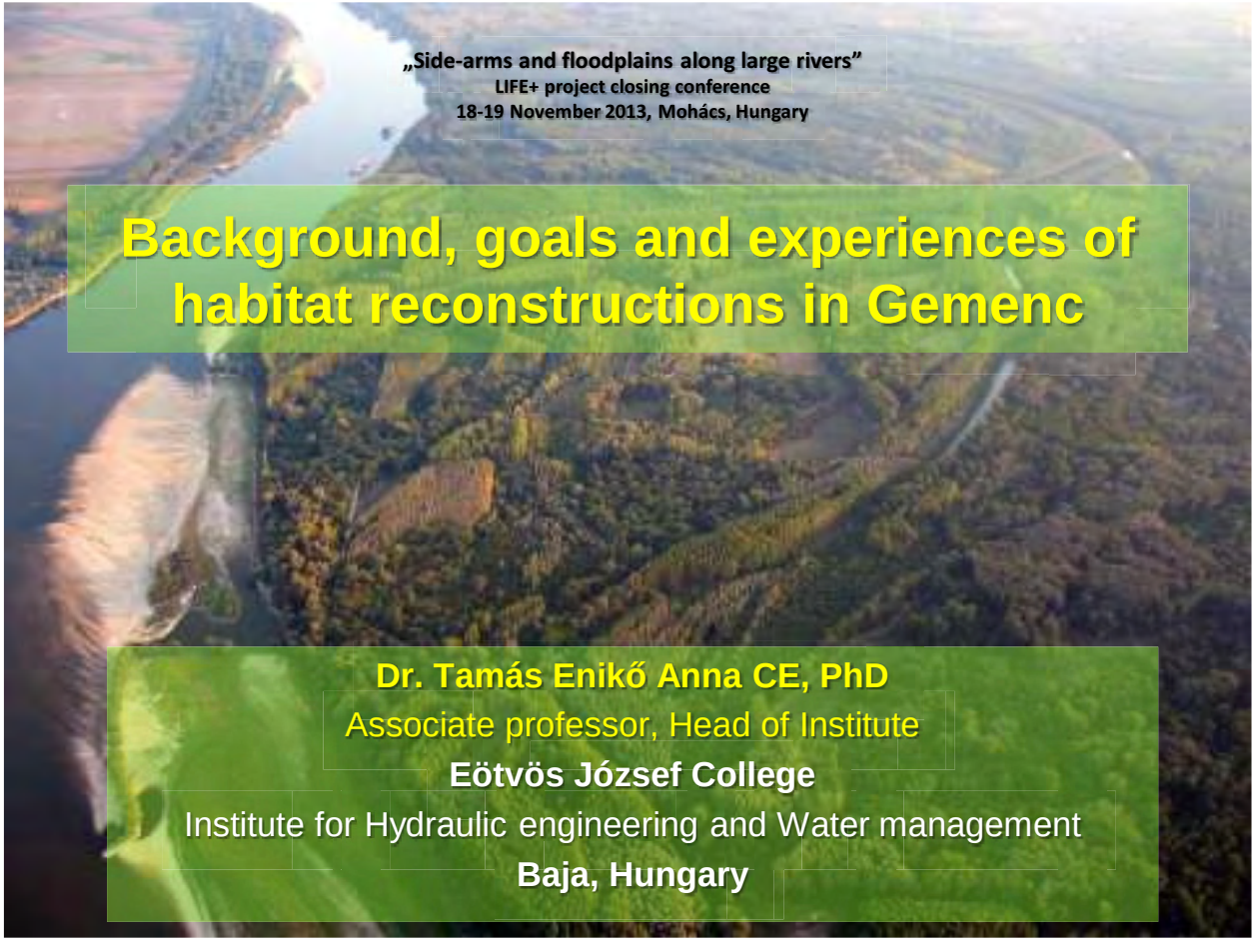

„Side-arms and floodplains along large rivers”
LIFE+ project closing conference
18-19 November 2013, Mohács, Hungary

Background, goals and experiences of habitat reconstructions in Gemenc

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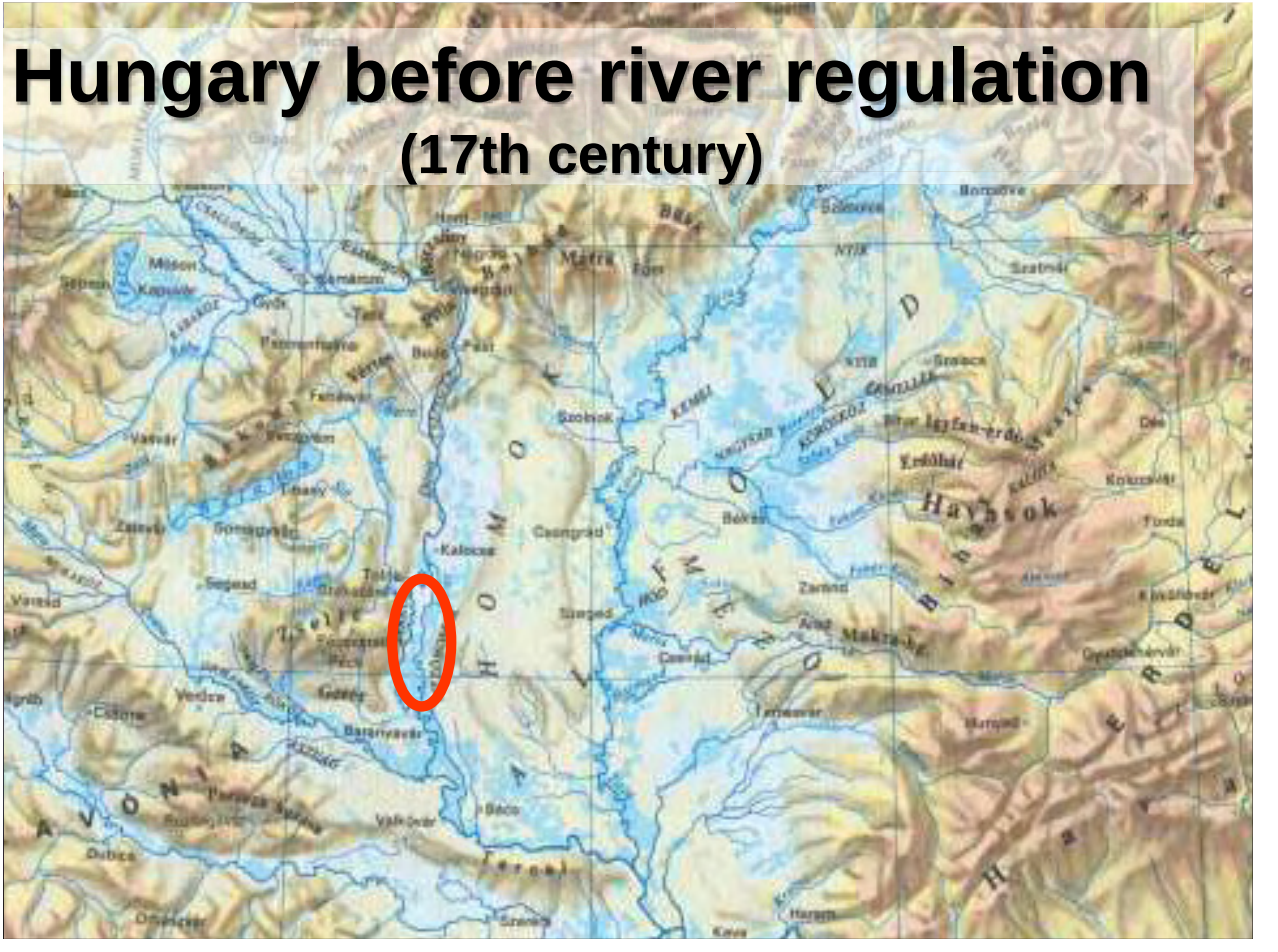
1. Background

