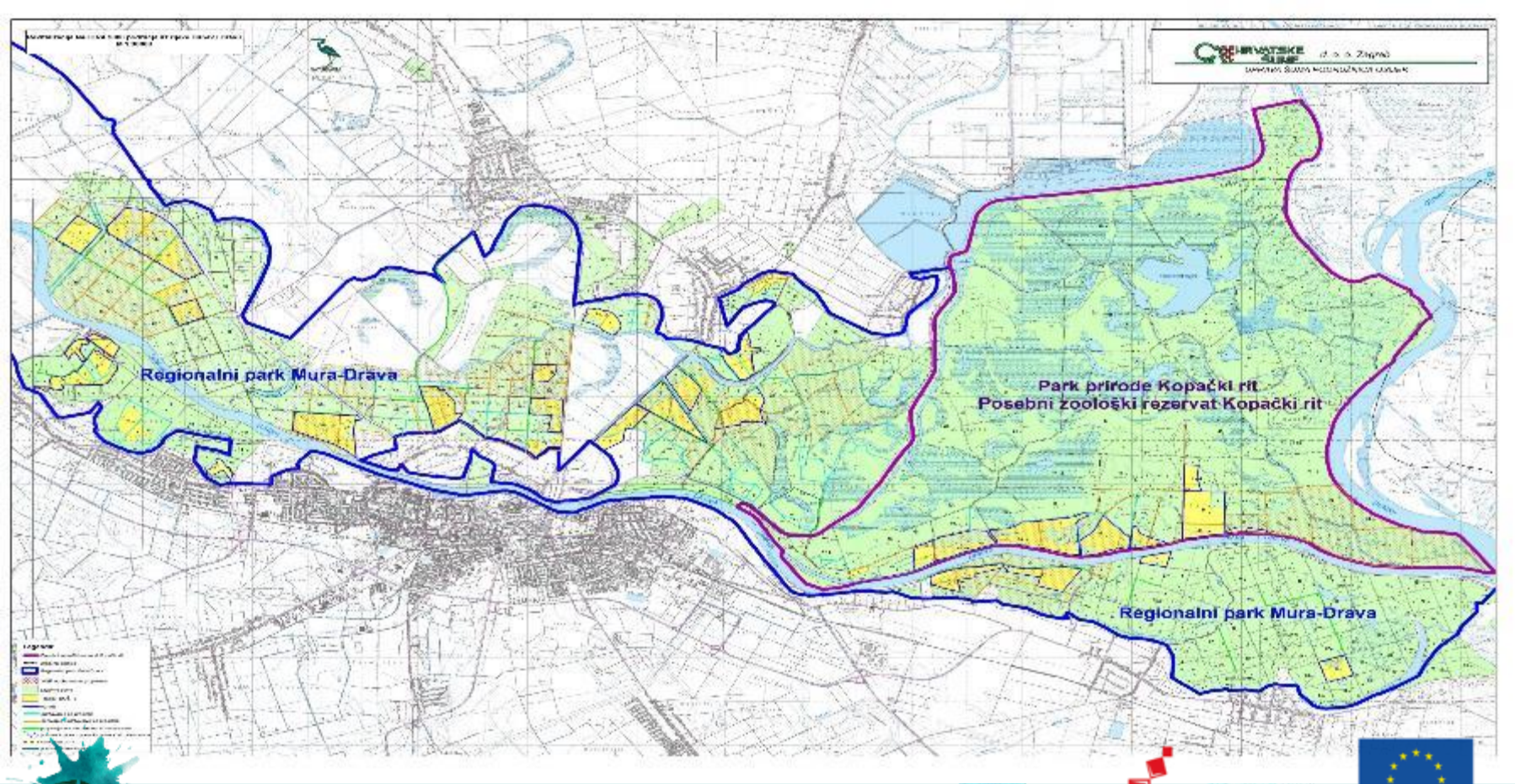
- The project is implemented in the „Kopački rit” Nature Park (KRNP) and in the Mura-Drava Regional Park, one of Europe’s richest ornithological habitats
- The area where the project is implemented is to the greatest extent defined by rivers and large wetlands rich in flora and fauna



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Project results

- More than 25 km2 of forests and forestland in the Kopački Rit Nature Park and Mura-Drava Regional Park demined
- Biological restoration of forests on 868.87 ha
- Fire protection of forests improved
- Reconstruction of the Podravlje forest lodge and establishment of the „Podravlje“ educational visitor centre with 4 educational and recreational trails and open-air classrooms
- Definition of the baseline state of the aquatic ecosystem, management goals and measures for their achievement
- Monitoring system for the restoration and preservation of water and water-dependent systems established and the Restoration Study for KRNP Aquatic Systems prepared

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Activity A7. Protection and preservation of water and water-dependent ecosystems

HRVATSKE VODE

SUB-ACTIVITIES

1. Identification of the retention capacity and baseline status of water and water-dependent ecosystems of the Kopački rit Nature Park floodplain
2. Exploratory works, establishment of system and implementation of monitoring with interpretation of results
3. Preparation of a restoration study for aquatic ecosystems in the Kopački Rit Nature Park floodplain

HRVATSKE VODE BUDGET

- **The budget planned for project activities of Hrvatske vode: 3.022.243,38 EUR, including 85% EU co-financing in the amount of 2.568.906,87 EUR, and 15% share of Hrvatske vode in the amount of HRK 453.336,51 EUR**

