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TAKING
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Final meeting
9-10 June 2020

# Nagykunság River Basin and Analysis with FramWat tools, results of dynamic tool

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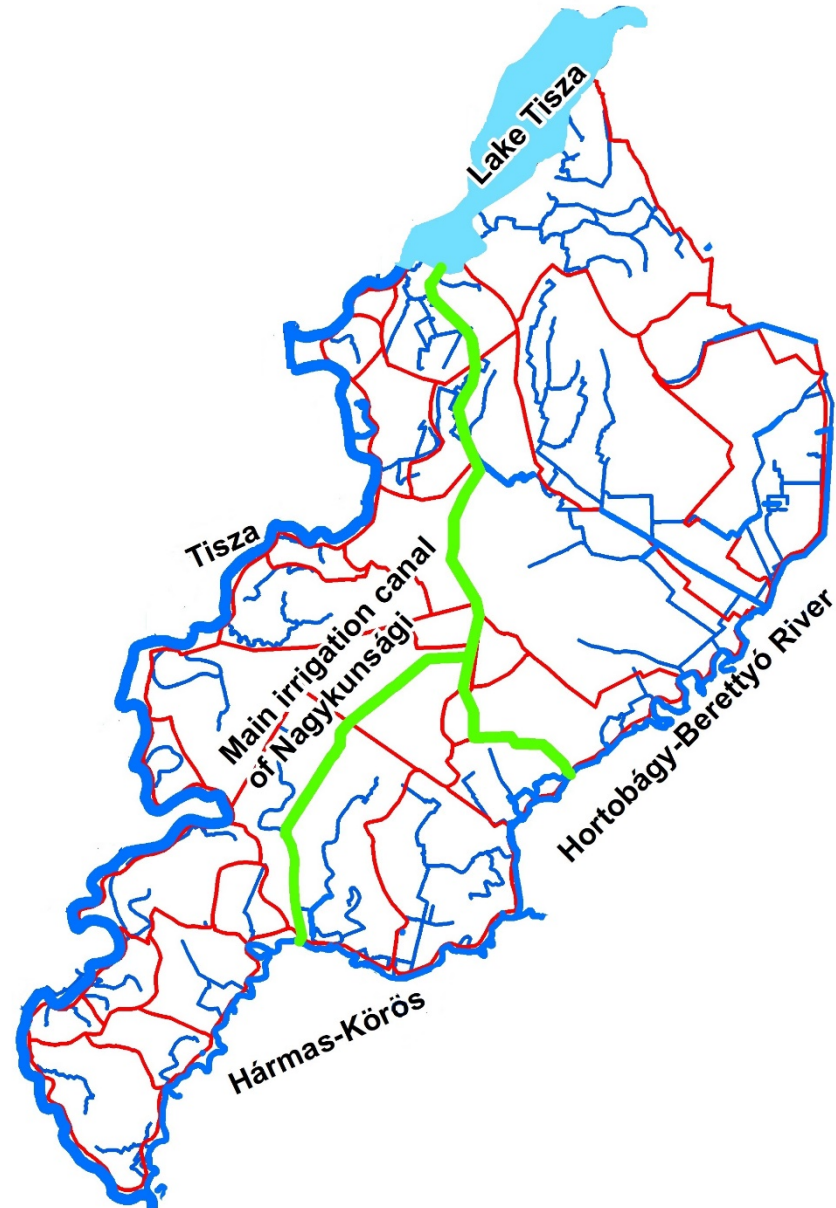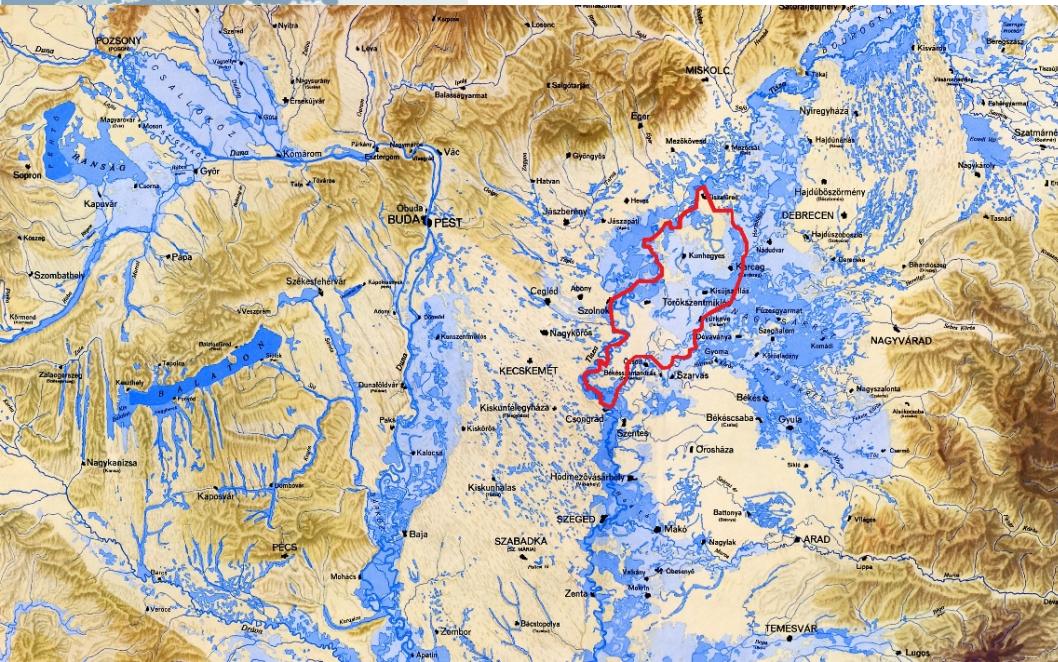# Catchment characteristic



## Nagykunsági River Basin

Area: 2 965 km²

# Nagykunsági River Basin

Simplified profile of Nagykunsági river basin

Pump station

Irrigation network

Drainage canal network

River Tisza

River H-Körös

Not permeable soil types

Excess water inundation

| | % | |
|---|---|---|
| Agriculture area | % | 73 |
| Urban area | % | 5 |
| Forest area | % | 5 |
| Open water area | % | 1 |

Irrigation canal: 430 km,

Drainage canal: 2030 km,

Pump stations: 68 pcs (tot. cap.: 95,0 m³/s.)