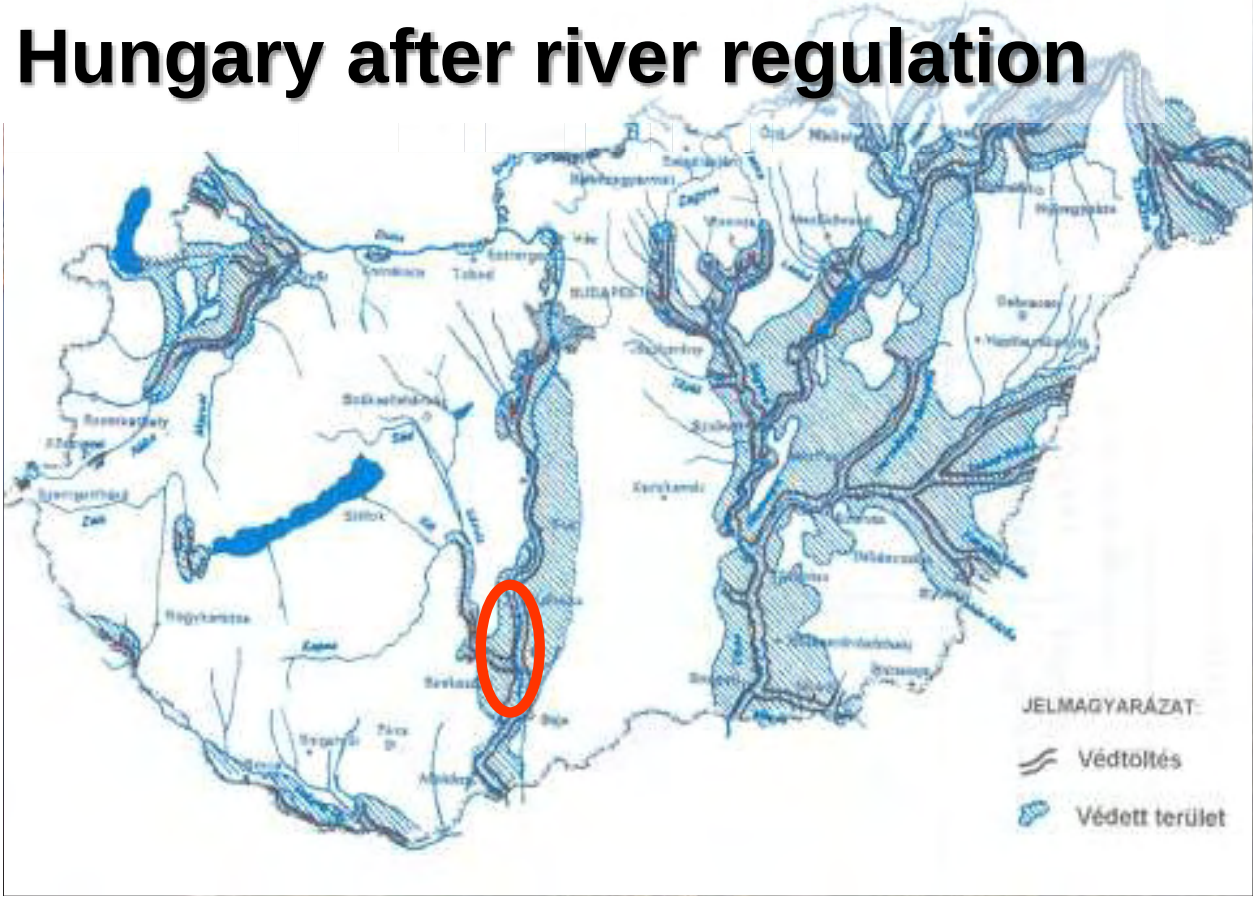
Danube river basin – Carpathian Basin

Hungary before river regulation

(17th century)