- **21 contracts signed**

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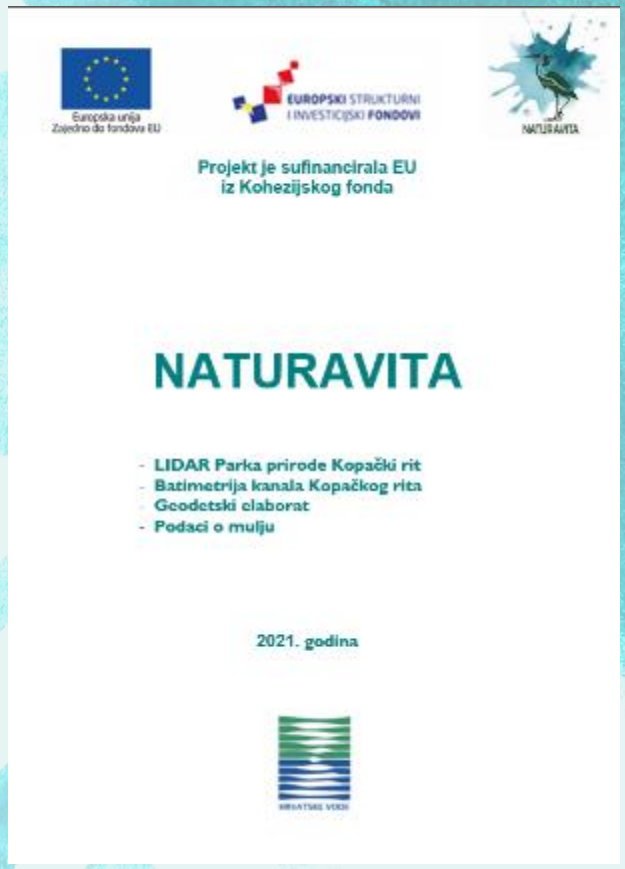
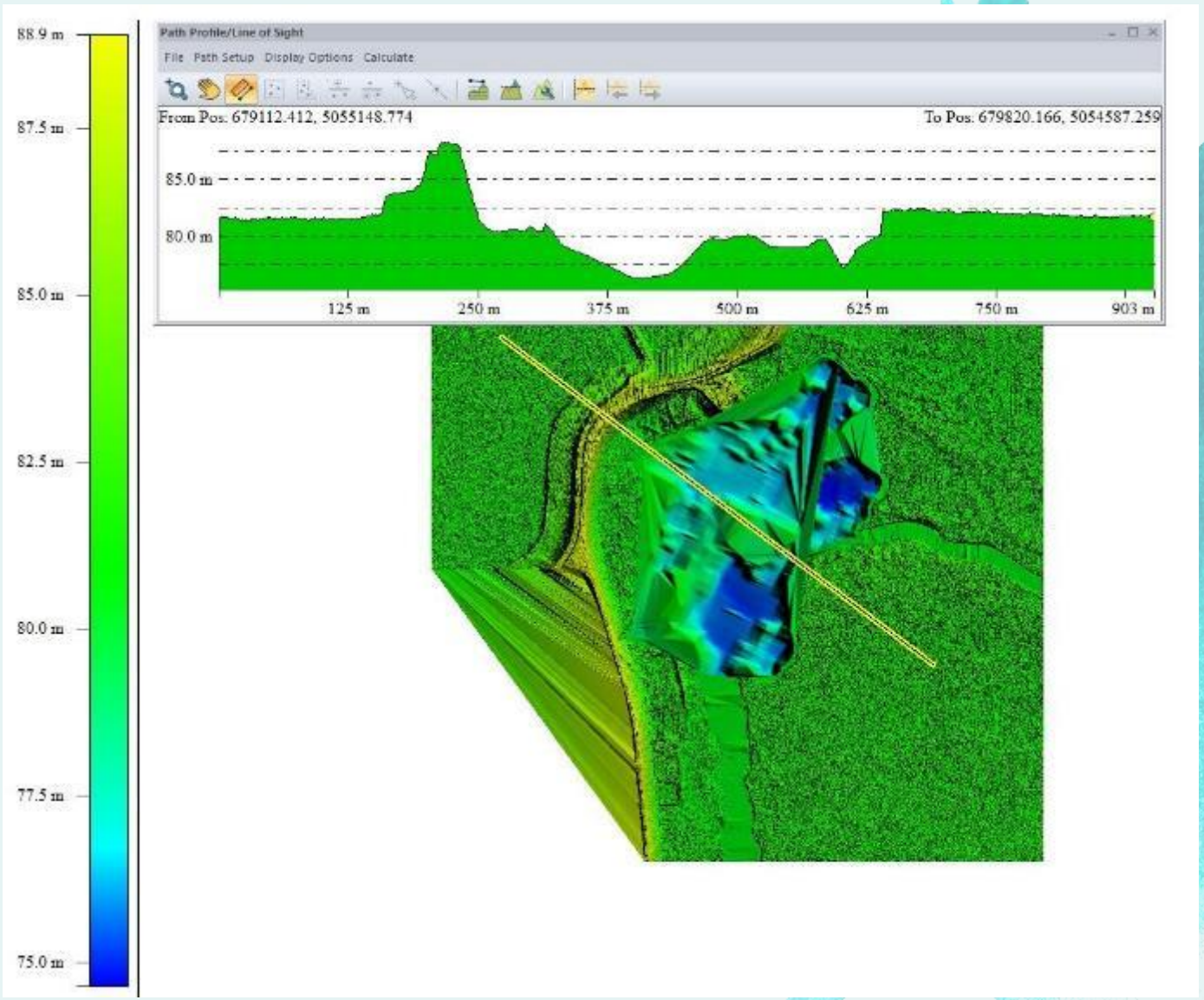
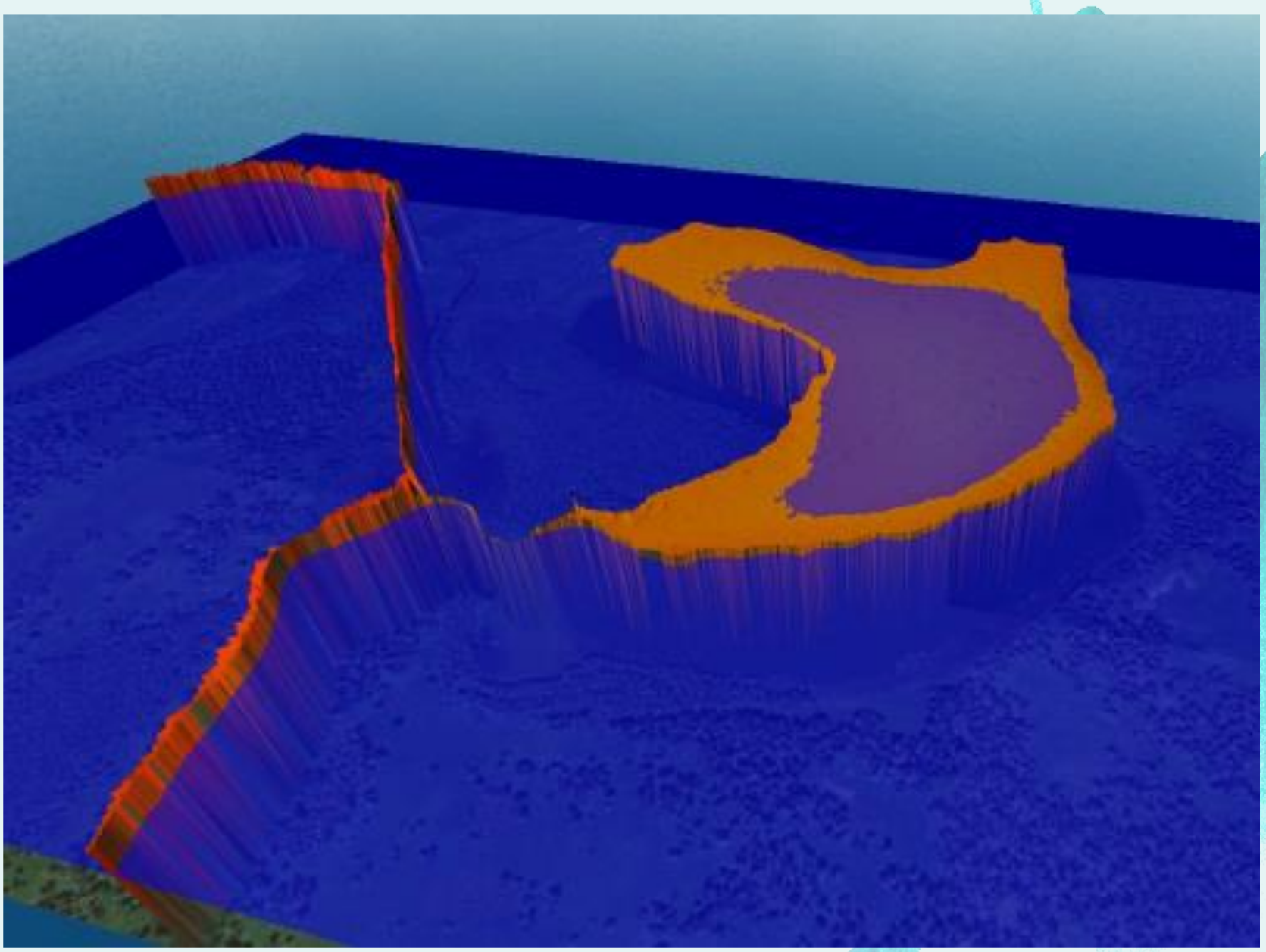
Subactivity 1.
Identification of the retention capacity and baseline status of water and water-dependent ecosystems of the floodplain of the Kopački rit Nature Park