2 emergency reservoirs with total capacity of 196 million m³.
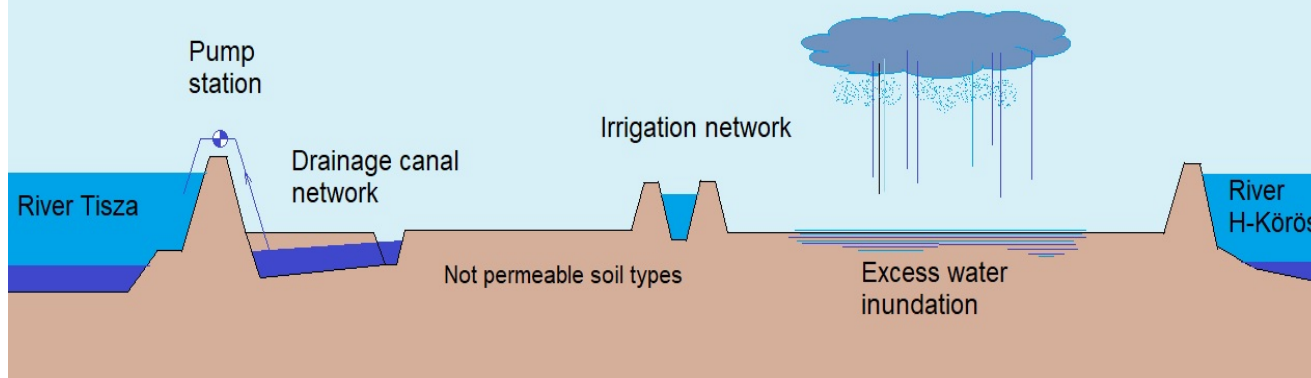
- Lowland catchment,

- Natural flow is small: artificially influenced,

- Mainly agricultural area,

- Flood, Drought and excess water risk.

Nagykunsági flood reservoir:

99 million m³.

Tiszaroff flood reservoir:

97 million m³

## SPU's: Sub-basins: (28 basins)

059. Örvény-Abádi
060/a. Mirhó-Gyócsi
060/b. Ledencei
060/c. Tólaposi
60/d Gyenda-Tiszaбői
61/c Kakati
62/d Örményes I.
63/c Örményes II.
64/a Fegyverneki
049. Hortobágyi
61/a Karcagi
61/b Villogó
64/b Óballai
64/c Szajoli
64/d Alcsi-Tenyő-Kengyeli
64/e-f Rákóczifalva-Szandai
65/a Cibaki
65/b Tiszakürti
65/c  Tiszaugi
66/b Kungyalu I.
66/c Tóközei
66/d  Tőkefoki
62/a Túrkeve - Kiserdei
62/b Mezőtúr - Álomzugi
62/c Mezőtúr – Halásztelki
63/a Mesterszállás-Bartap.
63/b Szenttamási
66/a Kungyalu II.

