



Ecological reconstruction of wetlands as instrument for reduction of climate change effects

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RADAR IMAGE OF THE DANUBE DELTA



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DETAILS ▼

Title Radar image of the Danube Delta

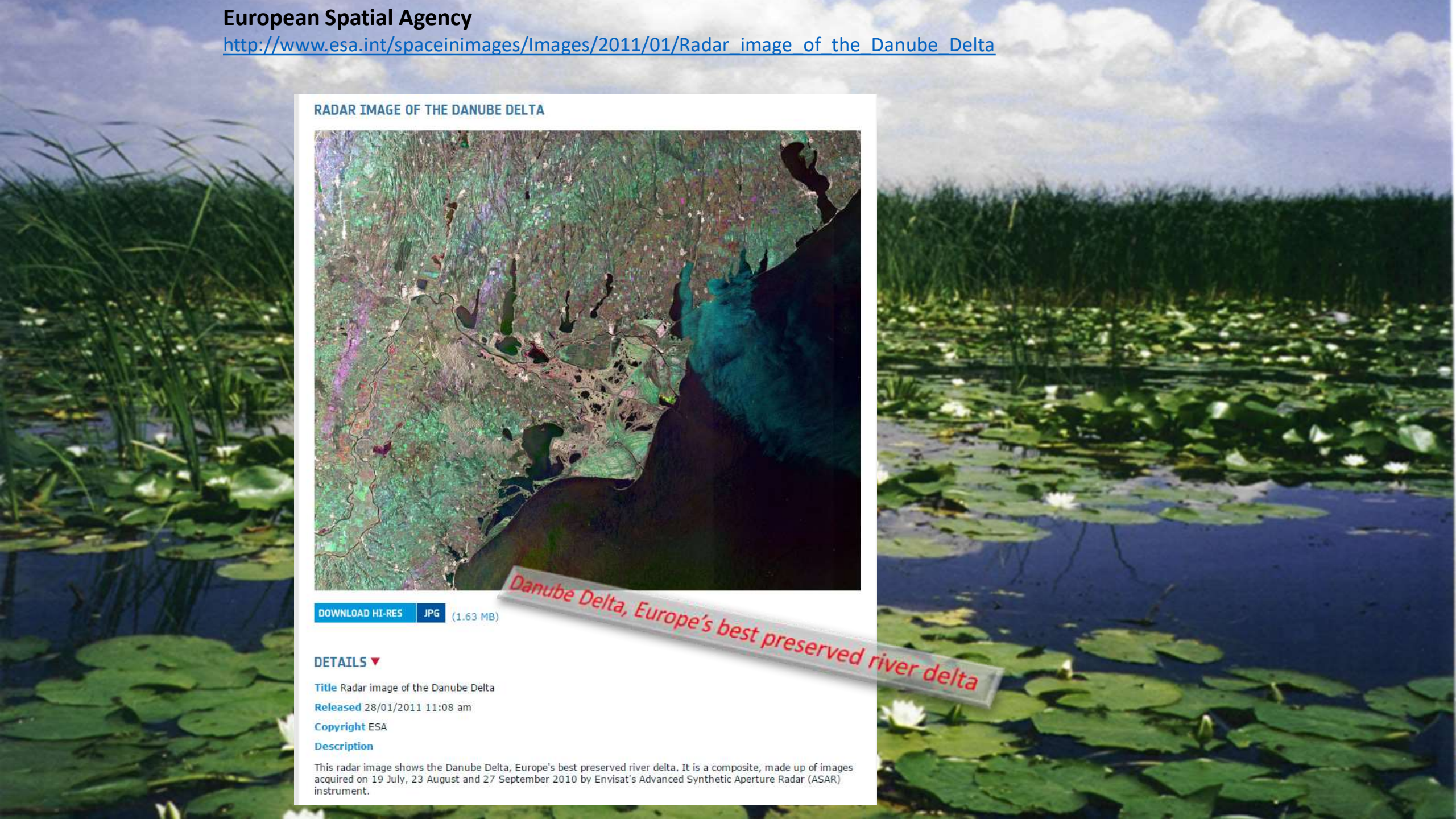
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Description

This radar image shows the Danube Delta, Europe's best preserved river delta. It is a composite, made up of images acquired on 19 July, 23 August and 27 September 2010 by Envisat's Advanced Synthetic Aperture Radar (ASAR) instrument.