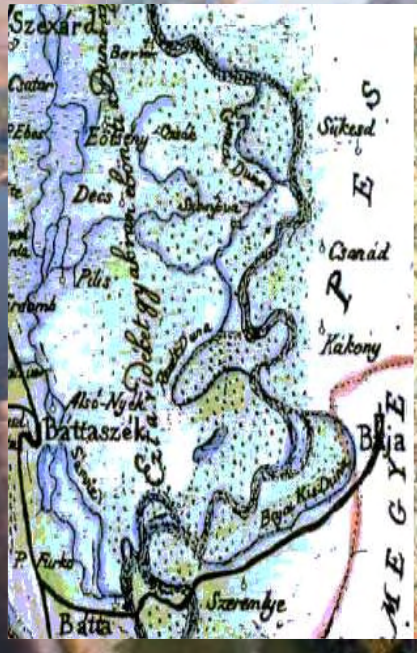
Hungary after river regulation

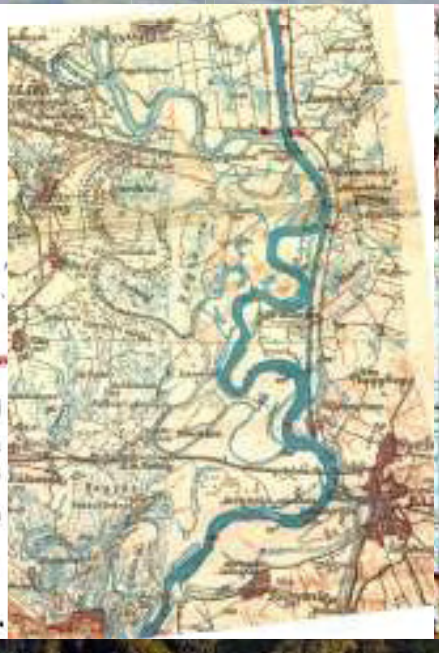


Location, status

- Danube 1503-1433 fkm
- Mainly floodplains
- Protected since 1977
- Ramsar Site
- Natura 2000 area
- National Park since 1996
  - **Gemenc: 180 sq km**
  - Béda-Karapancsa: 105 sq km

Development of the Gemenc area





1800 1900 2000

Effects of river training

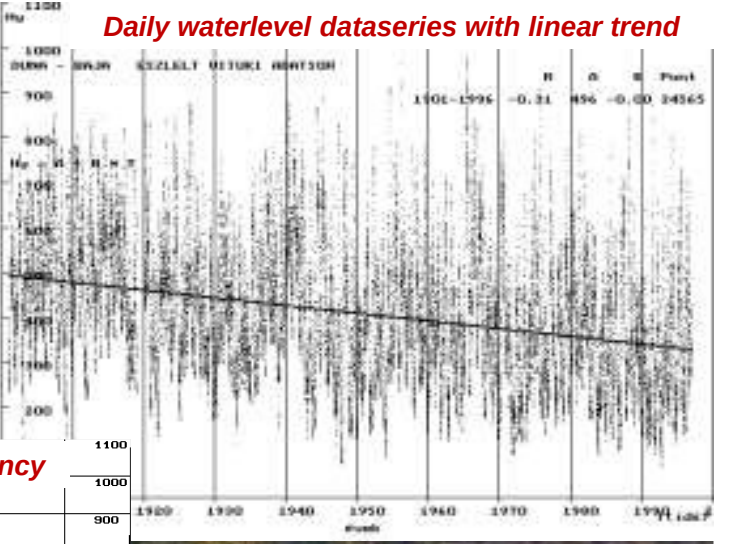
River Danube shortened with 100 kms on 240 kms

Slope increase (- almost double)

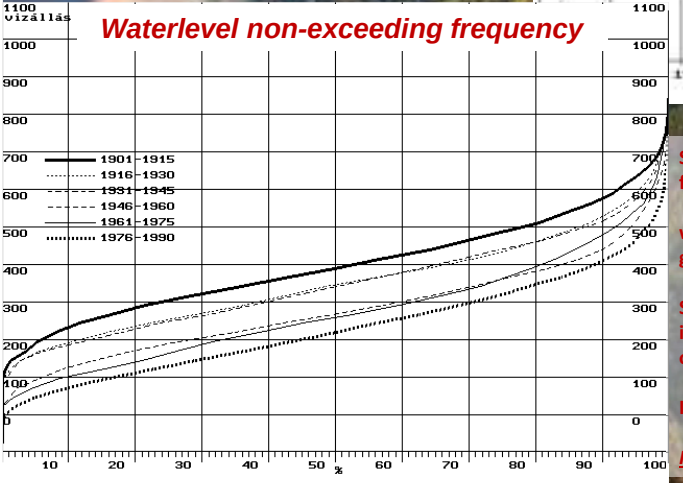
$5 < I_{avg} < 8$ [cm/km]

Sediment capacity – much higher – horizontal erosion not possible!

Daily waterlevel dataseries with linear trend



Waterlevel non-exceeding frequency



Sediment transport capacity C (m^2 $time^{-1}$) can be calculated as function of discharge and slope

$$C = \alpha \cdot Q^m \cdot \Lambda^n$$

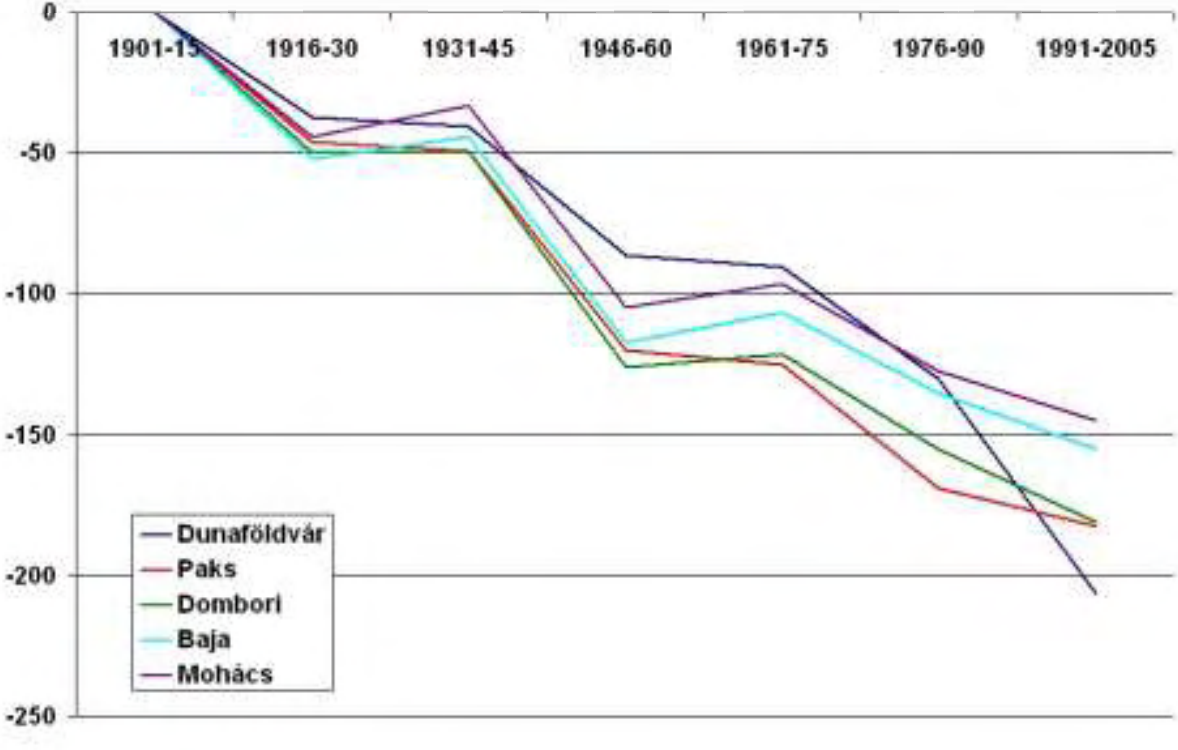
where Λ is the slope gradient ($\partial z/\partial x$); m and n are constants giving an indication of the system (Kirkby, 1971).

