

ALGORITHM  
FOR ASSESSING

# IRRIGATION WATER USE POTENTIAL

PERTAINING **PRESENT WATER PROTECTION MEASURES**  
AT THE DANUBE AND ADRIATIC SEA RIVER BASINS  
IN SLOVENIA

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4TH CASEE CONFERENCE

UNIVERSITY OF ZAGREB, FACULTY OF AGRICULTURE, CROATIA, JULY 1 - 3, 2013

# RATIONALE

**River basin management plans** (Danube and Adriatic Sea)

≅ umbrella operational plans under the WFD

set to achieve good status of water bodies 2009-2015

**Measure DDU26** to estimate

(a) Available stock of surface- and groundwater

(b) Existing and projected water use until period 2021

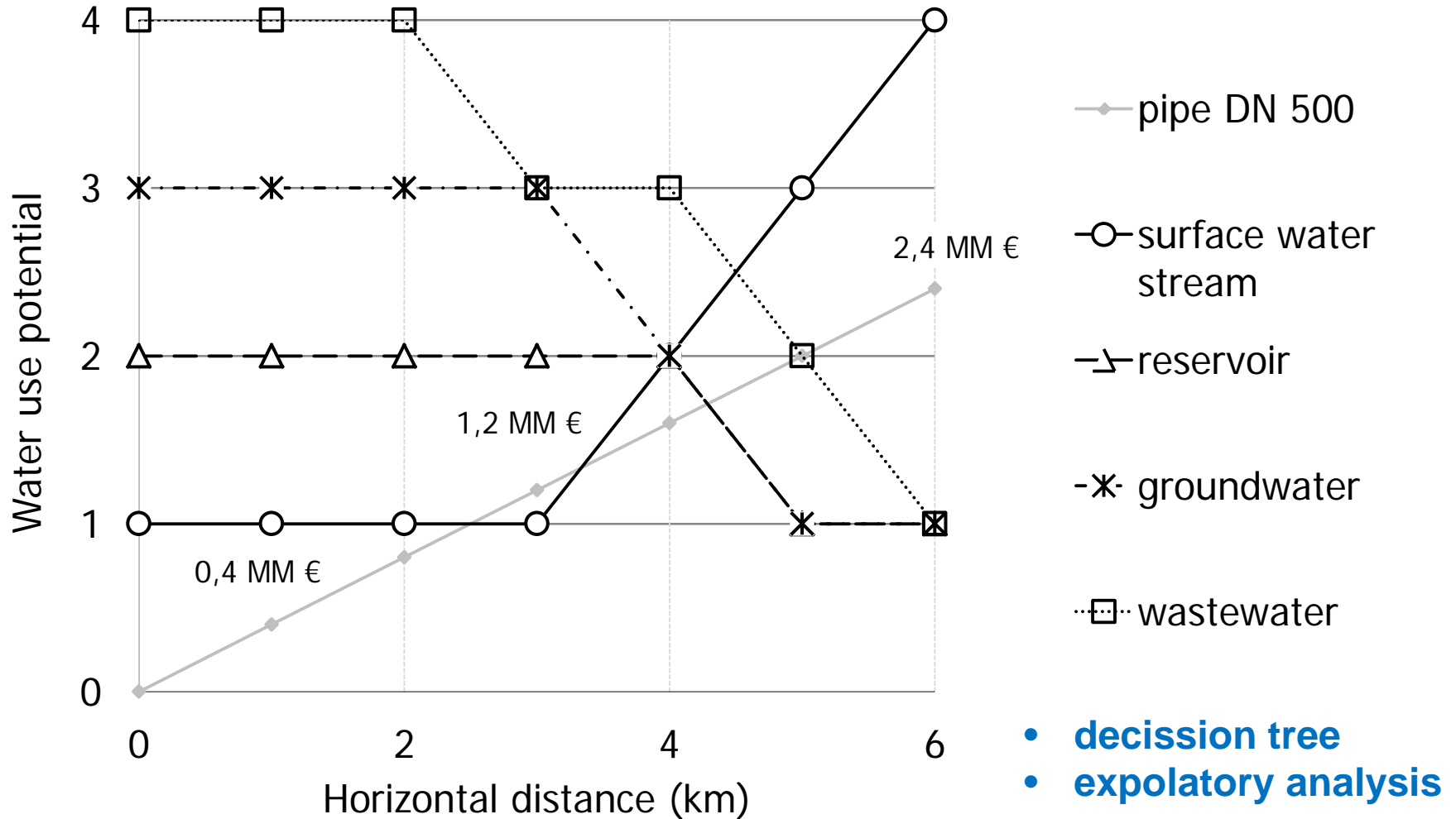
**Projections show future irrigation water use will increase.**