Danube Delta, Europe's best preserved river delta

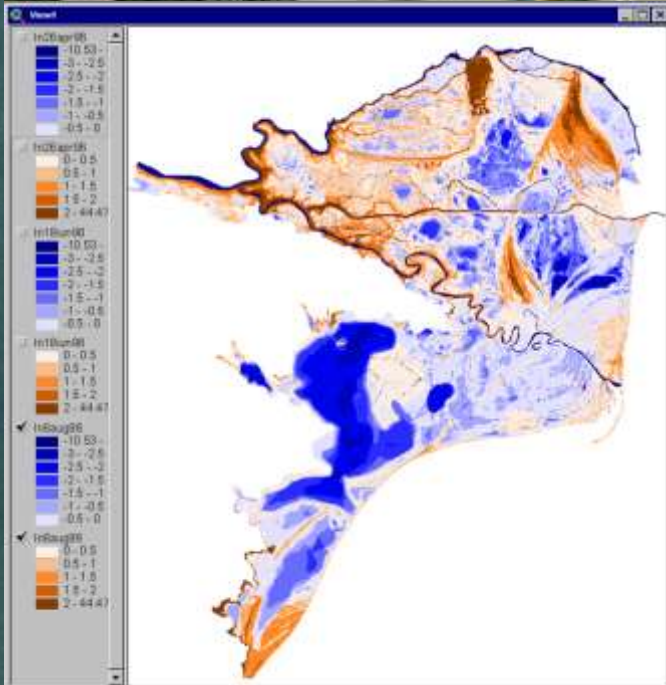
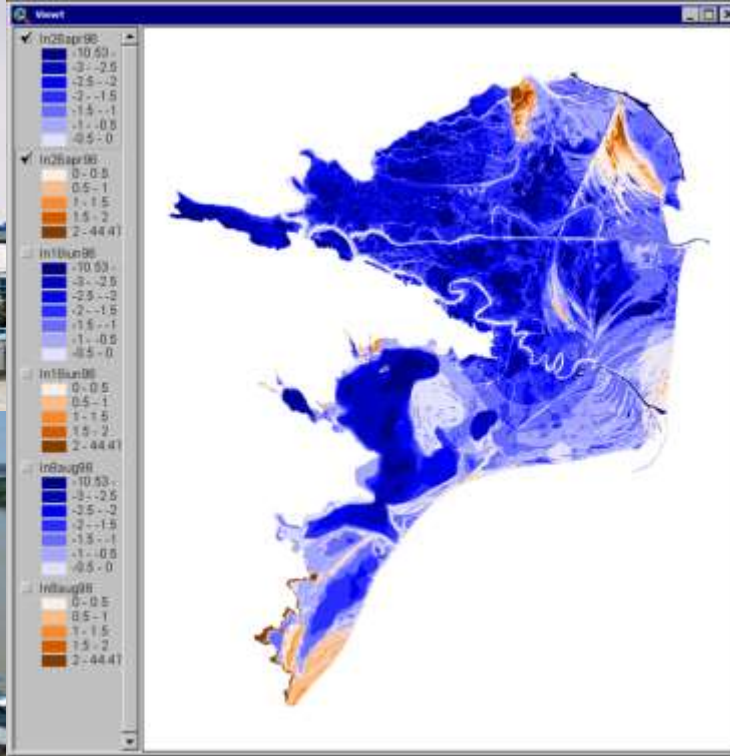




APRILIE 2006



IULIE 2010



APRIL 2002



SEPTEMBER 2023

THE DROUGHT in the Danube Basin has a major impact on the DANUBE DELTA

- Reduction of the water area of the Lake Complexes



- Marshes or lacustrine areas turn into arid - terrestrialization, or without vegetation, partially or totally drained lands



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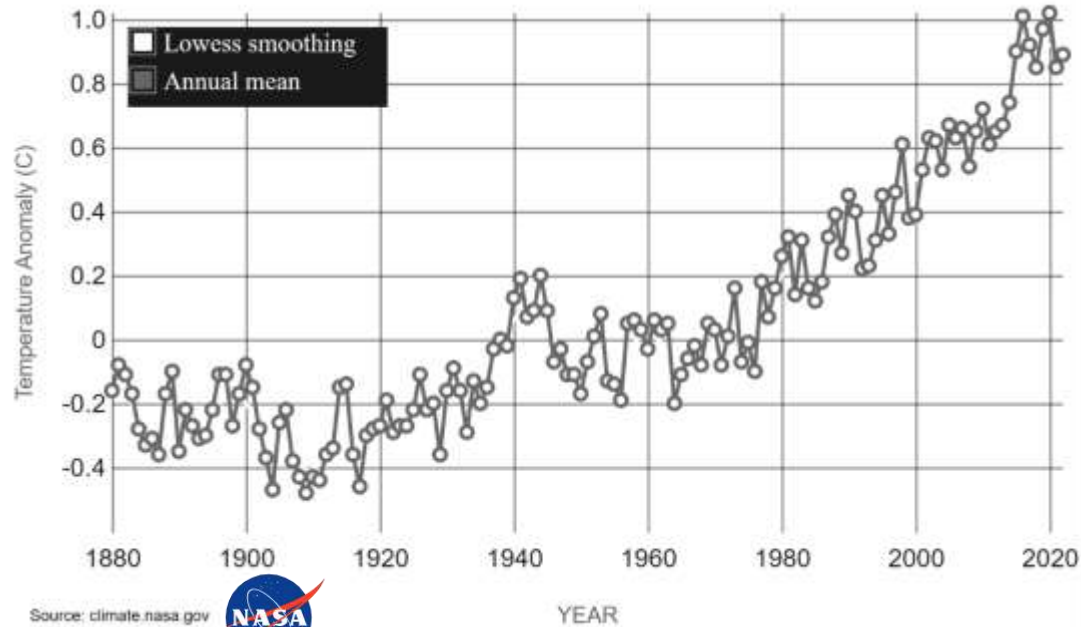