Sediment transport rate S (m^2 $time^{-1}$) is calculated based on the integrated continuity equation for sediment movement. The rate of sediment already in transport is S_0 (m^2 $time^{-1}$).

If $S_0 < C$ there is erosion, while when $S_0 > C$ there is sedimentation.

If S_0 decreases while slope increases, erosion accelerates.

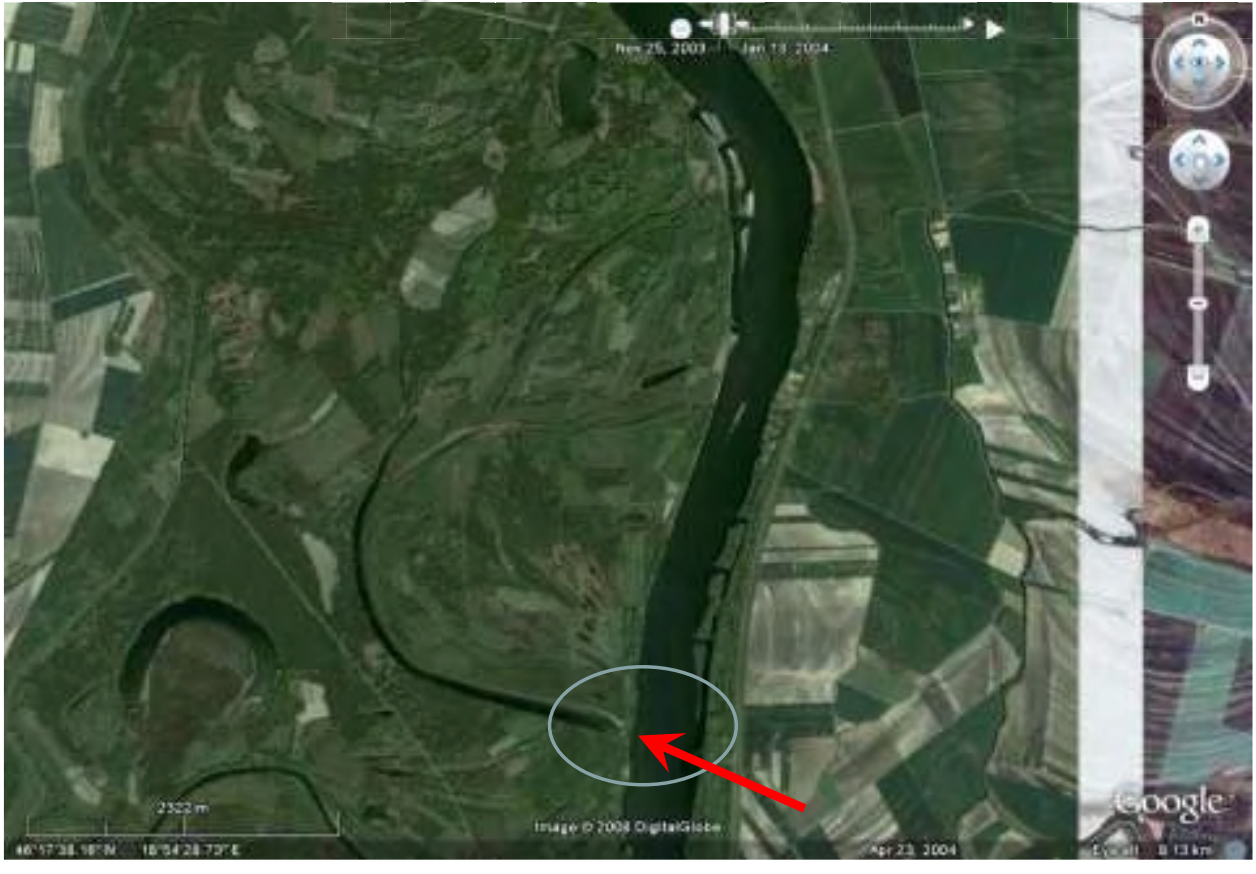
Speed of erosion, 15-year periods, 1901-2005

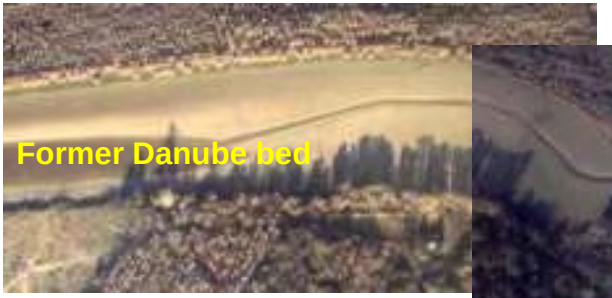


Riverbed incision of the Danube – the main factor

- Second half of the 1980's: first signs of „drying" of Danube floodplains recognized
- As floodplain water regime is determined by Danube, the first analysis of Danube dataseries between 1901-1990 took place (*Kalocsa-Zsuffa sr., 1992*)
- Statistical analysis of Danube waterlevel dataseries shows unambigous decrease of long-term trends – but there is no evident change in discharges
- Suspected reason for an increased erosion is regulation in the end of 19th and beginning of 20th century, i.e. the increase of slope and thus sediment transport capacities
- As annual minimal stages on the reach dropped lower than ever in the beginning of the 2000's, new investigations were done, which gave evidence of increased erosion (***Tamás 2006***)

