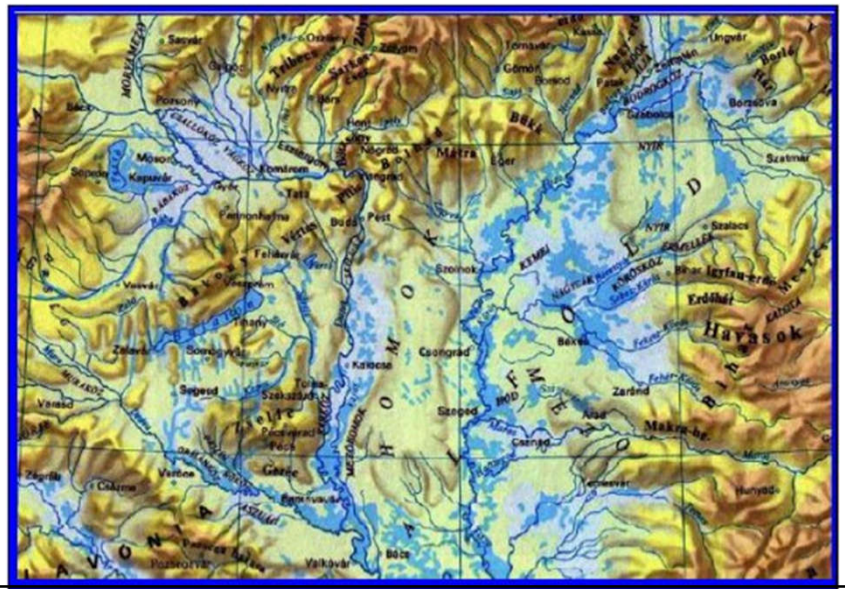
Riparian vegetation in Hungary: biological and hydrological perspectives

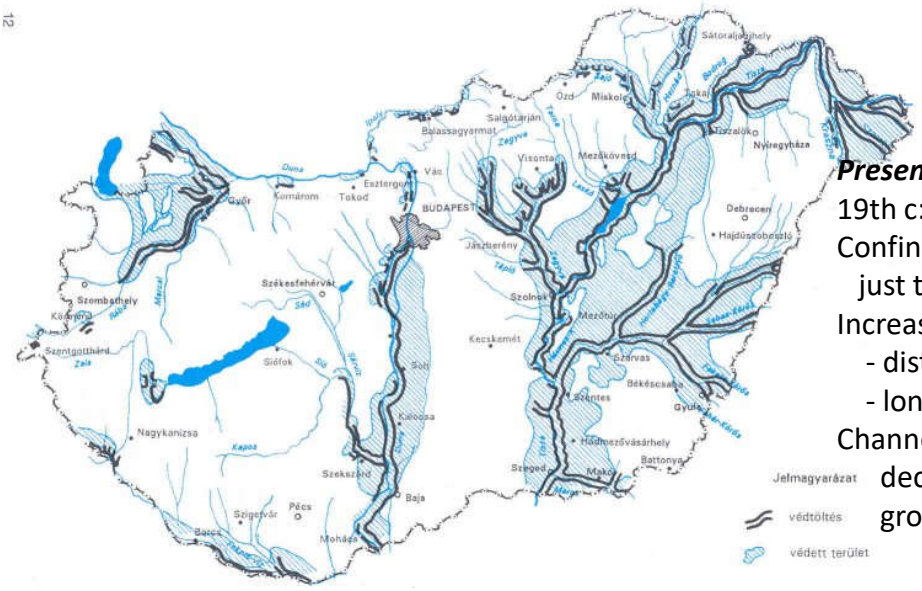
Tímea Kiss, Judit Nagy, István Fehérvári
University of Szeged, Hungary
Department of Physical Geography and Geoinformatics

Floodplains in the Carpathian Basin (Hungary)



Pre-regulation conditiions:
Flooded areas for months
Especially along large rivers

Floodplains in the Carpathian Basin (Hungary)



Present conditions:

19th c: artificial levee constr.