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ECOSYSTEM SERVICES

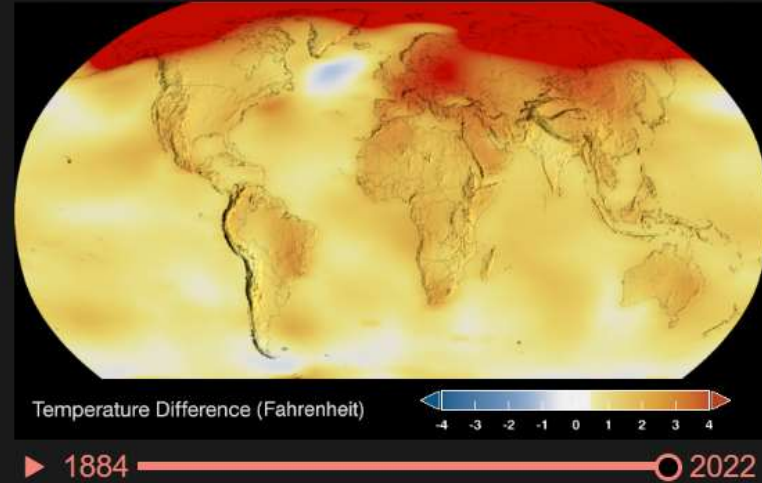
INDEX GLOBAL TEMPERATURE LAND-OCEAN



TIME SERIES: 1884 TO 2022

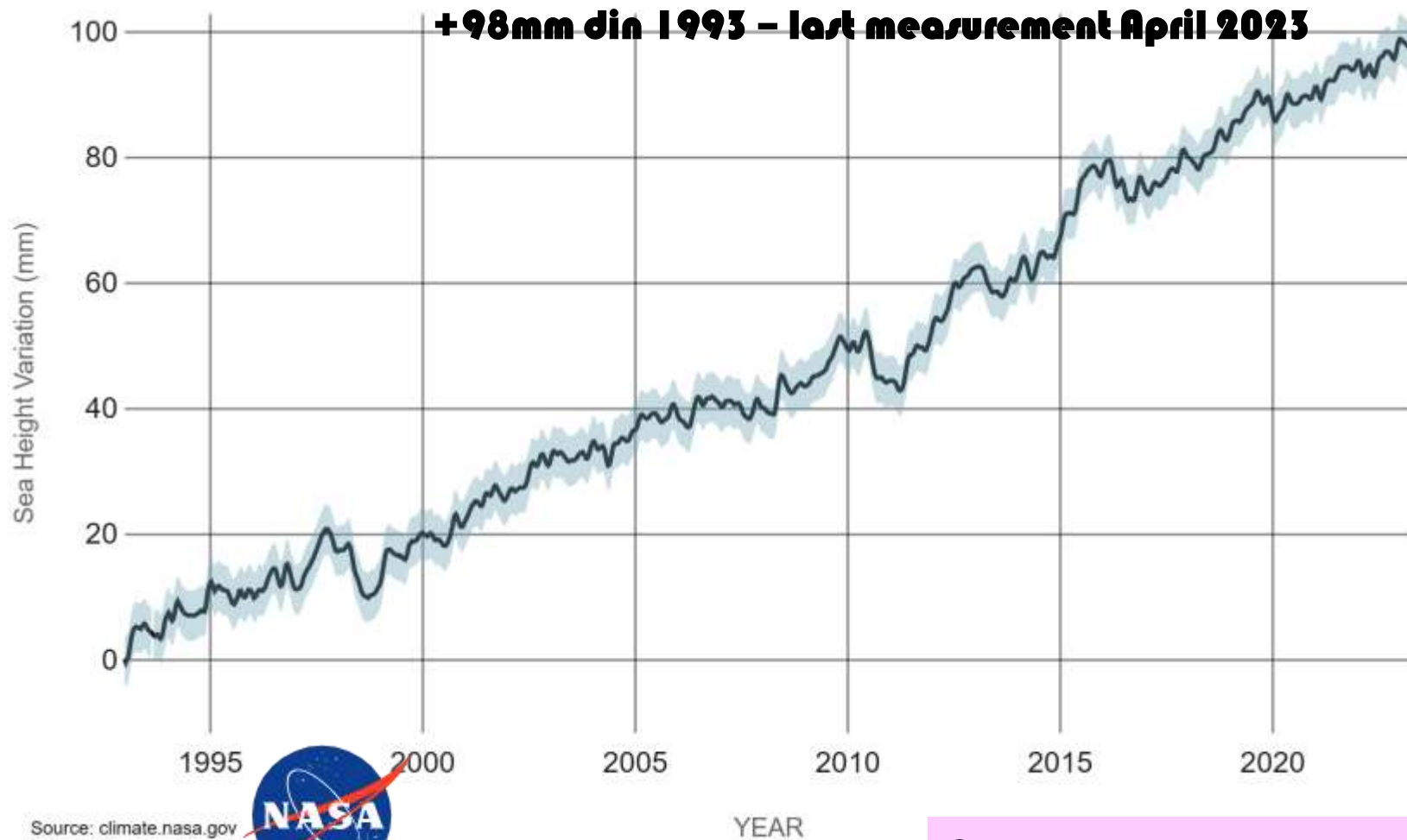
Data source: NASA/GISS

Credit: [NASA's Scientific Visualization Studio](#)



SOCIO-ECONOMICAL SERVICES

Planetary Ocean level Variation



Consequences:

- Decreases the Hydraulic Slope
- Flow Rate decreases
- Increases the degree of sedimentation