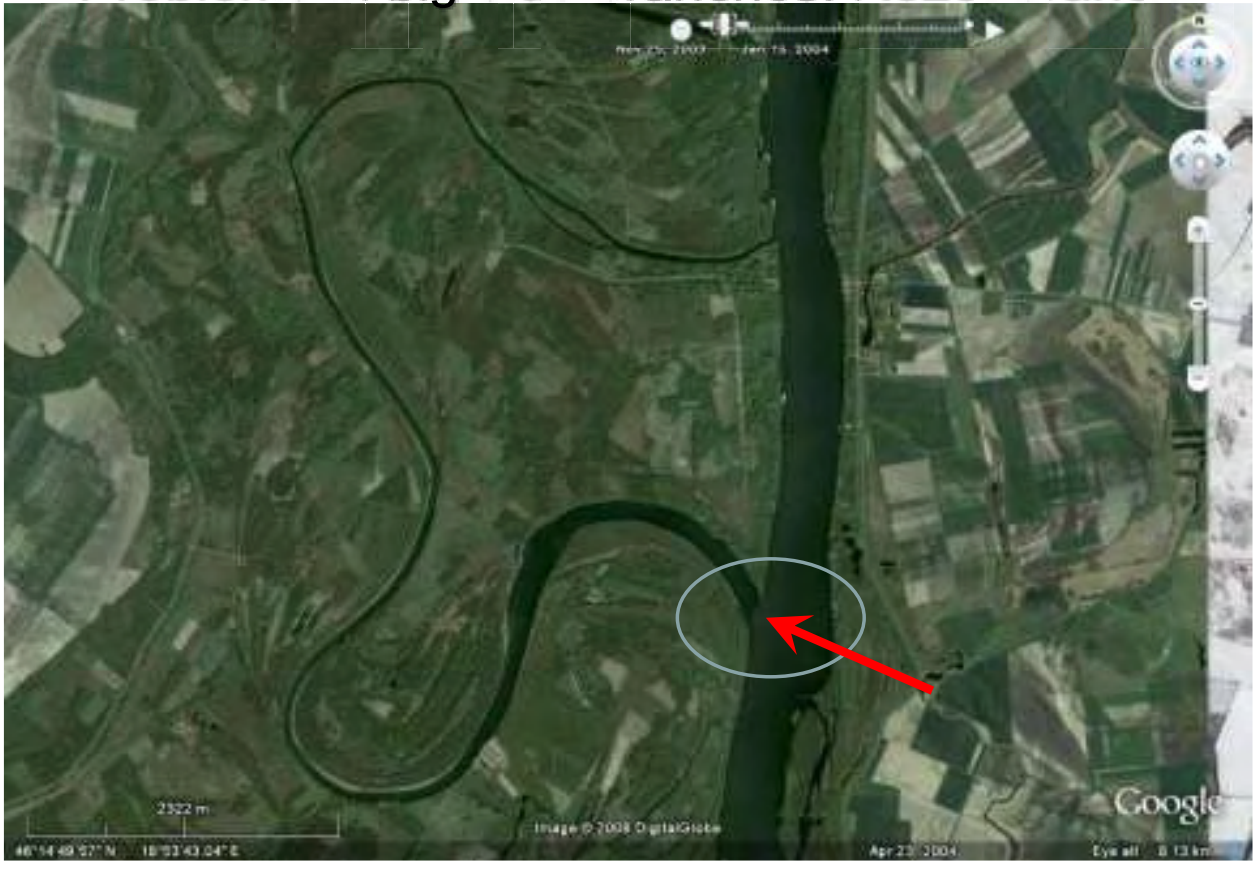
Problems in big side branches: Grébec branch




Former Danube bed


Sediment aggradation is prominent

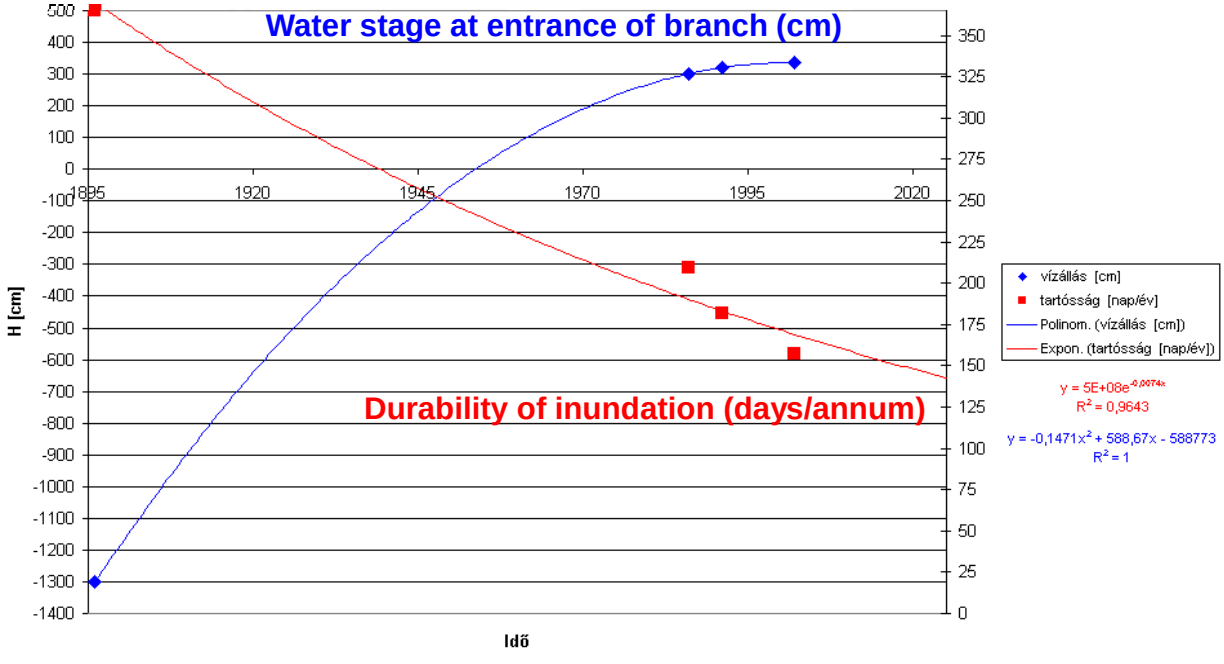
Problems in big side branches: Rezét branch