# FroGis results

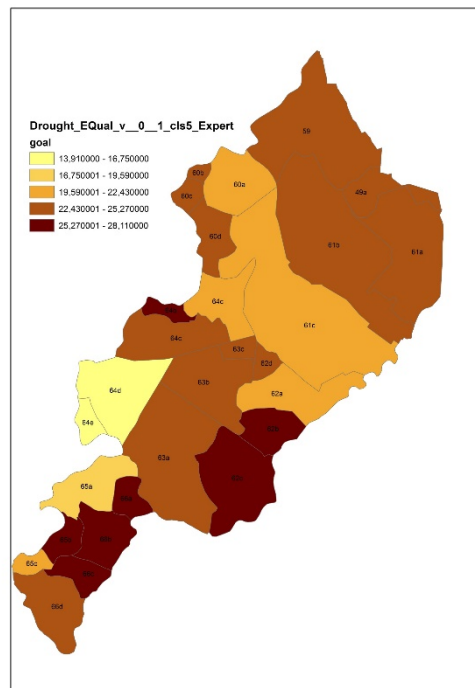## Final valorisation maps

### General
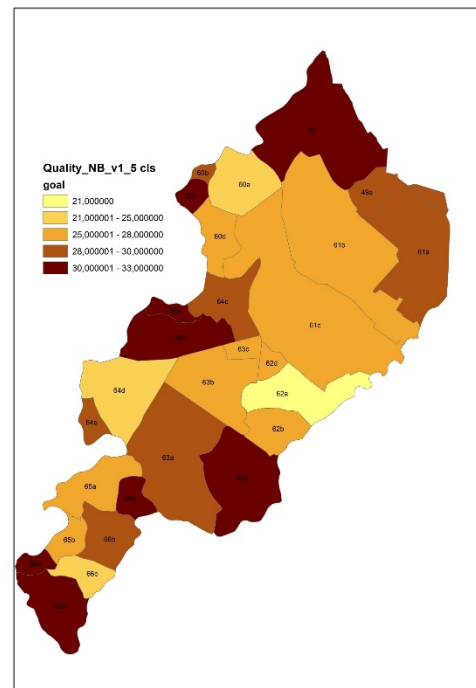(Five classes/Natural breaks classification, variable indicator weight)
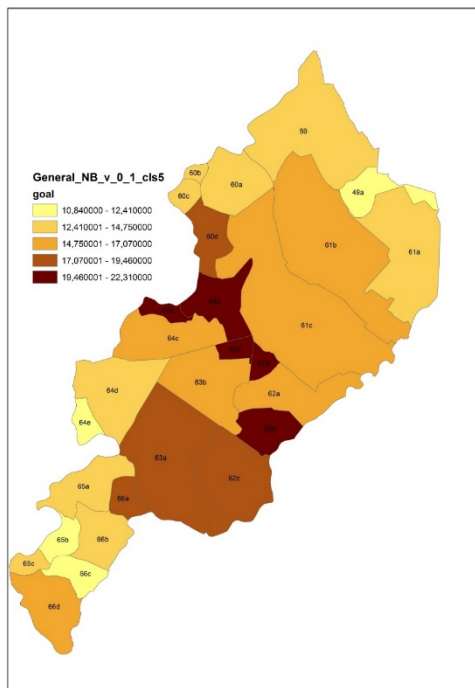
### Drought mitigation
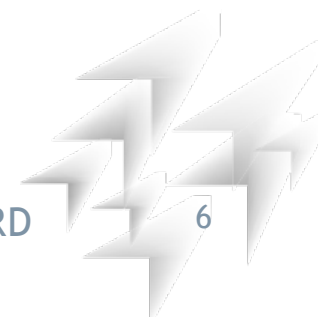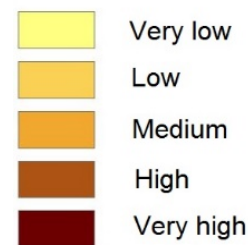(Five classes/Equal classification, variable indicator weight)

### Water quality
(Five classes/Natural breaks classification, constant indicator weight)

# Selection of N(S)WRM's- Concept plan

| Code | Sector | Measures type (NWRM/NSWRM) |
|---|---|---|
| A01 | Agriculture | Meadows and pastures |
| A02 | | Buffer strips and hedges |
| A06 | | No till agriculture |
| A07 | | Low till agriculture |
| A08 | | Green cover |
| A15 | | Deep plowing or Deep ripping (removing the plow's sole) |
| N02 | Hydro-morphology | Wetland restoration and management |
| N07 | | Reconnection of oxbow lakes and similar features |
| F01 | Forestry | Forest riparian buffers |
| D01 | Drainage area | Regulated outflow from drainage systems |
| D02 | | Water damming in ditches, wires with constant crest (valleys) |
| D03 | | Active water management on a drainage system (river valleys) |
| D04 | | Construction of micro reservoirs on ditches |
| D07 | | Construction of reservoirs on outflows from drainage systems |
| D08 | | Construction of small reservoirs on rivers (dammed reservoirs) |

# Placement of N(S)WRM's. Examples

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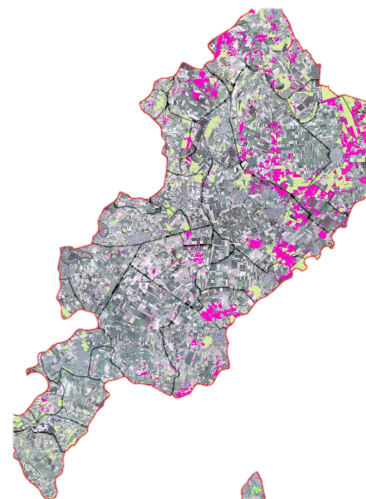European Regional
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**A01 Meadows and pastures-** Land use change from arable into meadow or pasture.

Selection criteria:

- Poor quality arable,
- High risk of pluvial flood.

Geodatabase:

- Arable quality map,
- Pluvial flood risk area map.



**Legend**

SPU

Planned land use change to M/P
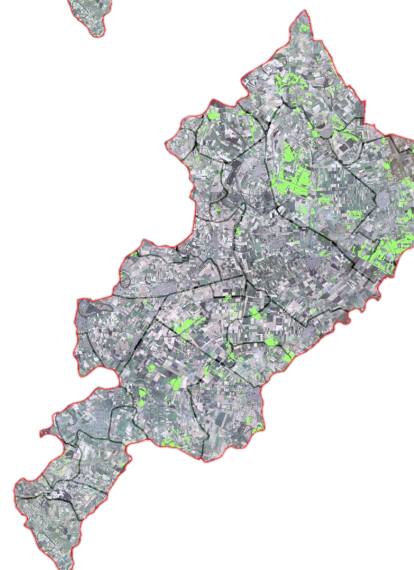
Current Meadows and pastures area

**A15 Deep plowing (removing the plow's sole) (Deep ripping)**

Selection criteria:

- Good quality arable,
- High risk of pluvial flood.

Geodatabase:

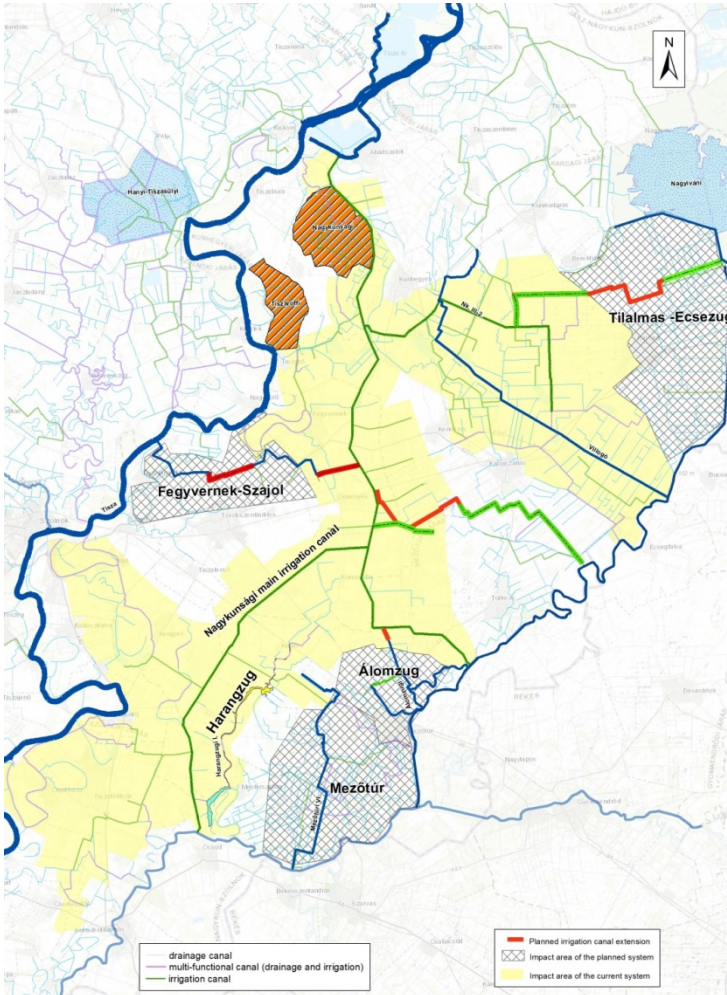- Arable quality map,
- Pluvial flood risk area map