Major impact on FISHING – traditional activity in the Danube Delta



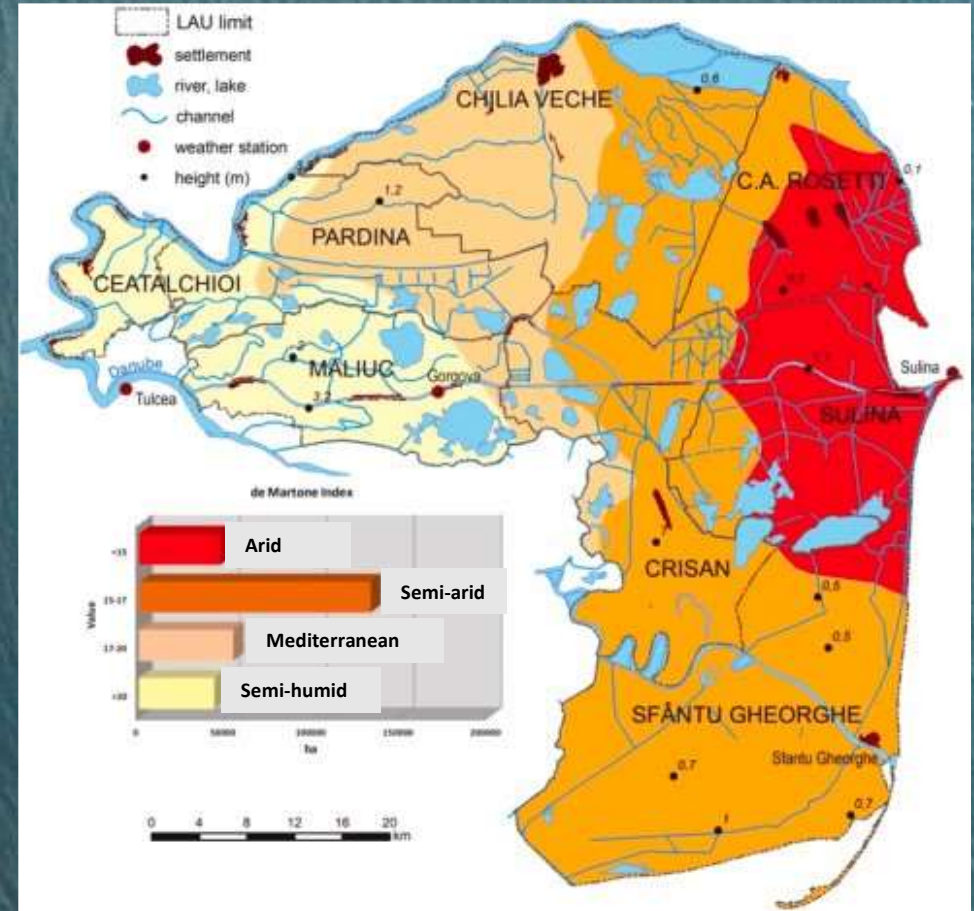
Defining the problem: Climate change impacts on wetlands and the urgent need for ecological reconstruction

Critical issue:

- Erosion and desertification
- Flooding
- Diminishing the content of organic matter
- Salinization
- The loss of soil biodiversity
- Landslides

Major influencing factors:

- Change in atmospheric concentrations of CO₂
- Rising temperatures
- Changing of the precipitation regime



Drought-affected areas based on De Martonne aridity index

Environmental Health Issues & Invasive Alien Species



Solutions for the Danube Delta:

- 1. ADAPTATION THROUGH BIOPHILIA CONCEPT -

Adaptation to climate change already underway, precisely by protecting but also restoring wetlands and aquatic complexes that can store huge amounts of C ("adaptation"),

- 2. MITIGATION THROUGH ECOMETRY CONCEPT-

Reducing emissions and stabilizing the levels of heat-trapping greenhouse gases in the atmosphere – USING SMART applications, IoT, ANN, AI, etc.