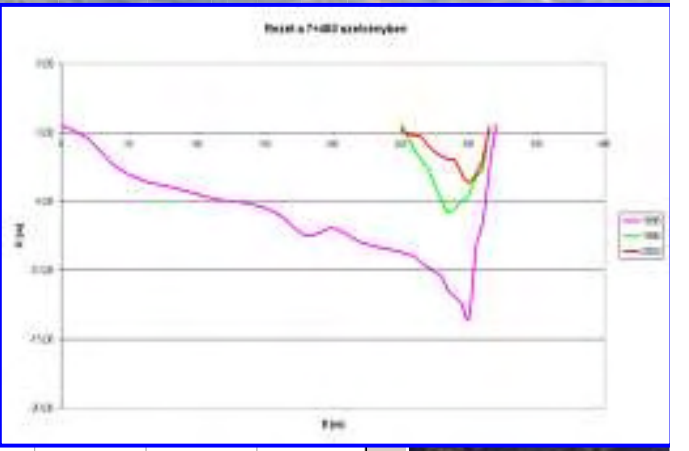

Former Danube
bed

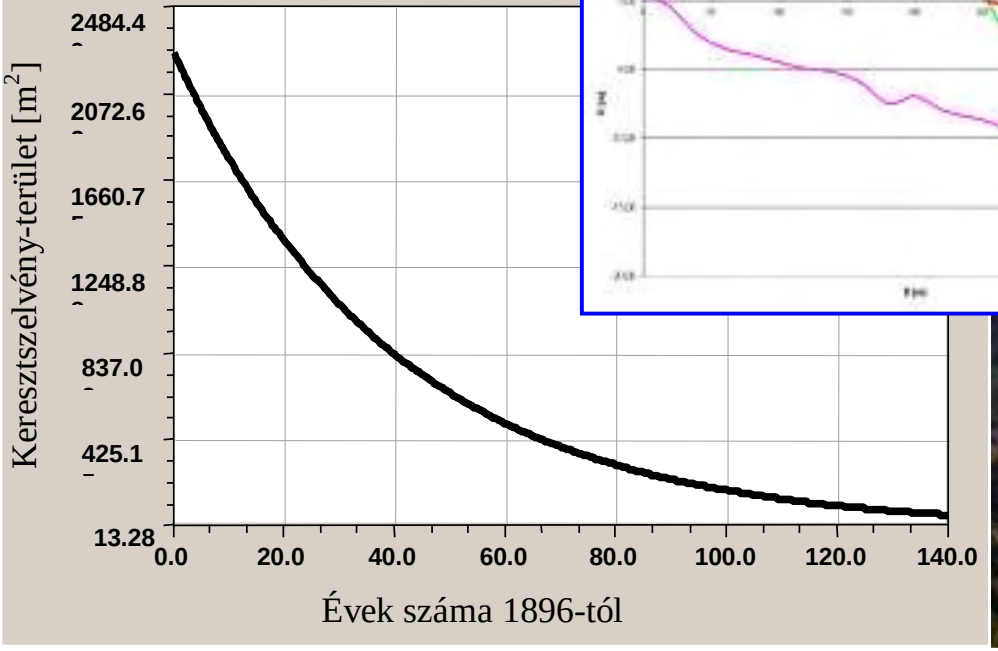

Sediment aggradation is prominent

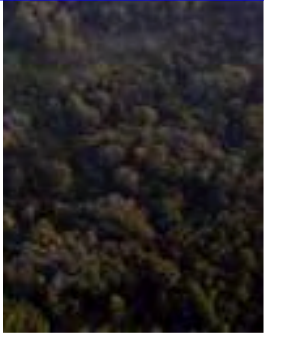
The higher the aggradation, the bigger stage is needed for inundation – changes over 110 years:



Decrease of cross-section areas – Rezét branch







Identified main problems

Danube main bed erosion → inundation ***frequency*** decreases

Sediment aggradation → inundation ***level*** increases

FLOODPLAIN WATER SUPPLY PROBLEMS!!


2. Goals

Uses and priorities present in the area

- Flood protection
- Navigation of the river
- Drinking water resources (infiltration wells)
- Forestry management and hunting
- Recreation and (eco-)tourism
- Fishery
- **NATURE PROTECTION**

Morphological diversity
Biological diversity
Sustainability
Wise use
etc.

The need for reconstruction

- Ecosystem functions are degraded
- The status and processes are unsustainable

- Need to
  - Try to reverse processes
  - Slow down ageing of watersystems
  - Mitigate human effects
  - Improve ecosystem services
  - Take human uses and priorities into account
  - Create a self-sustainable system (is it possible at all??)

Determination of target status

- No approved management plan available
- Water management concept exists (since 1998)
- Baseline:
  - More durable inundations at lower stages
  - Less sediment to be deposited in the floodplain
  - Solutions should be starting processes
  - Artificial structures to the minimum!
  - Minimalize maintenance costs and interventions

THE target status

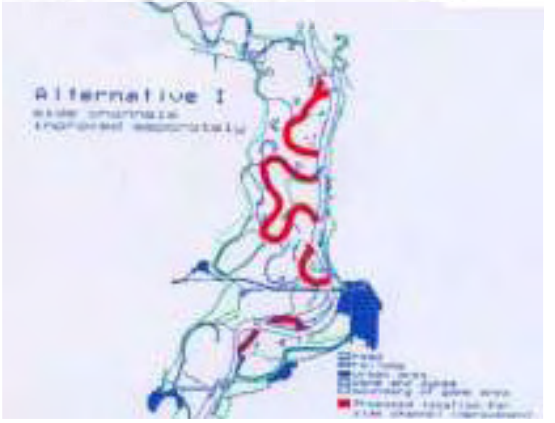
- **According to the water regime of the Danube, one inundation per year should be possible at (optimum) 95%, (minimum) 75% probability**