**Legend**
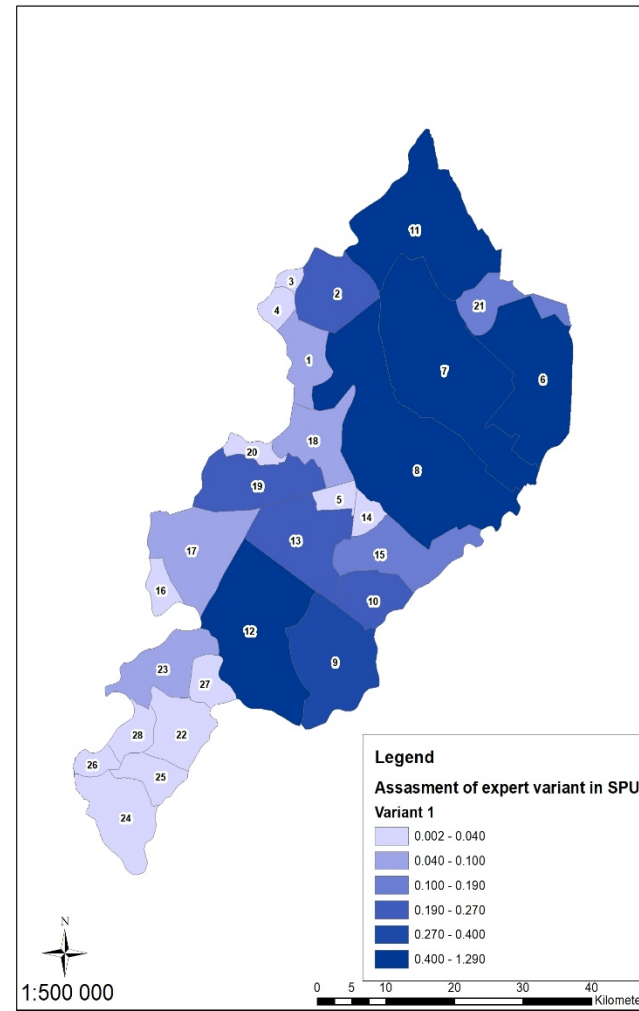
SPU

Planned deep plowing area

## Technical measures:

- Water retention in drainage-irrigation system,

- Developing the existing irrigation network,

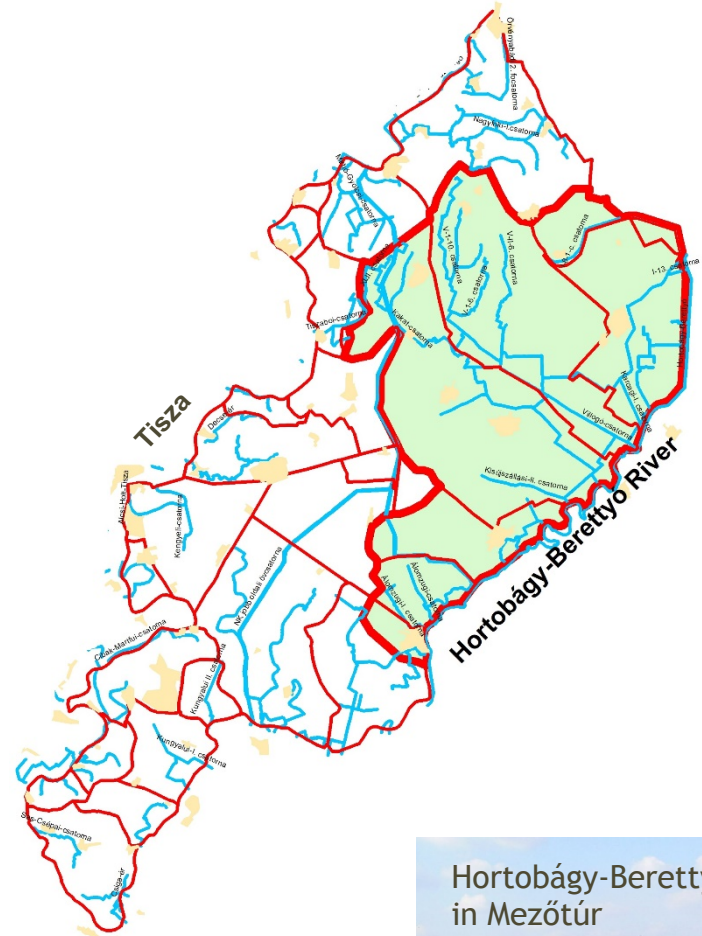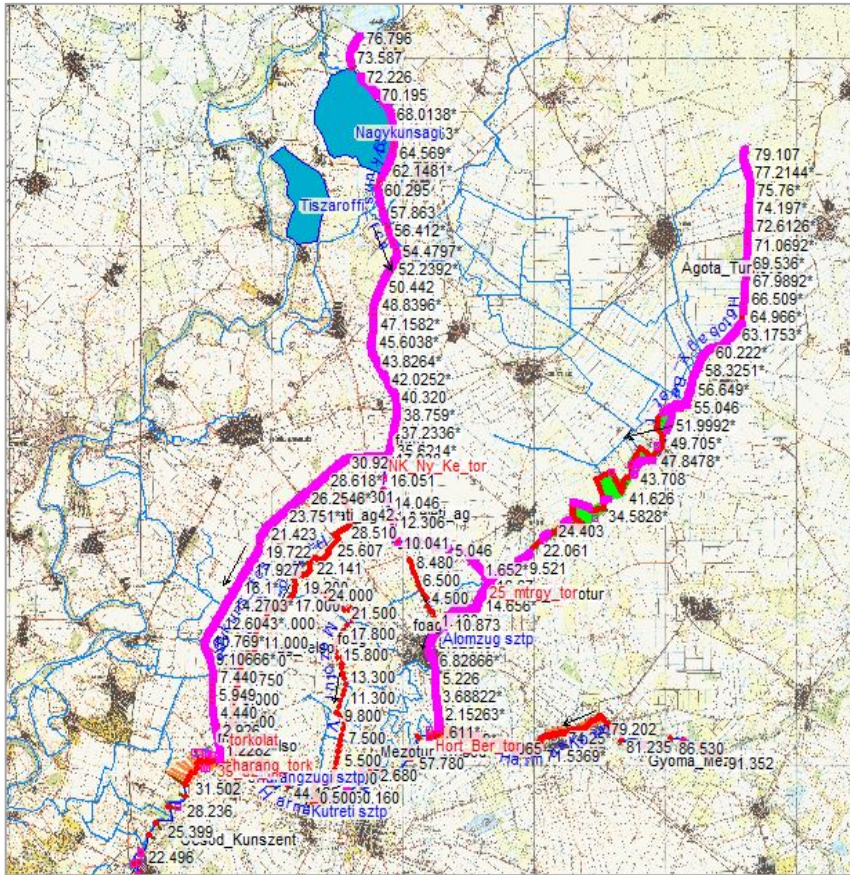- Oxbow lakes: water storage capacity increase, revitalization,

# Static tool results

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| Code | Sector | Measures (NWRM/NSWRM) | Aggregated measures for testing Static method |
|------|--------|------------------------|------------------------------------------------|
| A01 | Agriculture | Meadows and pastures | A01 |
| A02 | | Buffer strips and hedges | A02 |
| A06 | | No till agriculture | WRAL |
| A07 | | Low till agriculture | |
| A08 | | Green cover | |
| A13 | | Mulching/fertilization | A13 |
| A15 | | Deep plowing (removing the plow's sole) | A15 |
| N02 | Hydro-morphology | Wetland restoration and management | N02 |
| N07 | | Reconnection of oxbow lakes and similar features | N07 |
| F01 | Forestry | Forest riparian buffers | F01 |
| D01 | Drainage | Regulated outflow from drainage systems | BPDA |
| D02 | | Water damming in ditches, wires with constant crest (valleys) | |
| D03 | | Active water management on a drainage system (river valleys) | |
| D04 | | Construction of micro reservoirs on ditches | |

Legend

**Assasment of expert variant in SPU**

Variant 1

- 0.002 - 0.040
- 0.040 - 0.100
- 0.100 - 0.190
- 0.190 - 0.270
- 0.270 - 0.400
- 0.400 - 1.290

1:500 000

0 5 10 20 30 40 Kilometers

# Results of dynamic tool 1D HEC-RAS

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## Impact of excess water retention on floods level of Hortobágy-Berettyó River