- **Development of 3D elevation model of the Kopački Rit Nature Park floodplain**
  - **3D model developed, all surveyed data delivered**
    (LIDAR, hydrographic data, mud depth data)





Sakadaš – 3D model plan view with display of depths in shades



Kopačko Lake - 3D model incl. water surface at a certain water level

- **Identification of the retention capacity and baseline status of water and water-dependent ecosystems and preparation of the Baseline Study**

  - **BASELINE STUDY**
    - IDENTIFICATION OF RETENTION CAPACITY (climatological characteristics and meteorological conditions; hydro-geographical characteristics and water regime; geological and hydro-geological characteristics; geo-morphological and hydrological characteristics)
    - IDENTIFICATION OF BASELINE STATUS OF RECENT SEDIMENT (sediment, deposit, morphological modifications at locations of hydrological stations on the Drava and Danube Rivers, retention capacity)
    - IDENTIFICATION OF BASELINE ECOLOGICAL STATUS OF WATER BASED ON CHEMICAL AND BIOLOGICAL INDICATORS (chronology of investigations and reference lists)
    - IDENTIFICATION OF BASELINE STATUS – habitats and flora; macrophytes; insects; fish; amphibians; reptiles; birds; mammals;
    - CONCLUSIONS

  +

  - **DETAILED MONITORING PLAN**

SUBACTIVITY 11.
EXPLORATORY WORKS, ESTABLISHMENT OF SYSTEM AND IMPLEMENTATION OF MONITORING WITH INTERPRETATION OF RESULTS