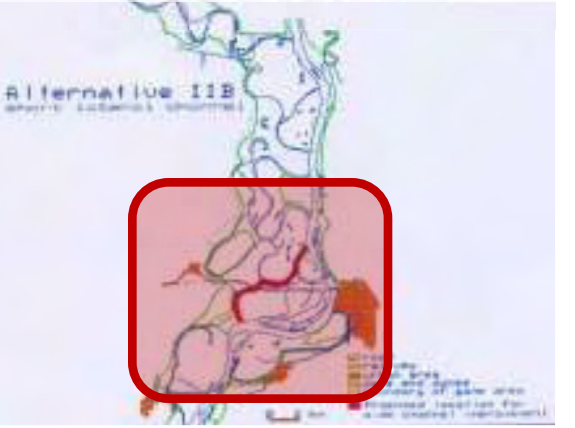
BUT

- Human uses should be taken into account besides nature protection aspects: they should not be affected
  - Flood protection and navigation
  - Forest and game management (keep certain areas dry – assure the possibility of access)
  - Recreational activities (freely accessible zones not to be flooded if possible)
  - Local village communities (fishermen, transport)


3. Interventions

Proposed water supply improvement solutions, 1992





Vén-Duna – Cserta – Nyéki reconstruction works, 1998-1999.

1480,8 - 1483,5 fkm


Closure: 1910
Opening: 1998


Retention of floodwater in the dead branches with bottom weirs

GEF Nutrient Reduction Programme in Gemenc 2010-2011

Elements:

–Dredging
–Building culverts and sluices
–Building water retention weirs
–Establishing monitoring

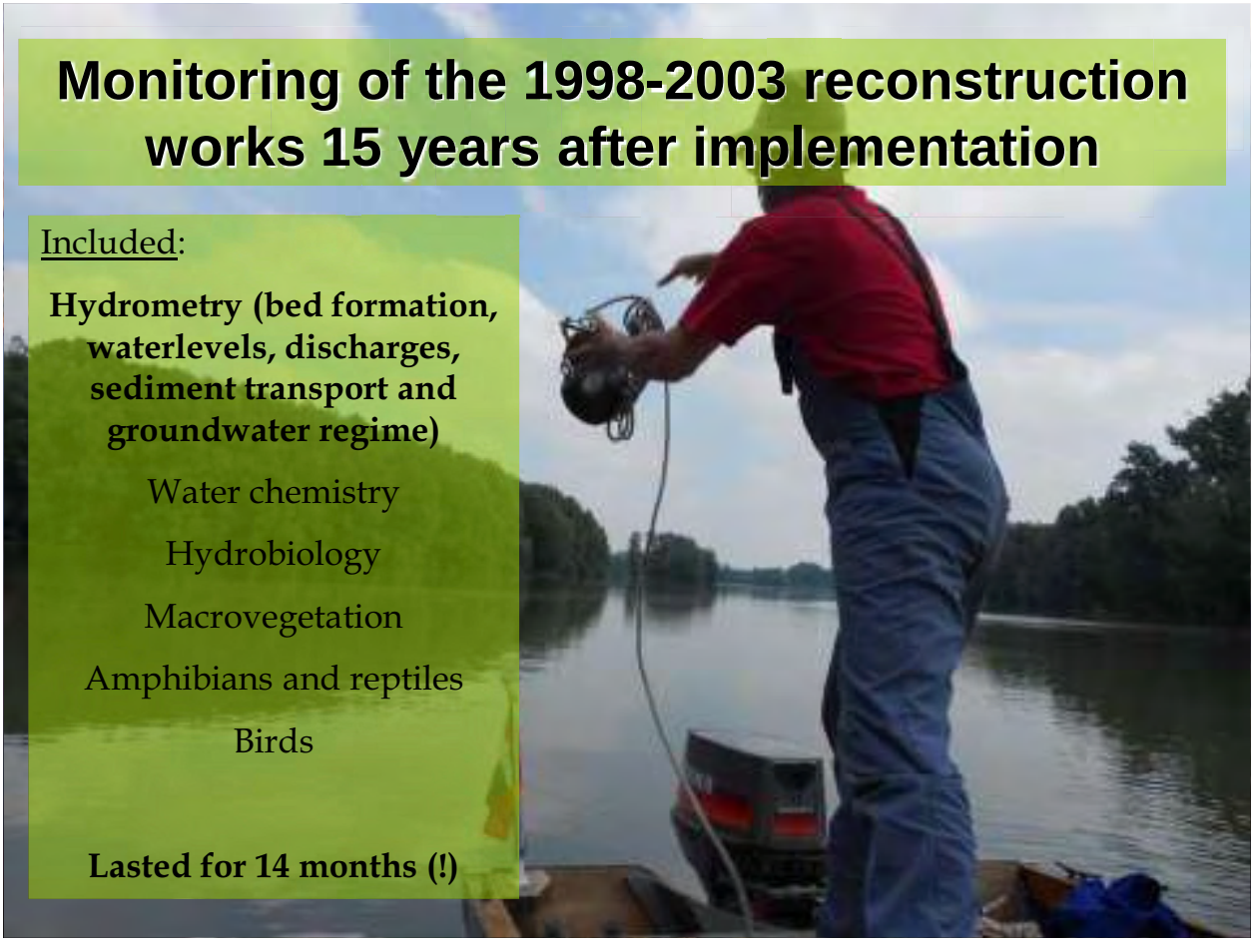

4. Experiences

Monitoring of the 2010-2011 reconstruction works 2 years after implementation

Proposed monitoring during operation

Monitoring Requirement	Monitoring Frequency	
Water Quality	Continuous for nitrogen, phosphorus, BOD and COD. Weekly for all other parameters	-
Water regime	Continuous	+/-
Floating material constructed structures	After each flooding event, weekly during the fall	-
Sedimentation	After each flooding event, monthly otherwise	-
Biomass	Monthly, weekly between May and October	-
Wildlife and biodiversity	Monthly	+
Health risks	Weekly between May and October	-

Monitoring of the 1998-2003 reconstruction works 15 years after implementation



Included:

Hydrometry (bed formation, waterlevels, discharges, sediment transport and groundwater regime)