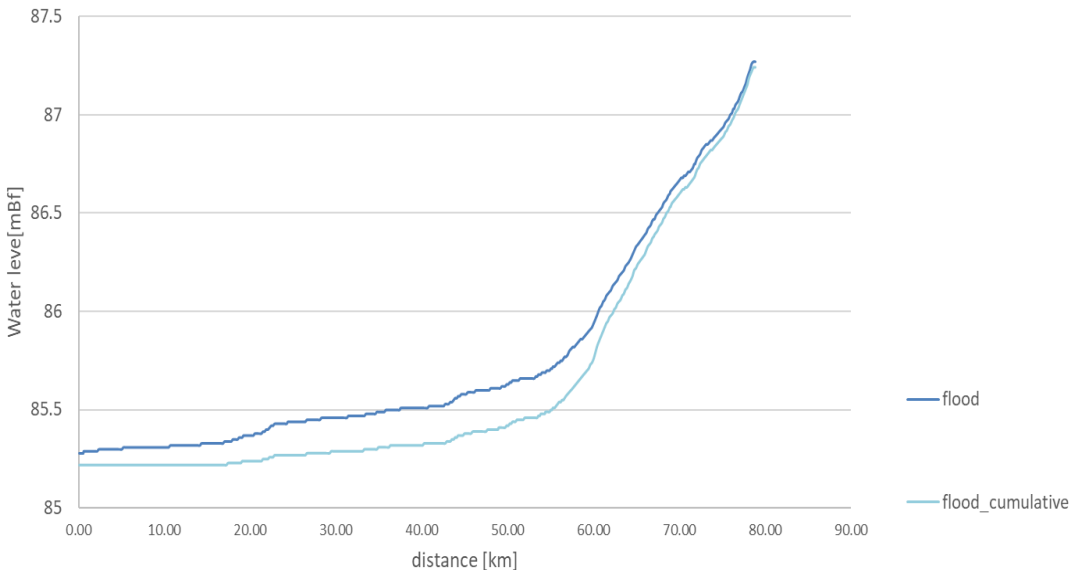



Hortobágy-Berettyó
in Mezőtúr

Photo: Gyula Papp

# Results of dynamic tool 1D HEC-RAS

## Impact of excess water retention on floods level of Hortobágy-Berettyó River



Crosssection results in Mezőtúr

- Stage - flood
- Stage - flood_cumulative
- Flow - flood
- Flow - flood_cumulative
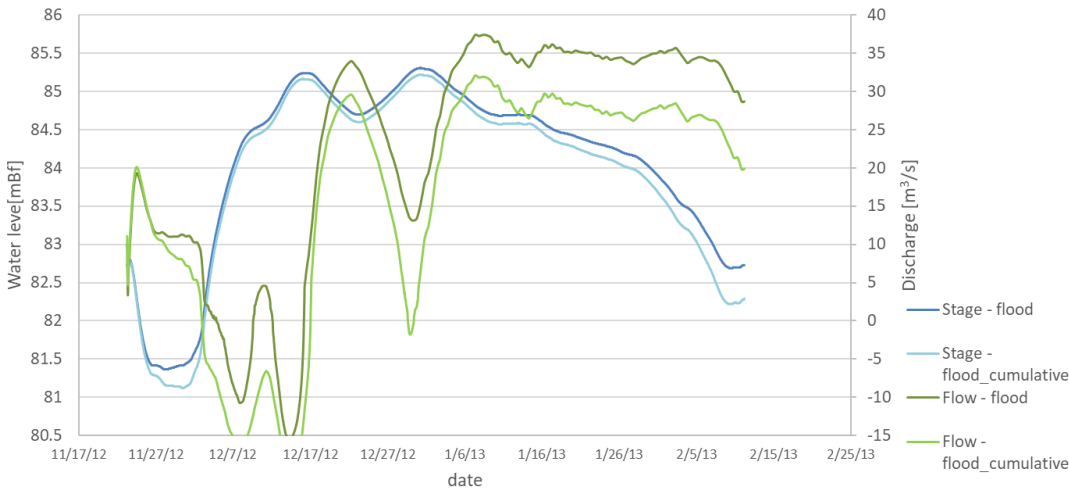


Longitudinal profile of Hortobágy-Berettyó

- flood
- flood_cumulative

Simulation period: Winter 2011

## Cumulative effects of :

- Temporary excess water storage in fields: **D01/A01 measures,**

- Soil water retention increase with deep plowing/ripping (**A15**)

- Water retention in drainage canal system (**D02**) and oxbows (**N07**)