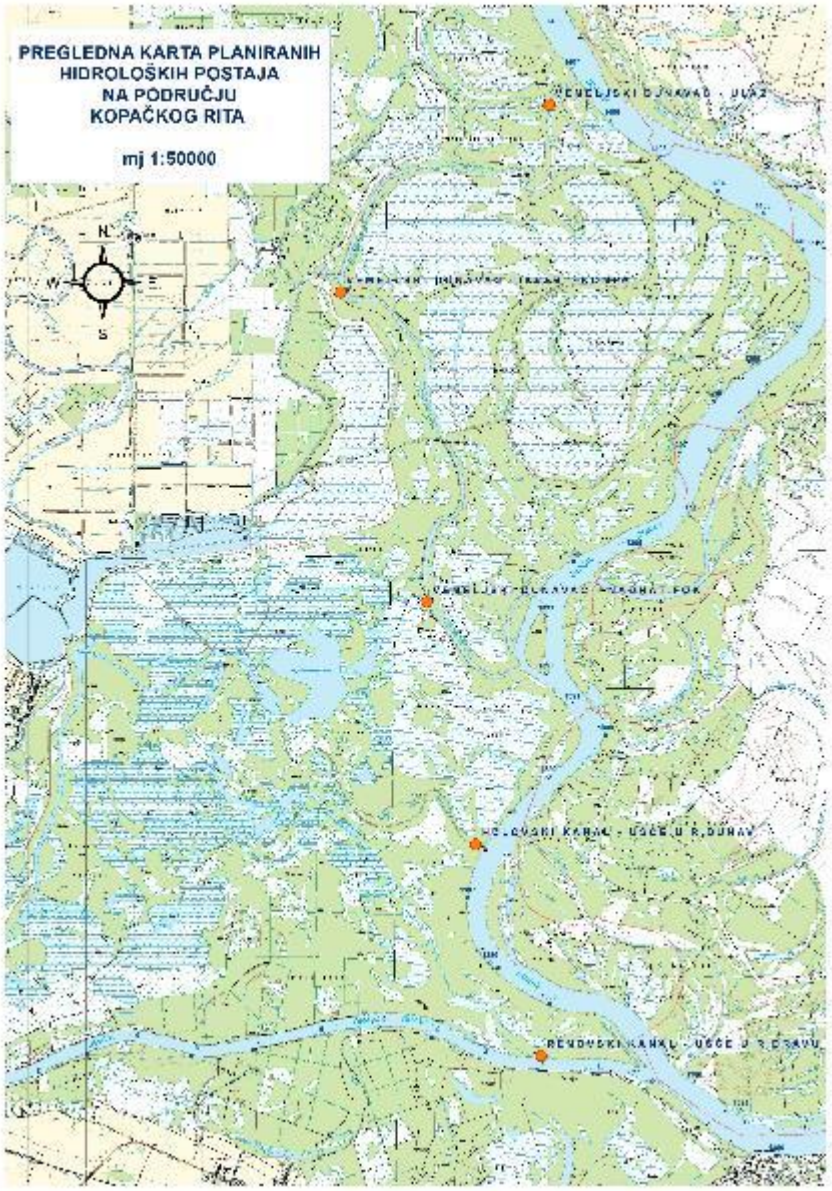
- **OBJECTIVE: Obtain complete and exact data needed for long-term quality management of aquatic systems in the Kopački Rit areas in accordance with the highest protection standards**
- **Includes:**
  - **Establishment of a network of exploratory boreholes – 10 exploratory boreholes have been drilled (9 shallow and 1 deep)**
  - **Establishment of additional water level monitoring profiles – 5 water gauging stations have been built**
  - **Procurement of equipment (for the exploratory boreholes:** 10 data loggers**; for the water gauging stations:** 5 contactless sensors to measure water levels; 4 contactless sensors to measure surface flow velocity (discharge rate); 4 probes to measure suspended solids; 5 data loggers; 5 mobile communication units; 5 solar charging units)
  - **Implementation of monitoring – 10 monitoring contracts have been concluded – on-site support provided by the Public Institution Kopački Rit Nature Park**

Surface water hydrological monitoring

- Includes:
  - Water level (stage) monitoring
  - Discharge monitoring
  - Sediment monitoring
- 5 water gauging stations have been built:

- Vemeljski Dunavac – Entry,
- Vemeljski Dunavac – Tikveš Kompa,
- Vemeljski Dunavac – Nađhat fok,
- Hulovski kanal – Discharge into the Danube
- Renovski kanal – Discharge into the Drava

- The stations are equipped with sensors to measure water levels, sensors to measure discharges, sensors for the sediment, and data loggers