Water chemistry

Hydrobiology

Macrovegetation

Amphibians and reptiles

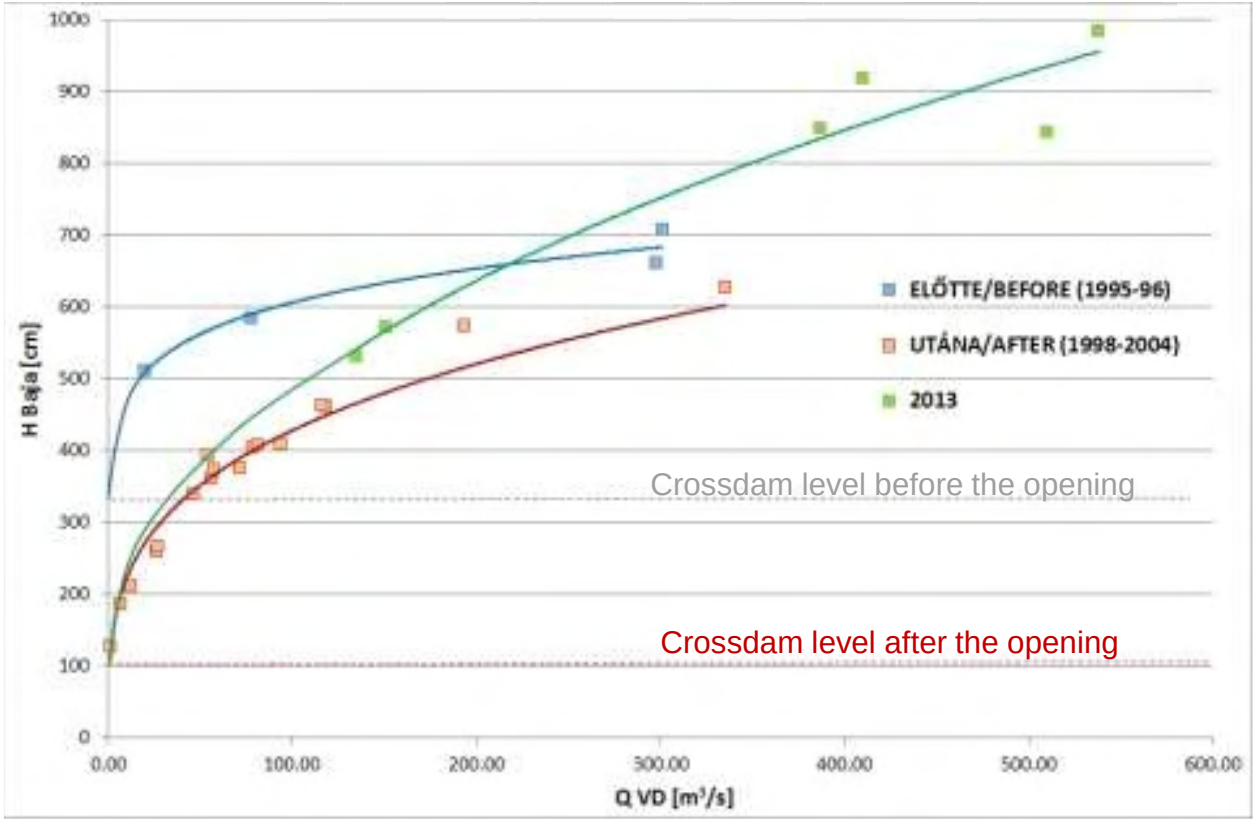
Birds

Lasted for 14 months (!)

Hydrometry on the Vén-Duna branch

Date	BAJA H (cm)	VD Q (m3/s)	Sediment sampling	Measured by	Instrument
1995.06.07	662	298.00		EJF-MF VGT	OTT Nautilus
1995.06.16	708	301.00		EJF-MF VGT	OTT Nautilus
1995.09.12	512	19.90		EJF-MF VGT	OTT Nautilus
1996.05.23	585	77.70		EJF-MF VGT	OTT Nautilus
1998.09.09	340	46.20	Bed and suspended	EJF-MF VGT	OTT Nautilus
1998.09.11	375	71.10		EJF-MF VGT	OTT Nautilus
1998.09.18	462	118.00		EJF-MF VGT	OTT Nautilus
1998.09.22	574	193.00		EJF-MF VGT	OTT Nautilus
1998.10.01	410	94.00		EJF-MF VGT	OTT Nautilus
1999.09.07	404	78.20		EJF-MF VGT	OTT Nautilus
1999.10.13	259	26.40		EJF-MF VGT	OTT Nautilus
1999.10.25	187	6.55	Bed and suspended	EJF-MF VGT	OTT Nautilus
2000.03.13	627	335.00		EJF-MF VGT	OTT Nautilus
2000.08.02	407	80.90		EJF-MF VGT	OTT Nautilus
2000.09.04	212	12.40		EJF-MF VGT	OTT Nautilus
2000.10.02	266	26.60	Bed and suspended	EJF-MF VGT	OTT Nautilus
2002.10.14	393	53.90		EJF-MF VGT	OTT Nautilus
2003.07.16	128	0.76	Bed-load only	EJF-MF VGT	OTT Nautilus
2003.10.12	362	56.00		EJF-MF VGT	OTT Nautilus
2003.10.12	373	57.70		EJF-MF VGT	OTT Nautilus
2004.01.17	463	116.00		EJF-MF VGT	OTT Nautilus
2013.05.11	572	150.57	Bed and suspended	EJF MKK VVI	ADCP RG WH1200
2013.05.19	531	135.10	Bed and suspended	EJF MKK VVI	ADCP RG WH1200
2013.06.08	843	510.00		ADUVIZIG	ADCP RG WH600
2013.06.13	985	538.00		ADUVIZIG	ADCP RG WH1200
2013.06.16	918	410.00		ADUVIZIG	ADCP RG WH600
2013.06.18	849	387.00		ADUVIZIG	ADCP RG WH600

Rating curves of the Vén-Duna branch



Summary and conclusions

The key of wetland habitat improvement in Gemenc (and generally, in floodplains) is the improvement of the water and sediment regime – monitoring of which is generally missing.

With accepting that current interests, such as flood protection, navigation and forestry can not be harmed, there is a very limited possibility for intervention and no chance for a long-term sustainable solution.

That's why all „reconstruction" interventions prove to be:

- **Even more artificial than the status before them and/or**
- **Recurrent, because governing causes still prevail**

THUS: without monitoring key hydrological elements and getting to know the nature of processes, further steps in this direction should not be taken.


Thank you for the attention!
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