## Water scarcity period

### Nagykunsági main irrigation canal.

# Results of dynamic tool
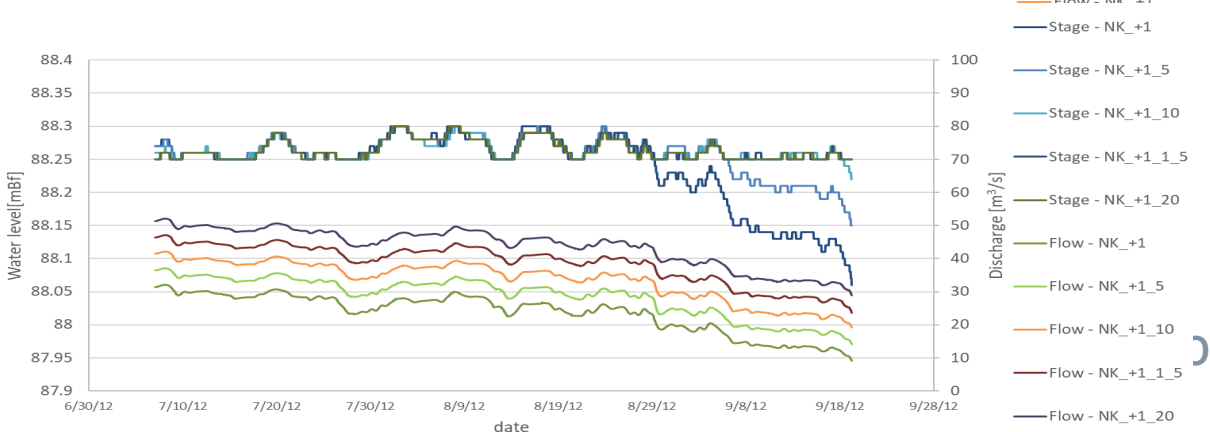## Effect of water storage on drought period
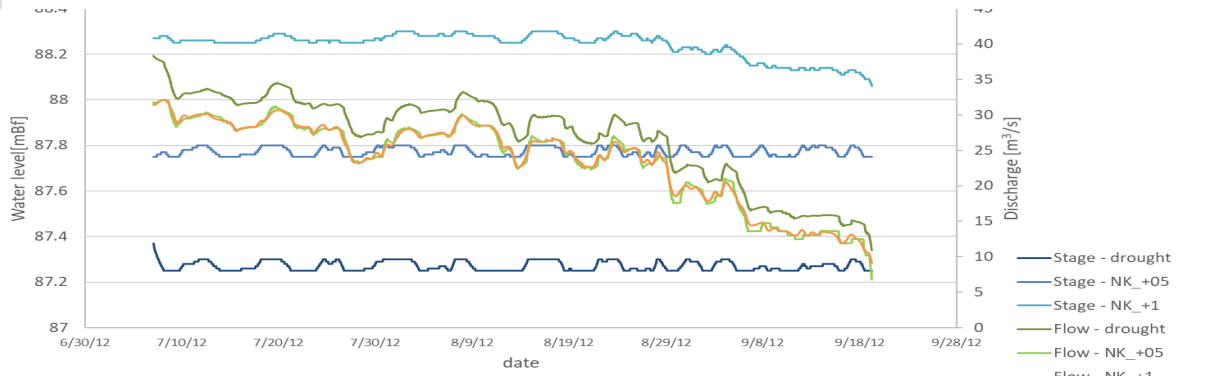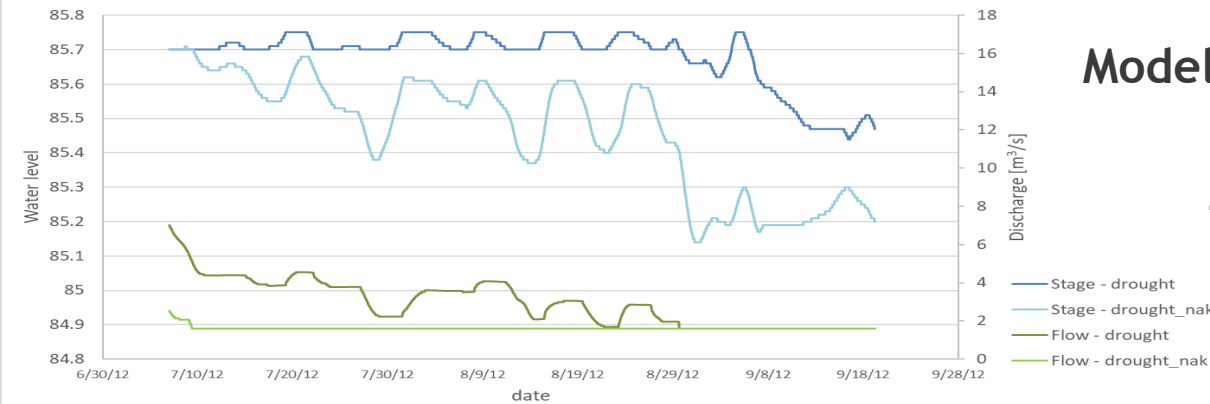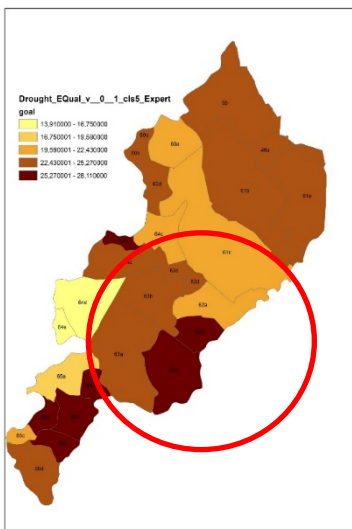
Crosssection results end of the West Branch

**Modelling period: Summer 2012.**

1)      Baseline scenario

2)      Increasing       water retention (Water       level increase 0,5, 1,0 m)

3)      Increasing       water retention     and     discharge (Water level increase 0,5, 1,0 m, discharge increase 5-20 m³/s.)
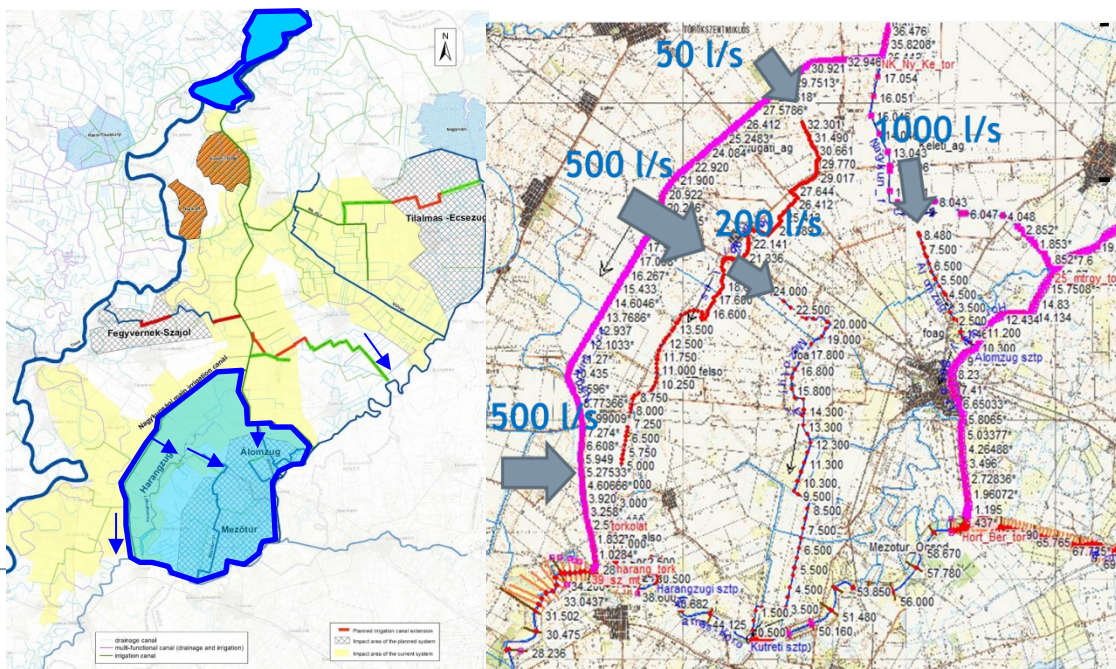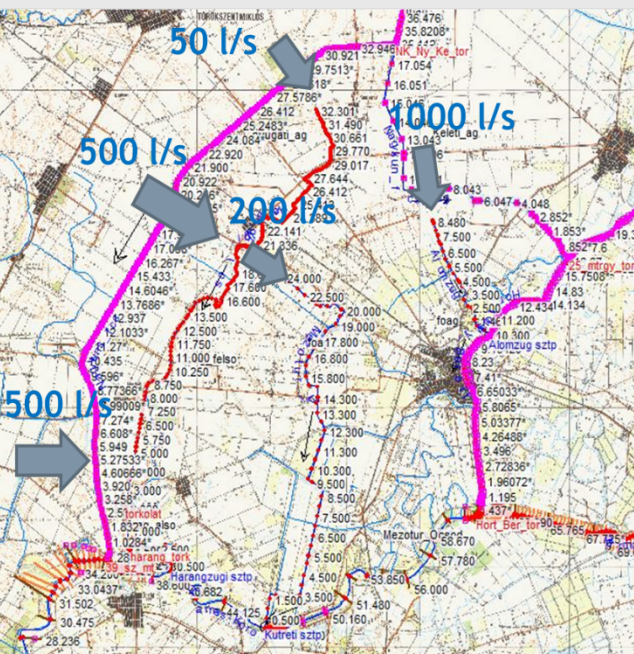
**Modelling water supply to dry areas using existing drainage network.**