**RESTORATION OF
ECOSYSTEMS FROM
ABANDONED
DEVELOPMENTS IN
THE DANUBE DELTA**



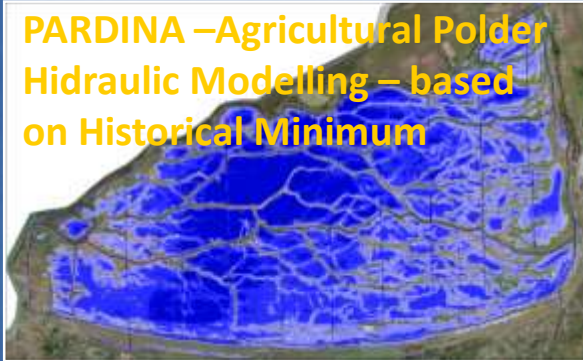
**IMPROVING THE FLOW
OF WATER, MATTER AND
ENERGY IN AQUATIC
COMPLEXES**



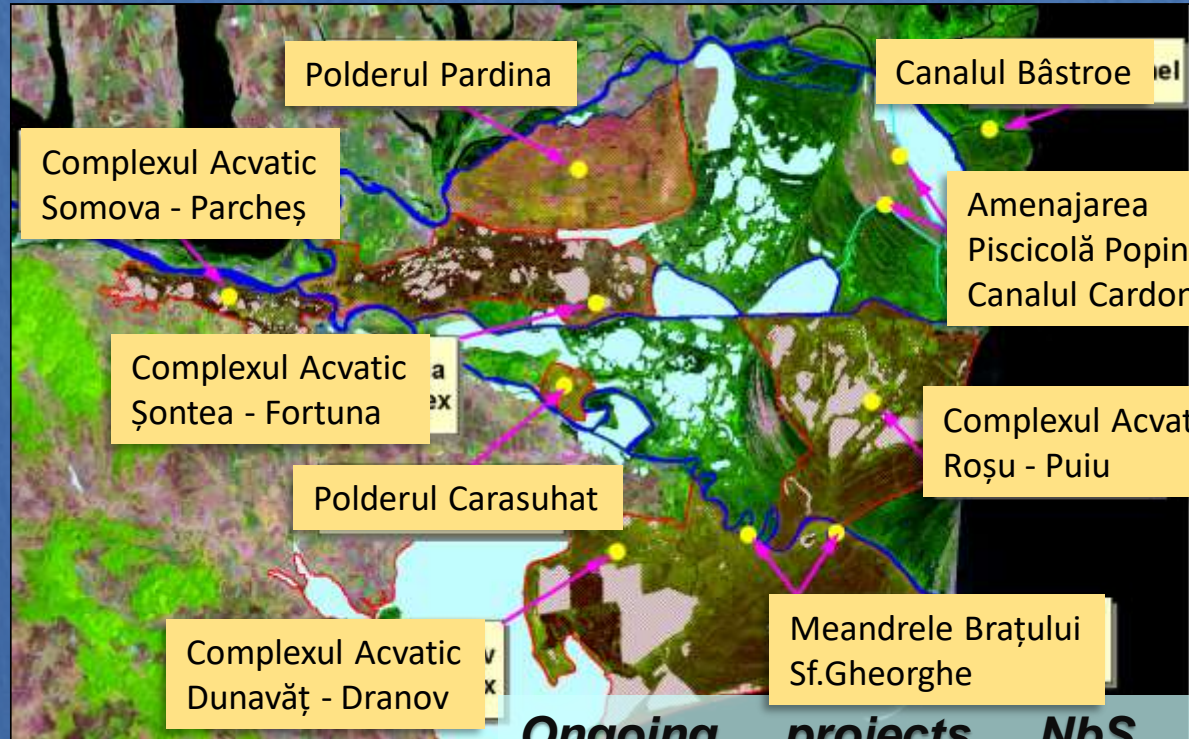
**RECOVERY OF
DECLINED SPECIES
THROUGH MOLECULAR
BIOLOGY**

3. Nature-Based Solutions (NbS) – Soluții bazate pe NATURĂ

**PARDINA –Agricultural Polder
Hydraulic Modelling – based
on Historical Minimum**



The NbS models can be successfully applied in the restoration of ecosystems from fragmented wetlands within the Natura 2000 sites of the Danube Delta Biosphere Reserve precisely to stop the decline of biodiversity in these ecosystems.

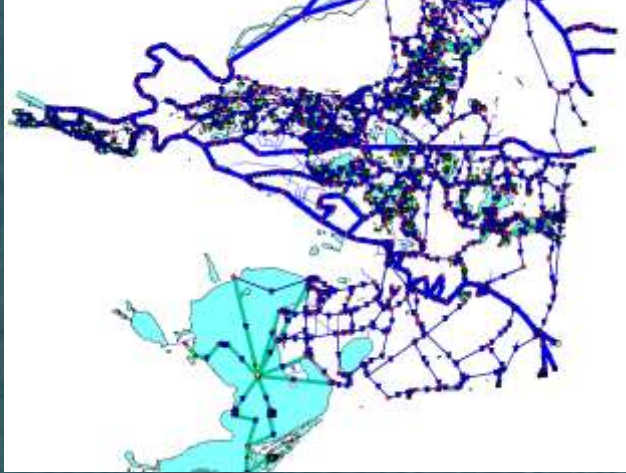


**Hărțile de Hazard și Risc la Inundații în Delta și Lunca
Dunării Danube (insurance of 30, 100, 1000)**

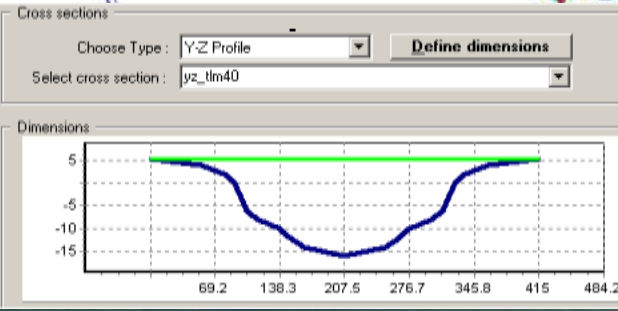
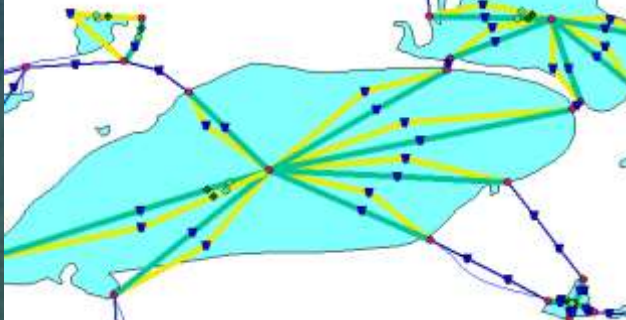
Ongoing projects NbS – Danube Delta:

- Improving the Water Circulation System in Aquatic Complexes
- Ecological Restoration of Abandoned Polders and Former Meanders of the Danube canalization
- Works with hydromorphological impact - recalibration of hydrotechnical systems
- Recovery Species in decline

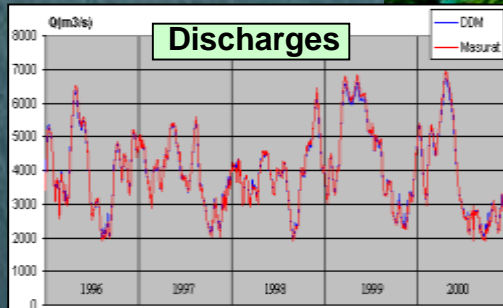
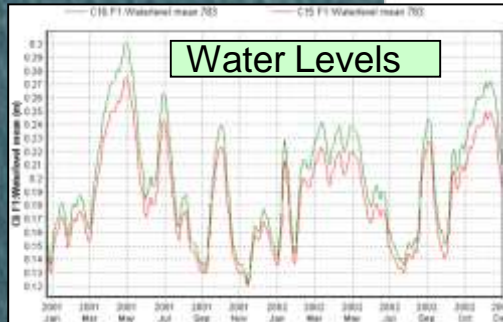
The hydrological model



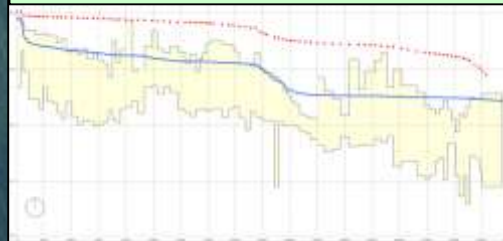
Principiul de modelare în zonele cu stuf versus lucii de apă și evapotranspirație și precipitații