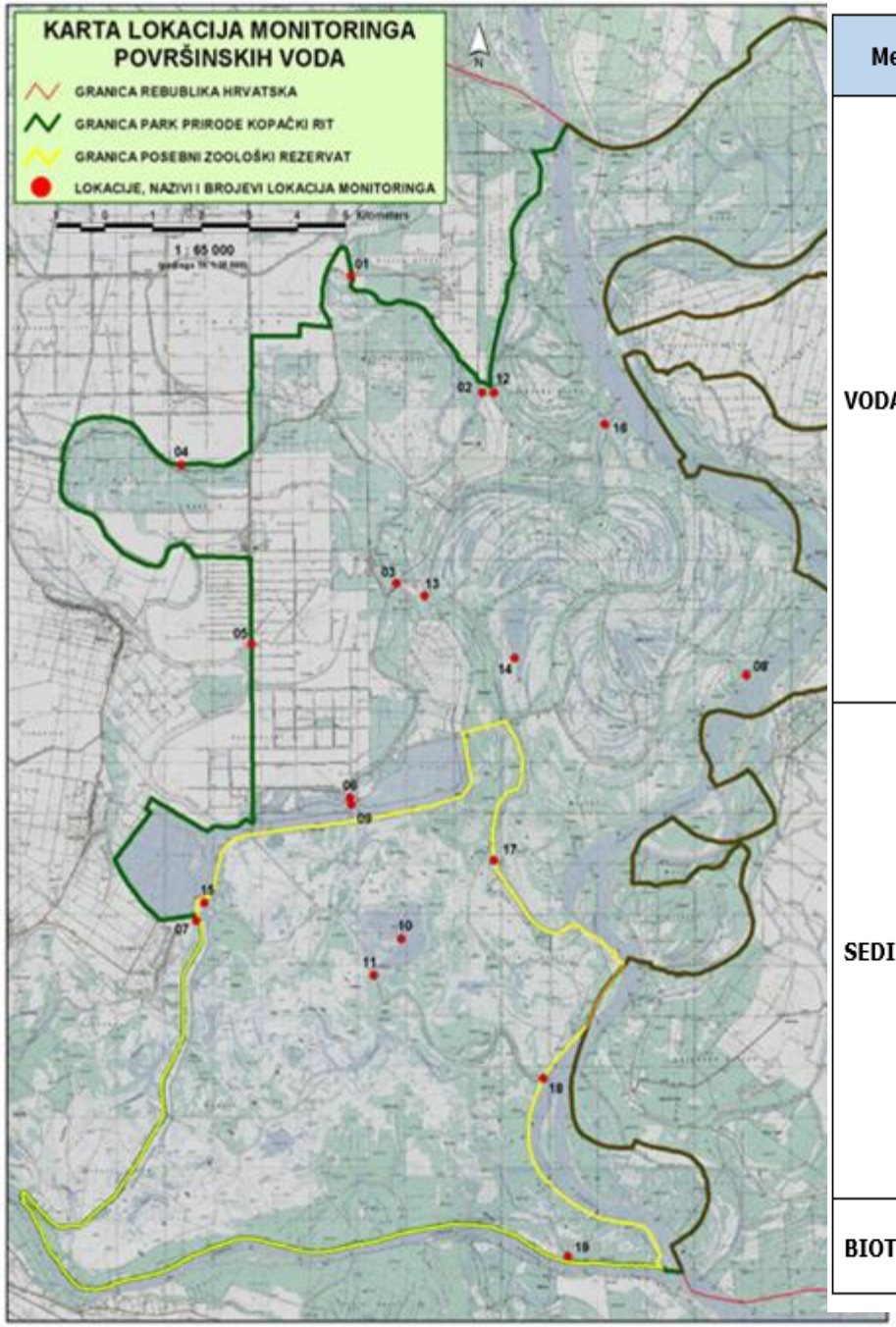
Installation of equipment to measure water levels, discharges and suspended sediment

1. Monitoring of surface water ecological status and monitoring of additional biological indicators

- 36 months of monitoring (ending in October 2023)
- Regular monthly sampling activities
- Biological elements sampled in 15 locations (phytoplankton, phytobenthos, macrozoobenthos, macrophytes, and fish)
- Basic physico-chemical elements and pollutants sampled in additional 4 locations (19 in total)
- The monitoring will serve to make an assessment of the ecological status and/or potential in accordance with the Regulation on water quality standard

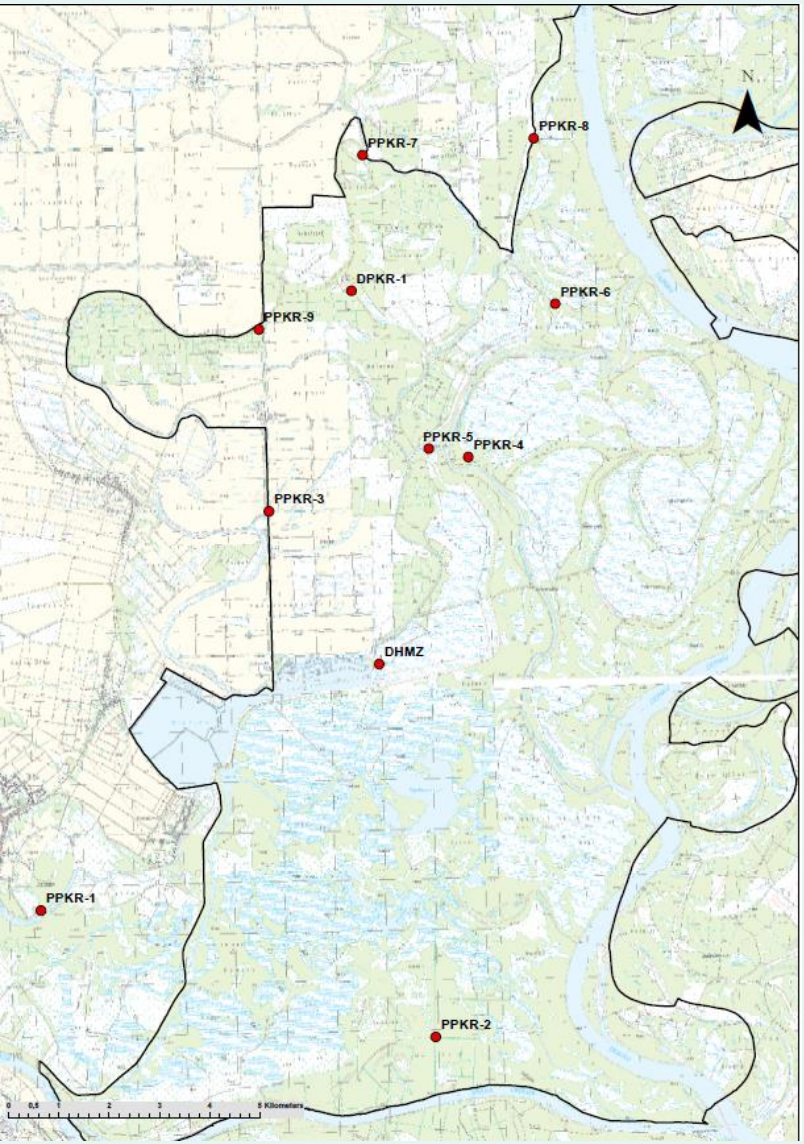
2. Monitoring of surface water chemical status