Confined floodplains:
just the very core remained

Increasing flood levels (+3-4 m)
- disturbance for native sp.
- long-lasting floods

Channel incision (3-4 m)
decreasing stages,
ground water lowering

I. Hydromorphological framework for RV *characterisation* (2008)

Parameter group	Parameters applied in the National Method
Channel continuity	**Longitudinal continuity** **Lateral continuity (water input of ox-bows on the active and inactive floodplain)**
Morphological characters	
Variability of the channel depth and width	**Large rivers: degree of regulations,** **Small/medium rivers: meandering, longitudinal variability**
Channel bed material and structure	**Channel bed material** **Degree of in-channel accumulation (type, degree)** **Rate of submerging/floating vegetation** **Small/medium rivers: channel size, bank slope**
Structure of the near-bank zone	**Floodplain/Artificial floodplain width and condition** **Small/medium rivers: vegetation zones**
Hydrological conditions	
Rate and dynamics of flow	**Regime** **Existence of impoundement**
Connection to subsurface waters	**Mid-stage changes due to incision or impoundement**

Hydromorphological characterisation of rivers and riparian ecosystems

Groups: MF: macro-phyta, MZB: macro-invertebrates, Fish

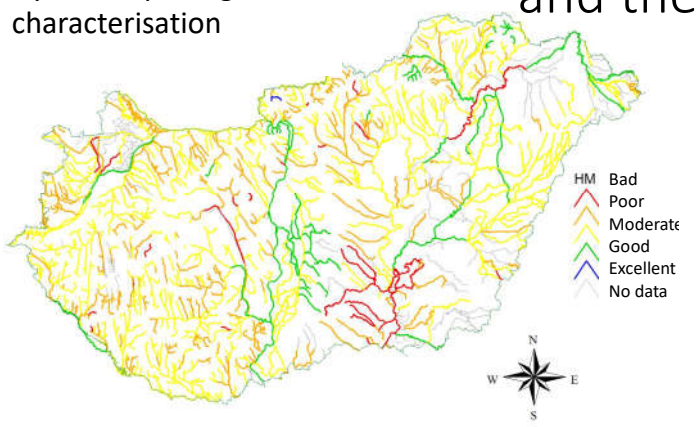
Parameter	Good state (WFD)	Weighted parameters			
		MF	MZB	Fish	Max
Width of active floodplain	Active floodplain considered as buffer zone: In case of floodplain forest: 300-500m,; In case of meadows (behind the forest) min. 500-800 m.	3	2	1	3
State of the floodplain	Agriculturaal area less than 30%.	4	2	1	4

No characterisation of forests (plantation vs. Riparian forest)