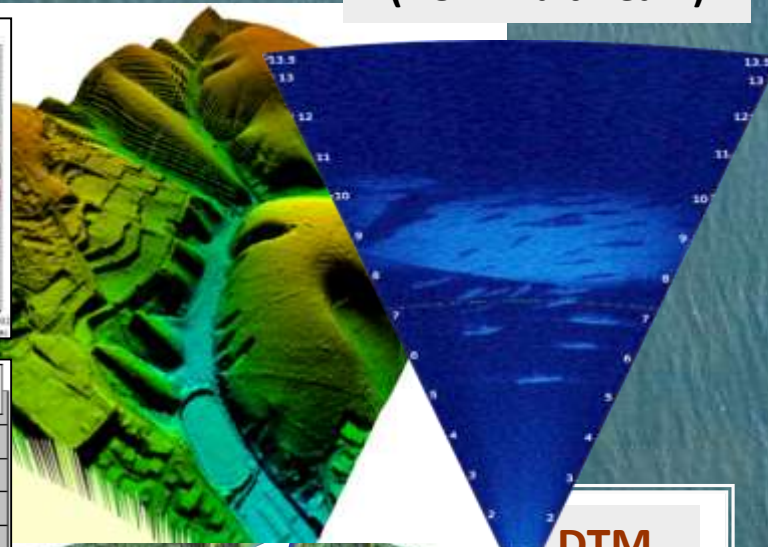
Monitoring System (Real Time)



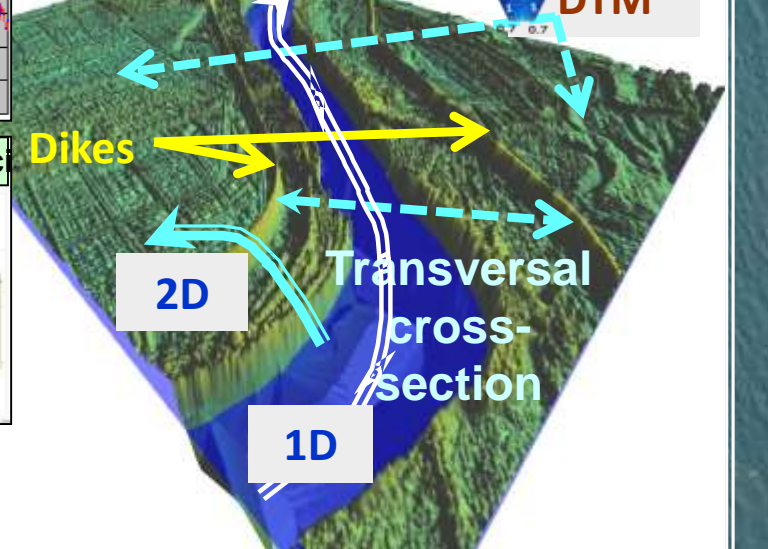
Variațiile parametrilor hidrolologici



DTM (Drons-Lidar)



Water Circulation System (AUV-MultiBeam)



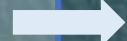
Danube Delta Hydrological Model

Ecological wetland reconstruction: Key ecological processes and mechanisms for climate change mitigation and adaptation

Ecological wetland reconstruction is a complex process that involves restoring degraded or destroyed wetlands to their natural state.

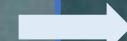
Key ecological processes:

• Carbon sequestration



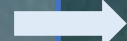
• Can sequester up to 20 tonnes of carbon per hectare per year (Seddon, N., et al. (2021).)