- 36 months of monitoring
- Performed at 19 stations with different frequencies depending on the group of indicators and the medium



Medij	Skupina pokazatelja	Pokazatelji	Učestalost uzorkovanja
VODA	Metali	otopljeni kadmij	12x u godini (trajanje tri godine)
		otopljeno olovo	12x u godini (trajanje tri godine)
		otopljeni nikal	12x u godini (trajanje tri godine)
		otopljena živa	12x u godini (trajanje tri godine)
	Pesticidi	glifosat	4x u godini (u vrijeme primjene) (trajanje tri godine)
		metoalaklor	4x u godini (u vrijeme primjene) (trajanje tri godine)
		terbutilazin	4x u godini (u vrijeme primjene) (trajanje tri godine)
		2,4-D	4x u godini (u vrijeme primjene) (trajanje tri godine)
SEDIMENT	Metali	kadmij	1x u 3 godine
		olovo	1x u 3 godine
		nikal	1x u 3 godine
		živa	1x u 3 godine
		arsen	1x u 3 godine
		krom	1x u 3 godine
		bakar	1x u 3 godine
		cink	1x u 3 godine
		aluminij	1x u 3 godine
	Anorganski pokazatelji	ukupan fosfor	1x u 3 godine
		ukupan dušik	1x u 3 godine
		TOC	1x u 3 godine
	Organski spojevi	PAH	1x u 3 godine
		Heksaklorcikloheksan	1x u 3 godine
		Ukupni DDT	1x u 3 godine
BIOTA	**Poliaromatski ugljikovodici (PAH)** - u školjkama	Benzo(a)piren	1x u 3 godine

3. Groundwater monitoring – Quantitative and chemical status



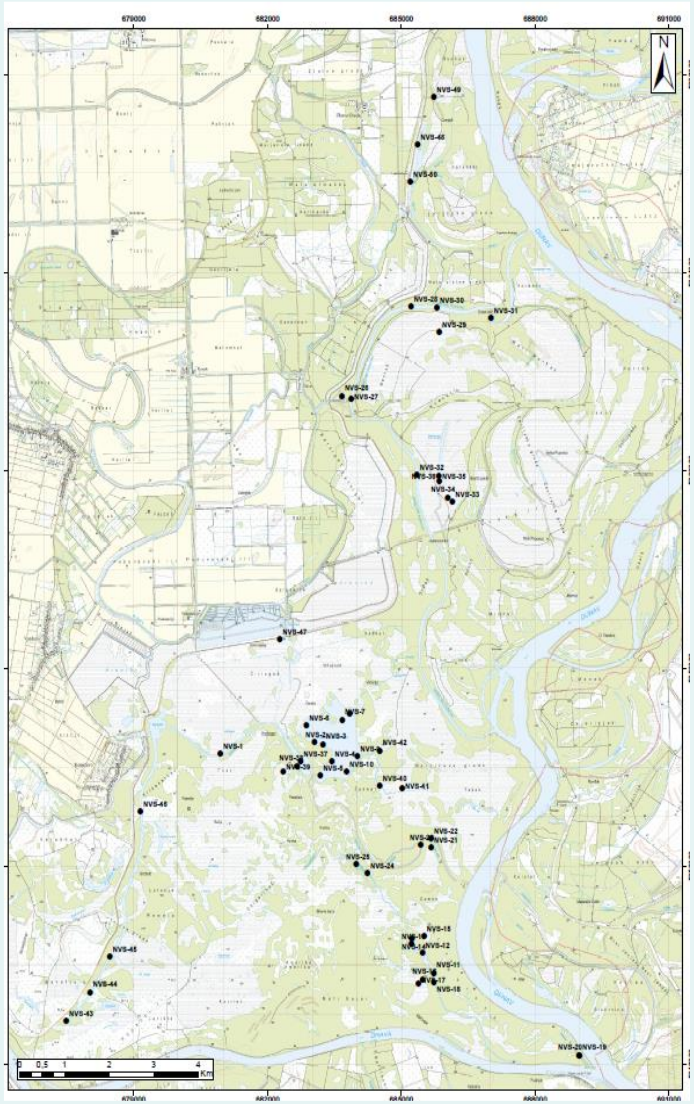
- It is planned to define the groundwater dynamics, hydro-geological parameters, surface water and groundwater connection, and groundwater status determined based on GW quantitative and chemical status
- Elements for quantitative status assessment:
  - Groundwater level,
  - Yield, and
  - Hydrogeological parameters
- The groundwater level is monitored on 10 exploratory boreholes
- Continuous monitoring ensured with the installation of data loggers that record GW level in 2-hour intervals
- 36 months of monitoring (until November 2023)

- Elements for chemical status assessment:
  - Electric conductivity, dissolved oxygen, pH value, basic anions and cations; and
  - Pollutants – nitrates, pesticides and specific pollutants