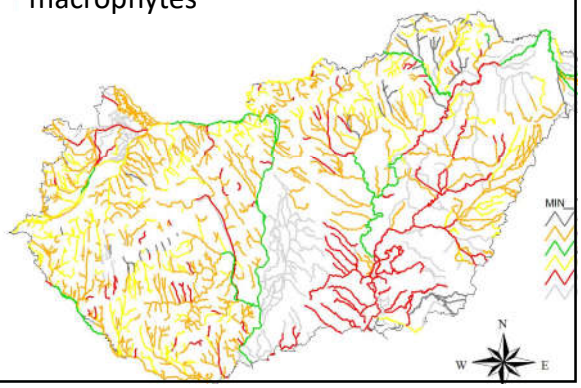
No evaluation of invasive species

Hydromorphological characterisation of rivers and the riparian ecosystems

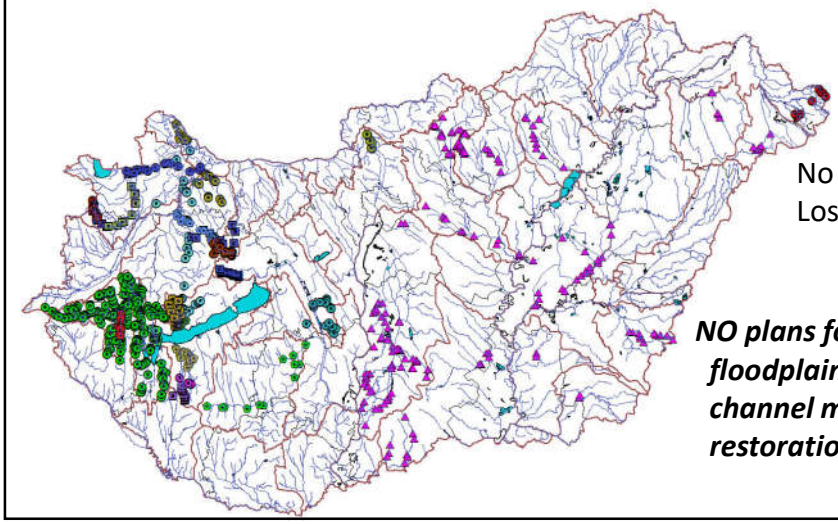
Hydromorphological characterisation



Hydromorphological characterisation for macrophytes



Hydromorphological characterisation of rivers and the riparian ecosystems



Study areas for the assessment of RV

No monitoring ever since
Lost data/not available

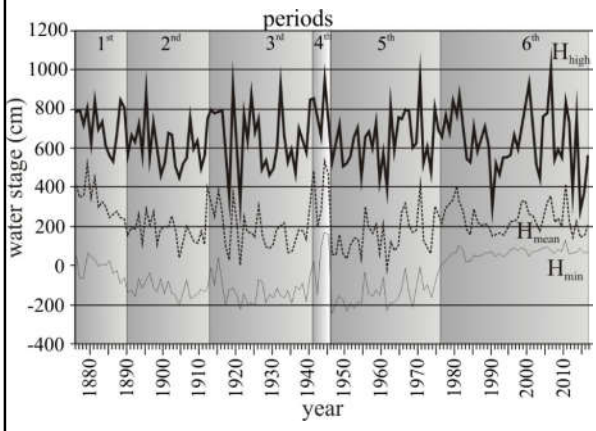
NO plans for floodplain vegetation management or channel management or restoration projects

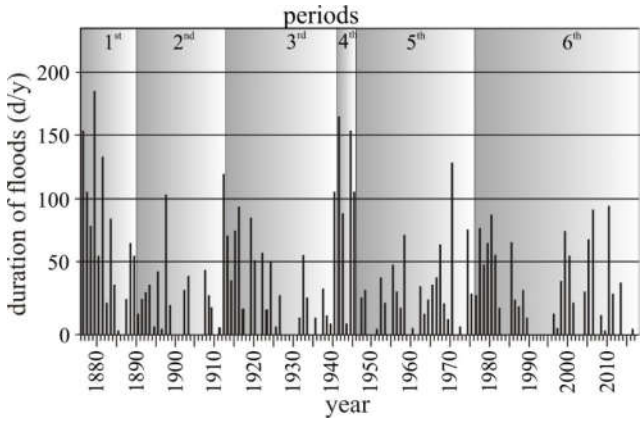
Tisza River

Large river:
Channel width: 100-150 m
Channel depth: 10-25 m
(+ 5-6 m during floods)
Low slope: 1-3 cm/km
→ high impact of RV on flow velocity

Artificial floodplain: 1-5 km

The problem (from a hydro perspective)

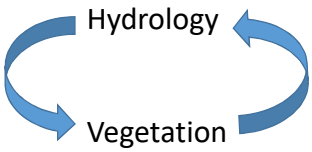




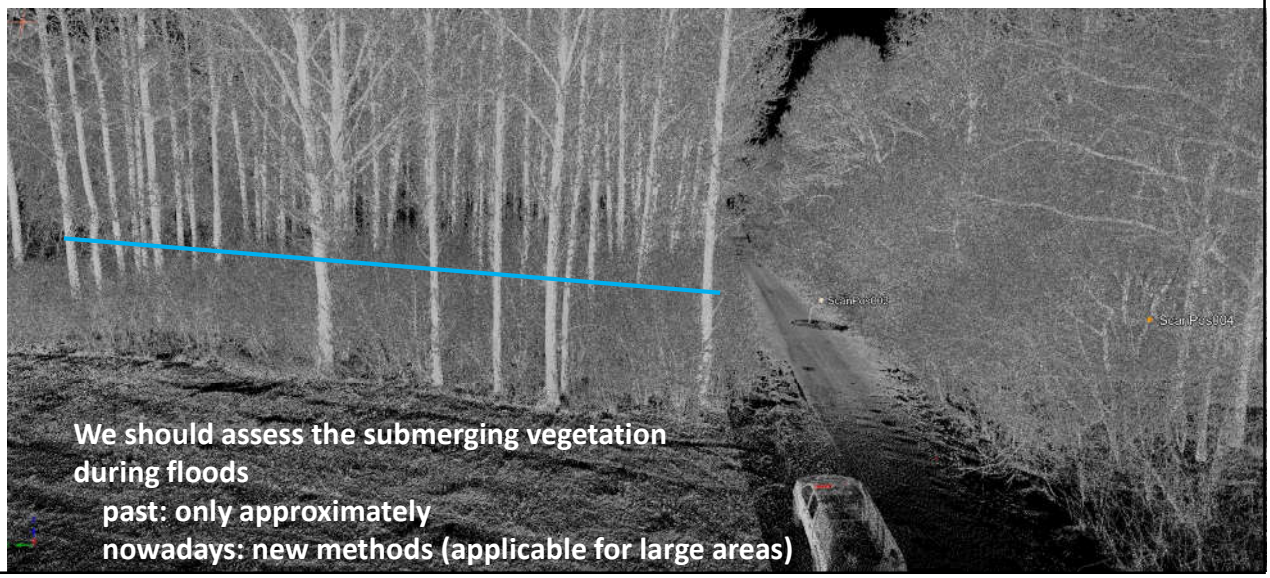
The role of vegetation and invasive species in flood hazard increase