• Flood protection and storm surge attenuation

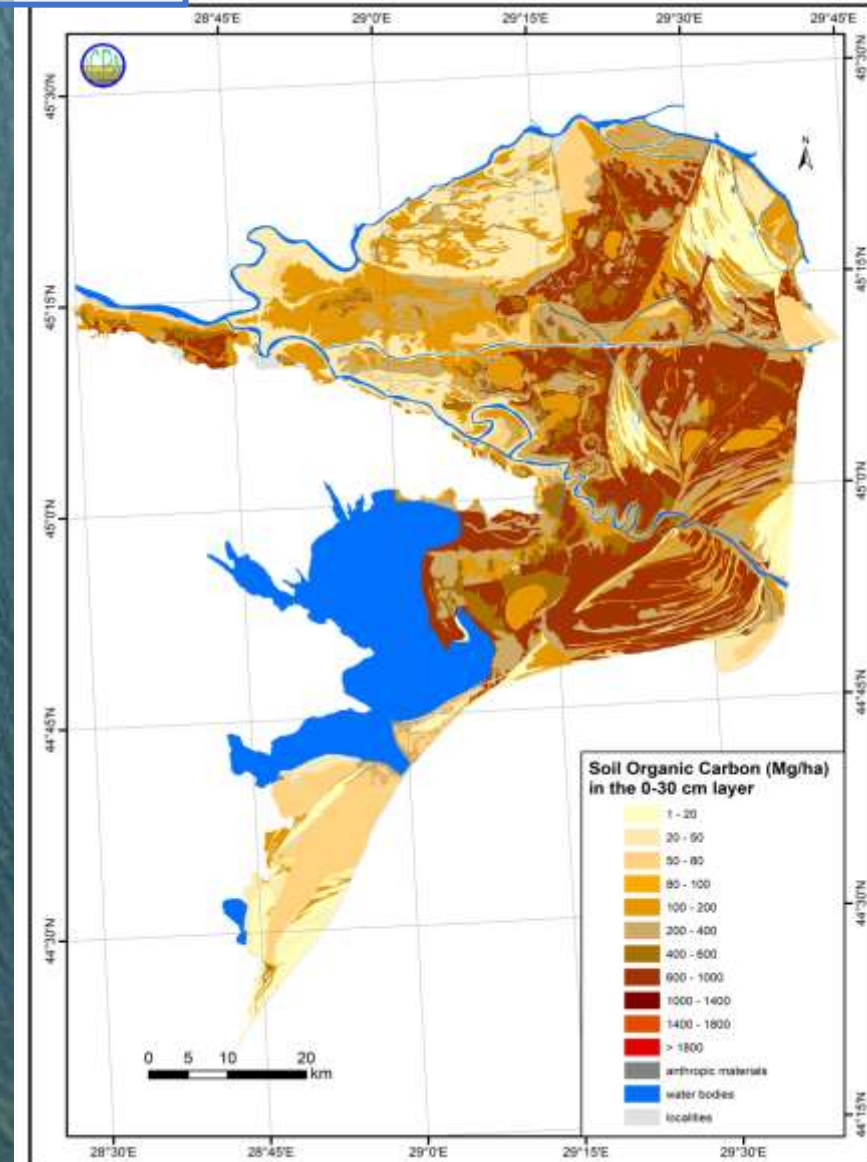


• Wetlands act as sponges, absorbing excess water and slowing down the flow of floodwaters. This helps to reduce the risk of flooding and damage to property and infrastructure

• Supporting biodiversity



• Ecological wetland reconstruction can help to restore biodiversity and create new habitats for wildlife



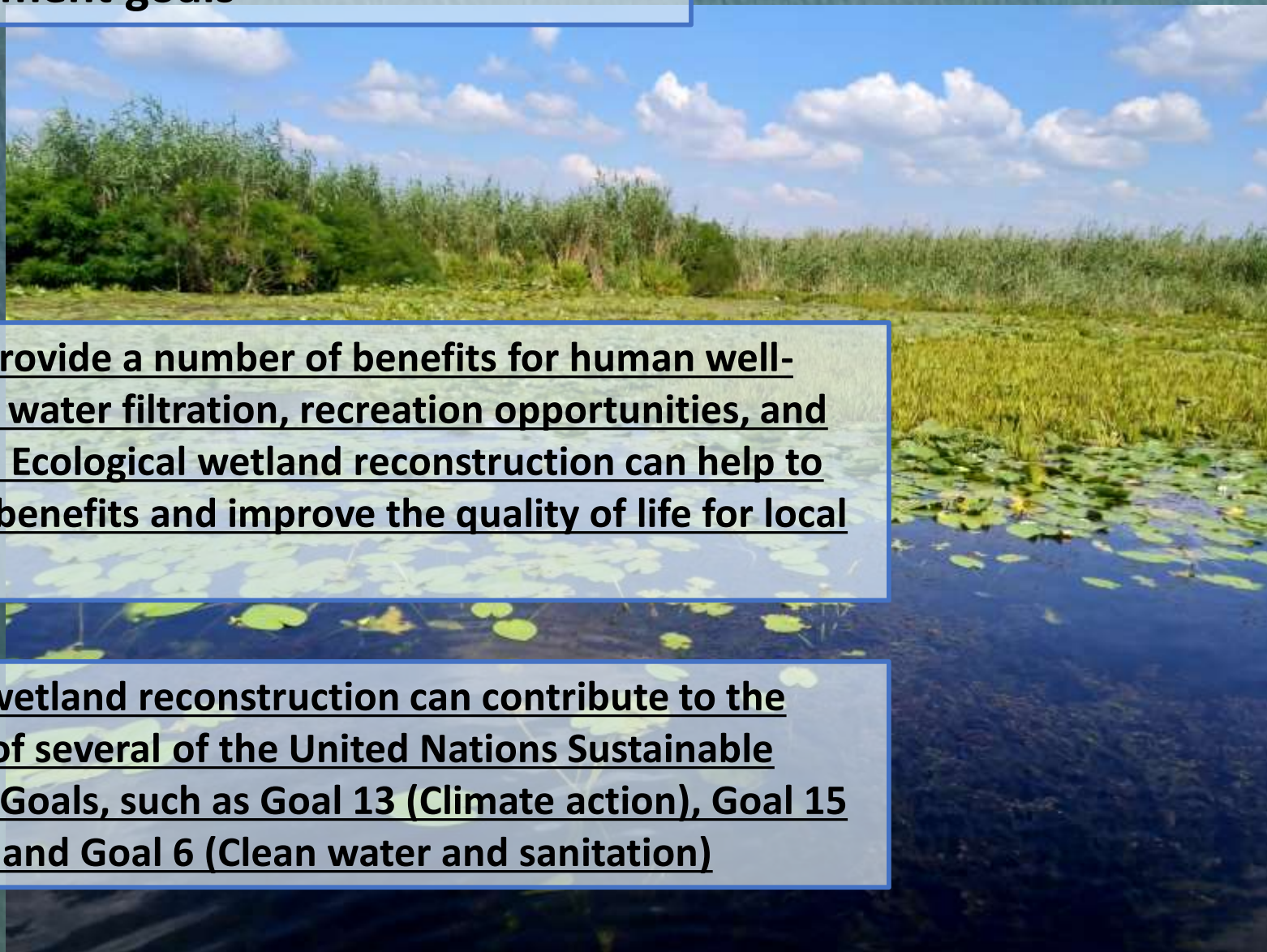
Co-benefits of ecological wetland reconstruction for human well-being and the sustainable development goals

In addition to its climate change mitigation and adaptation benefits, ecological wetland reconstruction also provides a number of other co-benefits, such as:

- Enhancing human well-being:
- Contributing to the sustainable development goals:

• Wetlands provide a number of benefits for human well-being, such as water filtration, recreation opportunities, and cultural value. Ecological wetland reconstruction can help to restore these benefits and improve the quality of life for local communities

• Ecological wetland reconstruction can contribute to the achievement of several of the United Nations Sustainable Development Goals, such as Goal 13 (Climate action), Goal 15 (Life on land), and Goal 6 (Clean water and sanitation)