- Water supply to mitigate the effects of drought,

- Impact of water retention for drainage canal system,
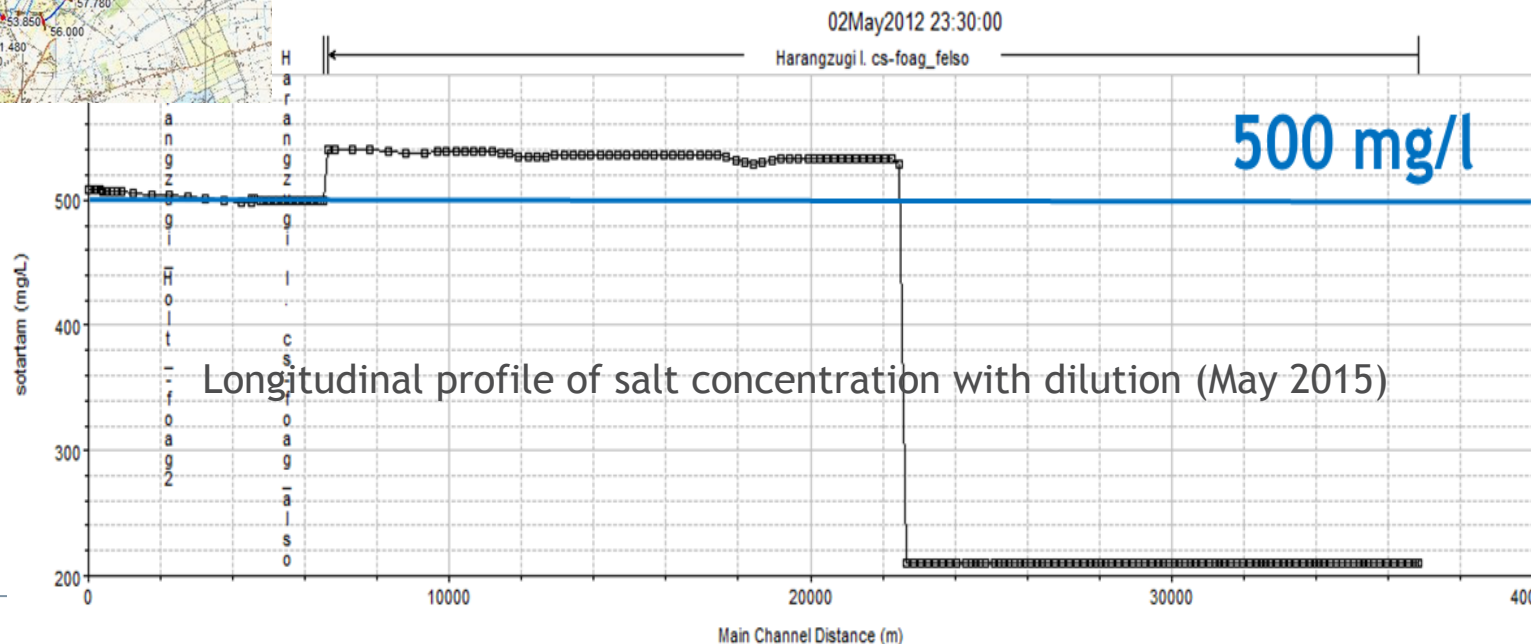
## Modelling water supply to dry areas using existing drainage network.

**Dilution effect of water retention on salt concentration of Harangzugi canal.**



Longitudinal profile of salt concentration with dilution (May 2015)

# Conclusions

- Water retention options in lowland catchments area are limited,

- Using the storage capacity of the soil profile is extremely effective in this kind of catchment.

- FroGis application is suitable to support planning process of N(S)WRM, identifying areas for water retention, for prioritization on river basin.

- Static tool is suitable for comparing variants in the pilot catchment without using detailed hydrological and hydraulic models of the analysed catchment.

- HEC-RAS 1D model as dynamic tool is suitable to model hydrodynamic processes. We analysed some of the process indirectly, in a few watercourses.

- The beneficial effects of small water retention is wider, e.g: local microclimate, habitat for aquatic communities, good ecological status, landscape attraction.

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Thank you for your attention!