Up to what extent will the vegetation influence the level of floods and flood hazard?

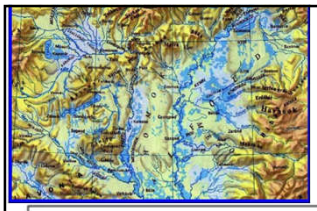
Amorpha fruticosa
Echinocystis lobata
Vitis vulpina



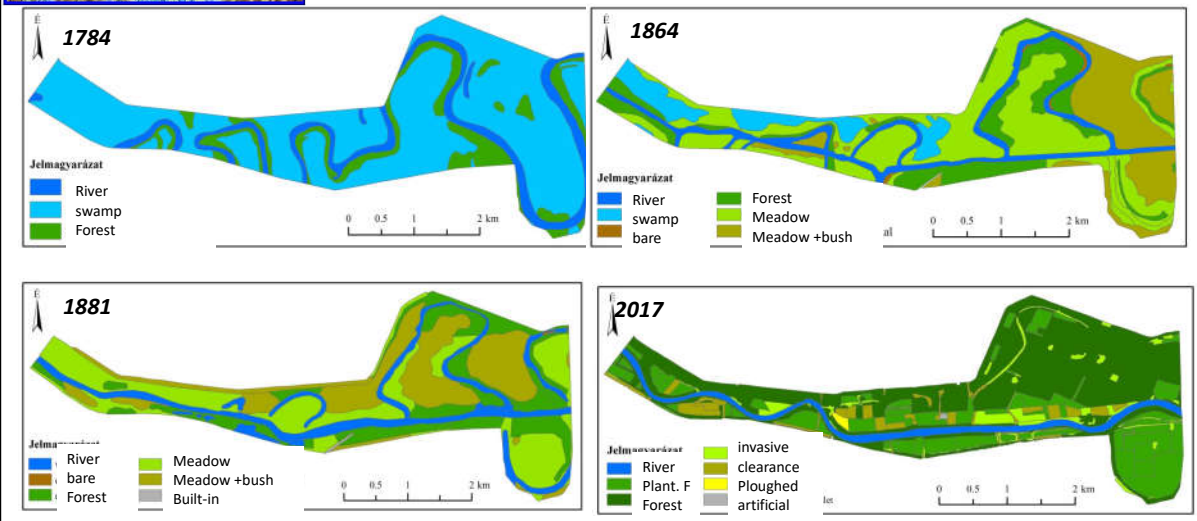
The role of vegetation and invasive species in flood hazard increase



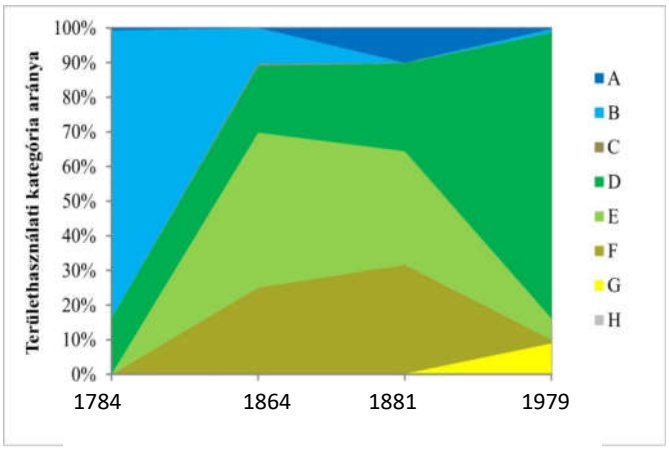
The role of vegetation in flood hazard increase