Ecological reconstruction of wetlands, examples from Danube Delta

The ecological reconstructed area Carasuhat

- 924 hectares restored degraded wetlands
- Implemented in 2012
- Improved water quality in the area
- Improved soil water status in neighbouring areas, agricultural systems
- Increasing habitat connectivity by reducing fragmentation
- Diversification of natural resources available to the local community
- Flood wave storage/attenuation



Ecological reconstruction of wetlands, examples from Danube Delta

The ecological reconstructed wetland from the Babina and Cernovca polders:

- 3.680 hectares restored degraded wetlands
- Implemented in 1994
- Restoring the natural hydrological regime
- Creating new habitats for fauna and flora
- Promoting sustainable tourism
- Increasing habitat connectivity by reducing fragmentation

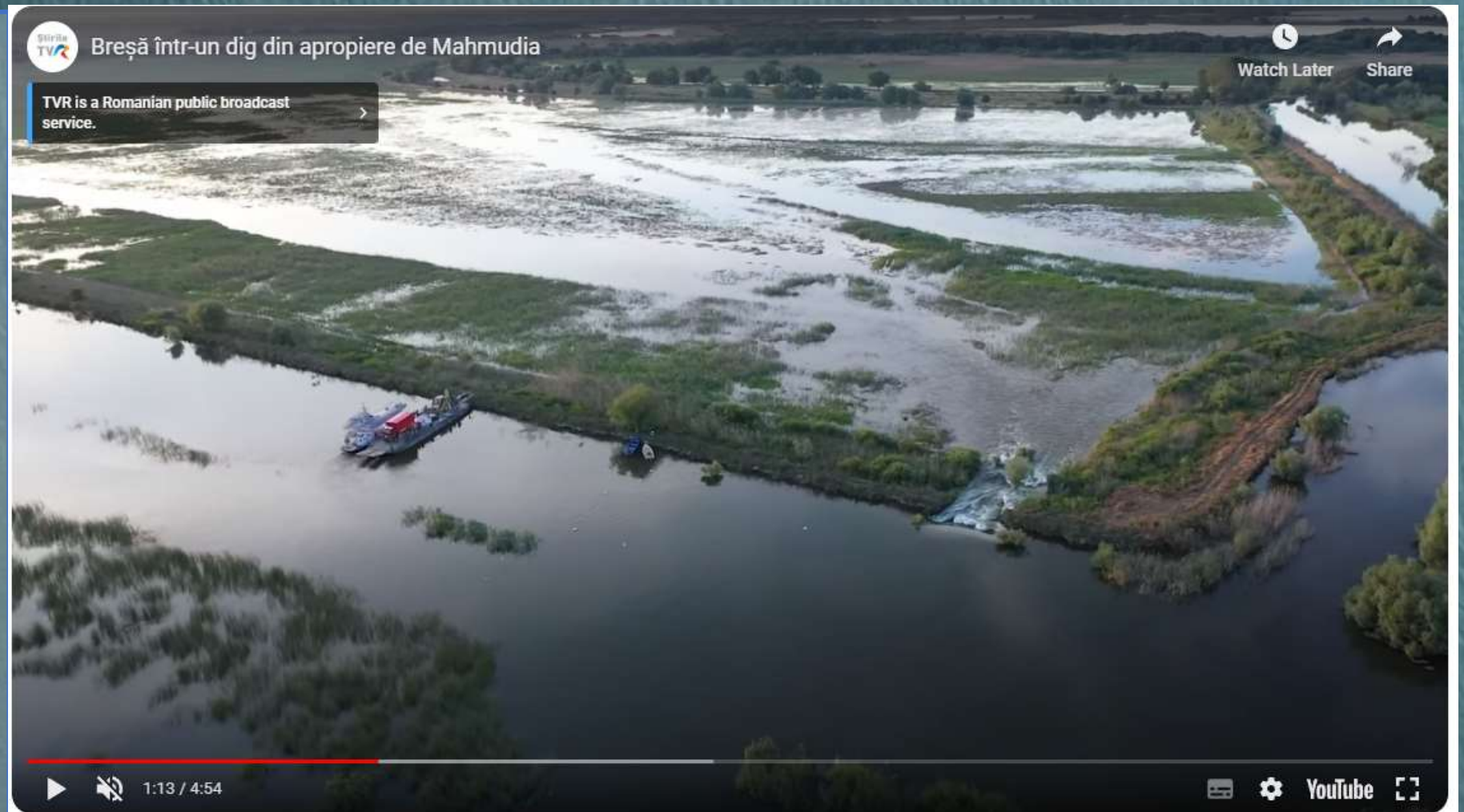


Prince Philip, Duke of Edinburgh, president of WWF International, handing over the "Award for Conservation Merit" to Ing. Romulus Ştiucă, Director of the Danube Delta National Institute of Tulcea/Romania, on the occasion of the WWF Annual Conference in Berlin (24.10.1996) as recognition for the first restoration project implemented in the Danube Delta Biosphere Reserve

Long-term Ecological reconstruction of wetlands risks

Reconstruction projects should be monitored and maintained over the long term to identify and address any potential problems:

- Invasive species
- Climate change
- Quality issues
- Sedimentation



Breach in the dyke of the restored Carasuhata area produced in the summer of 2023 during the floods/
source Youtube

CONCLUSION: Summary of key points and recommendations for future research and policy on ecological wetland restoration

- The importance of research in advanced technologies, such as remote sensing and modeling, to support ecological wetland reconstruction planning and implementation
- The role of ecosystem-based management approaches in promoting the long-term sustainability of ecological wetland reconstruction projects
- The importance of social and economic considerations in ecological wetland reconstruction, such as ensuring the participation of local communities and minimizing negative impacts on livelihoods
- The need for innovative financing mechanisms to support the large-scale implementation of ecological wetland reconstruction projects



Thank you for your
attention!



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