- Monitoring of groundwater chemical status performed on 5 exploratory boreholes

Pokazatelji	Učestalost uzorkovanja
temperatura vode i zraka	12x u godini (trajanje dvije godine)
pH	12x u godini (trajanje dvije godine)
elektrolitička vodljivost	12x u godini (trajanje dvije godine)
otopljeni kisik	12x u godini (trajanje dvije godine)
osnovni kationi i anioni (Ca, Mg, Na, K, SO4, Cl, HCO3)	12x u godini (trajanje dvije godine)
ukupni organski ugljik (TOC)	12x u godini (trajanje dvije godine)
nitrati	12x u godini (trajanje dvije godine)
amonij	12x u godini (trajanje dvije godine)
nitriti	12x u godini (trajanje dvije godine)
ortofosfati	12x u godini (trajanje dvije godine)
silikati	12x u godini (trajanje dvije godine)
cijanidi	12x u godini (trajanje dvije godine)
fluoridi	12x u godini (trajanje dvije godine)
arsen	12x u godini (trajanje dvije godine)
krom	12x u godini (trajanje dvije godine)
bakar	12x u godini (trajanje dvije godine)
cink	12x u godini (trajanje dvije godine)
kadmij	12x u godini (trajanje dvije godine)
olovo	12x u godini (trajanje dvije godine)
živa	12x u godini (trajanje dvije godine)
nikal	12x u godini (trajanje dvije godine)
aluminij	12x u godini (trajanje dvije godine)
željezo	12x u godini (trajanje dvije godine)
mangan	12x u godini (trajanje dvije godine)
organofosforni pesticidi	4 x u godini (trajanje jednu godinu)
triazinski pesticidi	4 x u godini (trajanje jednu godinu)

4. Research and monitoring of recent sedimentation



- Objective: Define spatial and temporal dynamics of sedimentation processes in certain parts of the Kopački Rit NP
- 50 measuring columns have been installed in representative locations throughout the Kopački Rit Nature Park
- GPS-surveyed locations of measuring rods
- Fluorescent floats have been placed on each column for their better on-site visibility
- Readings done every 3 months during the monitoring period
- Contract duration 36 months

- The installation of the measuring columns and their readings were followed by the development of a baseline sedimentation/erosion map as the basis for further measurements
- Development of sedimentation/erosion map/gradient
- Lithofacies map and model
- These will serve as the basis for future decisions about human interventions in the Nature Park

5. Monitoring of habitats and flora

- Habitat monitoring recorded the distribution and assessed the conservation status of endangered and rare habitat types
- A habitat map was prepared to present the range and spatial distribution of terrestrial and aquatic habitats in two types
  - One map in the flood period

and
  - One map in the dry period

Habitat type of slim sedge wetland

Target habitat type 3150 Natural eutrophic lakes with vegetation

- Flora monitoring recorded the present taxa of vascular flora
- A flora list was prepared as well as a taxon analysis and an analysis of ecological features of the identified flora
- A habitat map was prepared to present the range and spatial distribution of terrestrial and aquatic habitats in two types


Siberian iris

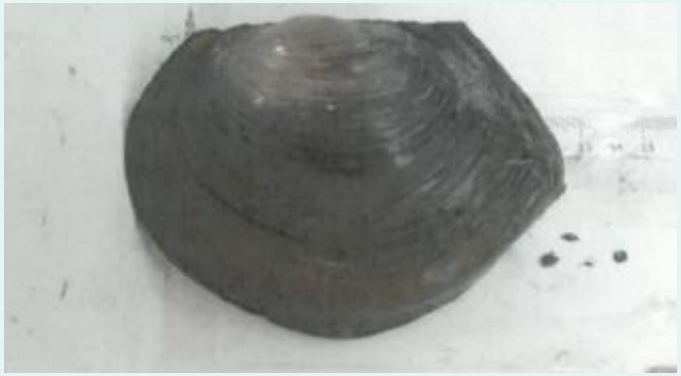
- For the purpose of continuous monitoring, 12 permanent surfaces were established to cover the selected terrestrial, aquatic and wetland habitat types in the floodplain and in the area protected from floods