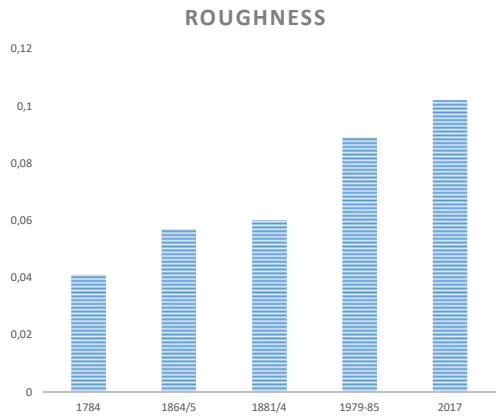


Land-use changes



The role of vegetation in flood hazard increase





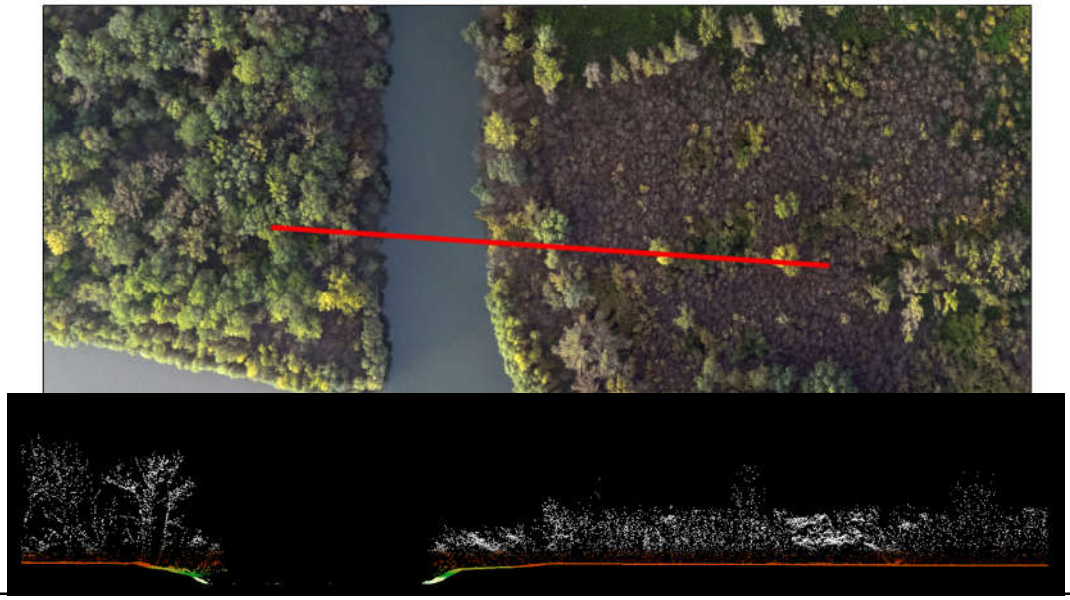
The role of vegetation and invasive species in flood hazard increase

Paralell Photographic Method - point like, not enough large areas

BUT:

role of Amorpha could be evaluated

Future: special processing of LiDAR (combining terrestrial and airborne images)



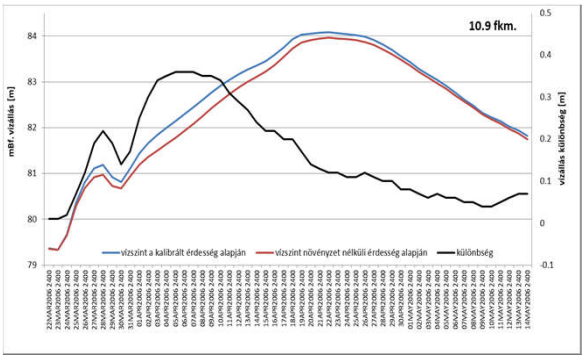
Site	Vegetation density		Decrease (%)
	With Amorpa	Without Amorpha	
101_a	0,0752	0,0752	0
101_b	0,1281	0,1281	0
101_c	0,0601	0,0597	1
102_a	0,0946	0,0203	79
102_b	0,0858	0,0554	36
102_c	0,0731	0,0381	48
102_d	0,0968	0,0924	5
01_a	0,1467	0,1380	6
01_b	0,1237	0,0621	50
01_c	0,1203	0,0995	17
02_a	0,0790	0,0682	14
02_b	0,1524	0,1514	1
03_a	0,2005	0,2005	0
03_b	0,2193	0,2193	0
05_a	0,1556	0,0000	100

The role of vegetation and invasive species in flood hazard increase

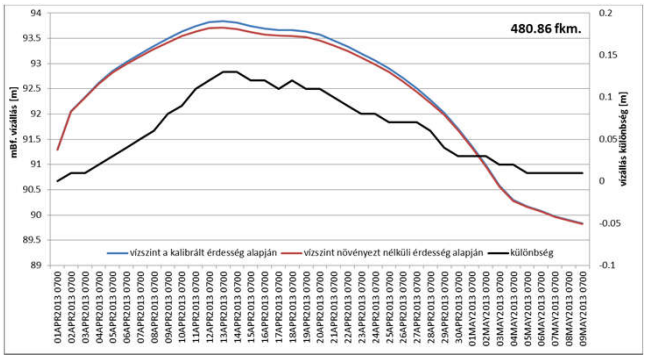
The role of vegetation and invasive species in flood hazard increase

Evaluation of dense (invasive) vegetation on floods

HEC-RAS and CES models



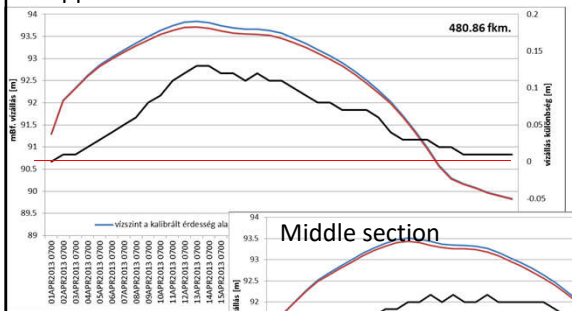
Maros River: high slope



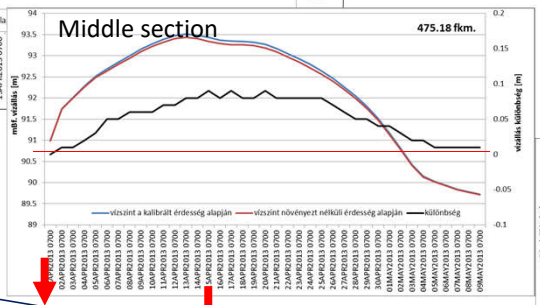
Tisza River: low slope

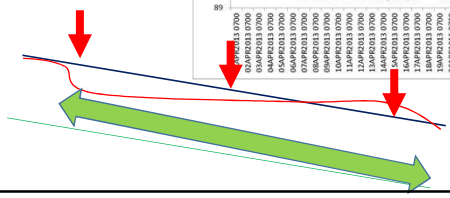
The role of vegetation and invasive species in flood hazard increase

Upper section

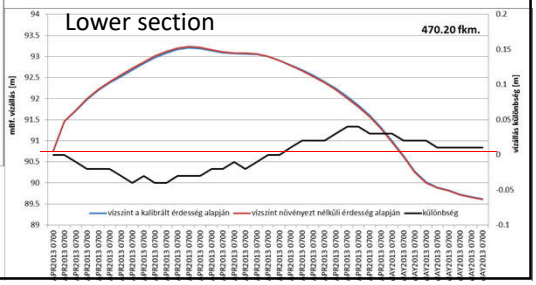


Middle section





Lower section



Conclusions

Invasive species will have increasing role in riparian vegetations

← climate change + human impact increase the pressure on RV

→ influence species composition

→ flood conveyance: height, velocity, sedimentation

Future:

New methods should be applied

Better floodplain management

Prevention