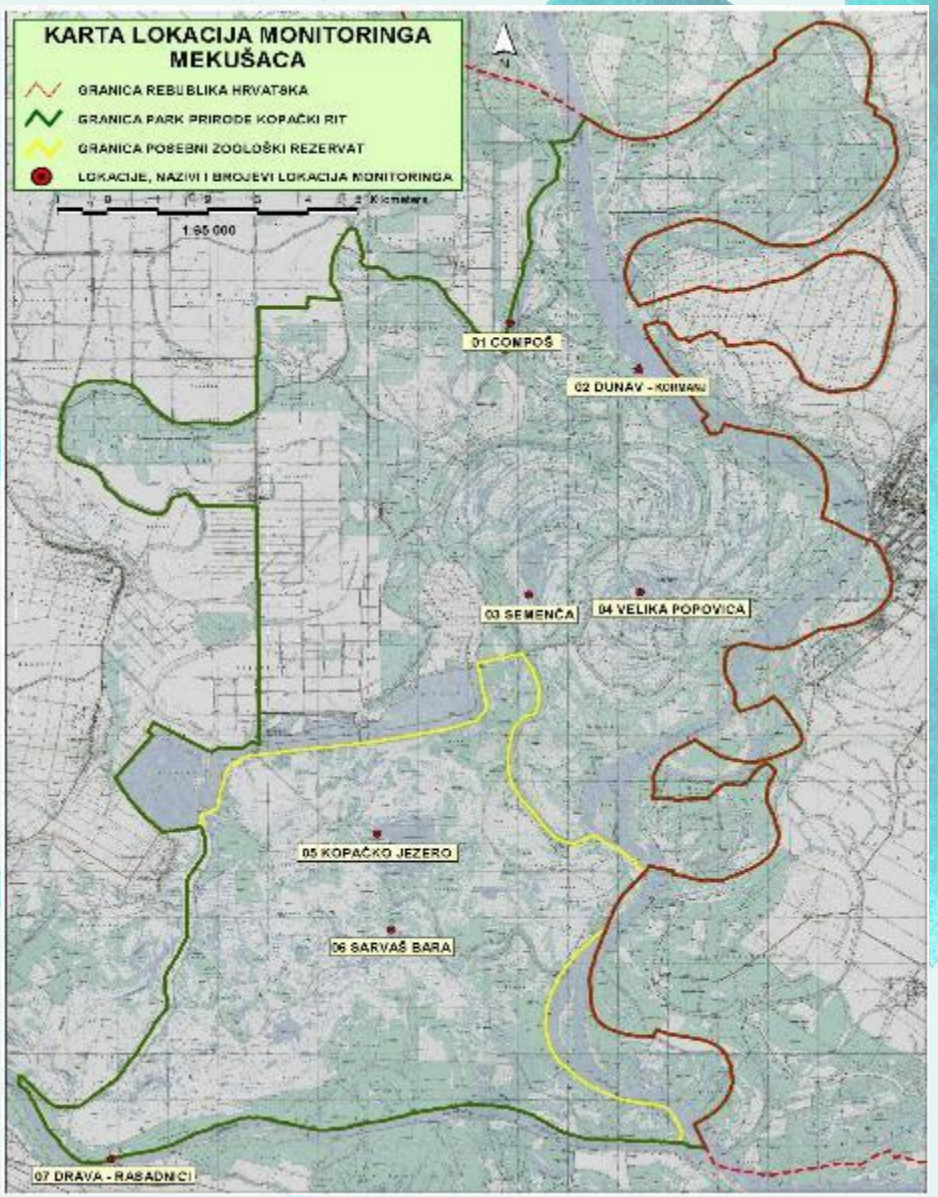

Permanent surface for wetland and aqutic habitats

6. Monitoring of mollusks – Aquatic mollusks (shells and snails)

- Objective: Study the aquatic mollusk fauna (shells and snails) with a special focus on invasive species and identify the abundance of invasive taxa in relation to autochthonous taxa
- Performed twice a year in 7 locations which occasionally run dry during the year
- A distribution map was prepared for the identified aquatic mollusk taxa
- The final report contains the interpretation of results together with required reviews and conclusions, as well as a proposal of restoration measures

Shellfish sampling





7. Monitoring of insects

- Mapping and monitoring of the N2K beetles and dragonflies in the Kopački Rit Nature Park
- Data collection was based on the mapping of distribution and monitoring of populations at the selected stations
- The basic objective of the mapping was to collect data about the real distribution of species and identify the presence/absence of species
- The final report contains the interpretation of results, together with required reviews and conclusions, as well as a proposal of restoration measures

Trap for saproxylic beetles at the Čošak šuma station

A specimen of the water beetle (*Graphoderus bilineatus*) species sampled at the Kopačevo station

Target species great capricorn beetle (*Cerambyx cerdo*) sampled at the Čarna transect

8. Monitoring of herpetofauna

- Objective: Identify the population size of target N2K amphibian and reptile species and detect their breeding grounds to assess their endangerment and specify efficient and appropriate protection measures
- Mapping and monitoring of amphibians and reptiles with a special focus on target N2K species (European fire-bellied toad, Danube crested newt, and European pond turtle)
- A special reference was given to the invasive herpetofauna species (red-eared slider and yellow-bellied slider)


European fire-bellied toad caught in the amphibian drop net


Smooth newt caught in the amphibian drop net


Amphibian drop net fixed and hidden in the grass

9. Monitoring of birds

- All indicator species and groups of birds (white-tailed eagle, black stork, ferruginous duck, graylag goose, mute swan, sand martin, common kingfisher, all kinds of herons and cormorants, etc.) and other strictly protected and endangered bird species were studied, in particular the species which are N2K conservation objectives in the Kopački Rit Nature Park.

- The final report compares both monitoring years and contains the interpretation of results, together with required reviews and conclusions, as well as a proposal of restoration measures

10. Monitoring of the otter and the beaver

- Monitoring of the otter and the beaver yielded data about the status of these wild species and the quality of their habitats
- The collected data are one of the bases for the definition of indicators of change in hydro-morphological, biological and ecological characteristics of the area, the scope of change of aquatic systems in the studied area and the associated habitats, flora and fauna
- The locations favourable for the placement of cage traps were identified: on Sakadaš Lake, on the shore near Čonakut canal and on the shore near Kopačko Lake
- The foreseen 5 otters and 5 beavers were caught

Cage trap placed on Sakadaš Lake

Entrance into the otter’s den
on Vemeljski dunavac

Preparation of the Typology Study and classification system for ecological status assessment of Kopačko Lake

- Objective: investigate a possibility for applying the existing classification system
- Proposal of a new lake type in the Pannonian ecoregion – shallow lake in the floodplain of a major river
- Classification systems for biological quality elements were also developed as part of the Study to assess the ecological status of Kopačevo Lake

SUBACTIVITY III.

PREPARATION OF RESTORATION STUDY FOR AQUATIC SYSTEMS OF KOPAČKI RIT NATURE PARK FLOODPLAIN

- Based on facts, i.e. conducted hydrological and hydraulic analyses, as well as conducted biological, physico-chemical and chemical monitoring, provide clear answers and instructions regarding the measures that need to be implemented in order to permanently ensure the stability of the ecosystems within the Nature Park
- The study contained 3 variant solutions, each with 3 analysis scenarios (worst case, best case, most probable case) and a climate change analysis
- The proposed restoration measures focused on reducing the difference between the disturbed and reference state (historical and geographical), with a focus on those parts of the floodplain where it is possible to implement individual measures to achieve higher water inflow
- Proposed revitalisation/restoration measures within the Kopački Rit Nature Park:
  - Measures within the Danube channel
  - Measures within the Drava channel
  - Restoration measures outside of the Danube channel in the flood zone within the KRNP
  - Restoration of lakes, wetlands and ponds
  - Restoration measures outside of the Danube channel and outside of the KRNP
- Presently, there is a much better understanding of the manner in which different restoration techniques can improve changes in habitats and their biological communities and which assist in flood management by restoring natural areas such as natural floodplains

THANK YOU FOR YOUR ATTENTION