**RDP 2014-2020: 7000 ha new large irrigation systems (LIS).**

**No spatial reference is provided by the sectoral plan !**

# THE CONCEPT:

## IRRIGATION WATER USE POTENTIAL ALGORITHM



# METHODS (1/5): ECONOMIC USE SUITABILITY

Max project costs for LIS implementation  $\leq$  € 3 MM

200 ha = 500  $\phi$  pipe = 80 % of the investment

1 km = € 0,4 MM    4 km = € 1,6 MM

2 km = € 0,8 MM    6 km = € 2,5 MM

Max high difference = 100 m

**Max optimal impact area of surface waters**

= max 3 km horizontal AND max 100 m vertical

# METHODS (2/5): SURFACE STREAMS

## Concept of ecologically acceptable flow

$$Q_{nett} = Q_{95} - Q_{es}$$

**Q<sub>95</sub>** = average monthly flow that occurs 95% time

**Q<sub>es</sub>** = ecologically acceptable flow

$$Q_{nett} = 1,5 \times nQ_s(m-s) - f \times sQ_{np}(m-s)$$

**nQ<sub>s</sub>(m-s)** = Medium Periodic Mean Monthly Flow (May-Sept.)

**f** = watershed characteristics

ecological body type

catchment size

abstraction rate and time occurrence

ratio between the Mean Annual Flow and Mean Annual Discharge in a period (daily average)

**sQ<sub>np</sub>** = mean annual discharge in a period (daily average) (May-Sept.)

**Modified and artificial water bodies:** hydropower concession agreements

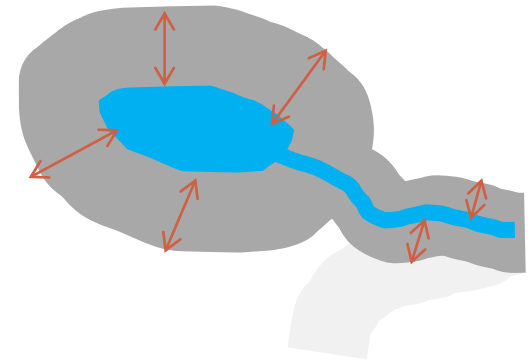
# METHODS (3/5): RESERVOIRS

## Optimal impact area:

360 ° around the reservoir

3 km distance

3 km water stream buffer from gate to fork



## Storage capacity for irrigation water:

Predefined: asset management plans

Set experimentally: 30 % of the existing reservoir volume

Defined indirectly: 30 % potentially irrigable land  $\cup$  impact area

# METHODS (4/5): GROUNDWATER BODIES

**National use priority:** drinking water supply

## **Availability**

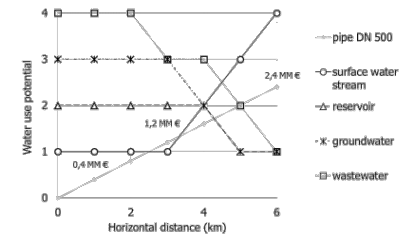
- Total yearly groundwater abstraction: water fees data (reserved)
- Groundwater body recharge
  - = effective rainfall x infiltration coefficient (Kennedy method)
- Quantitative status not endangered (WFD principle)
  - = Estimated total yearly abstraction / aquifer recharge < 33 %

## **Accessibility: porosity type and lithological structure**

- High: up to 50 m depth, € 11 K: river alluvial plains
- Medium: 70-150 m depth, € 15-30 K: intergranular, alluvial plains
- Low: 200 m depth, € 45 K: low hydraulic conductivity, Paleozoic shale and sandstone, clay rocks, metamorphic rocks

# METHODS (5/5): APPLICATION

**LAND USE LAYER:** 1 m resolution orthophoto imagery



**Categories:** irrigated, experimentally irrigated, potentially irrigable

- Arable land
- Orchard plantations, Olive groves
- Forest and other plantations, Permanent crops on arable land
- Nurseries, Hop fields

**Area size and water requirements:**

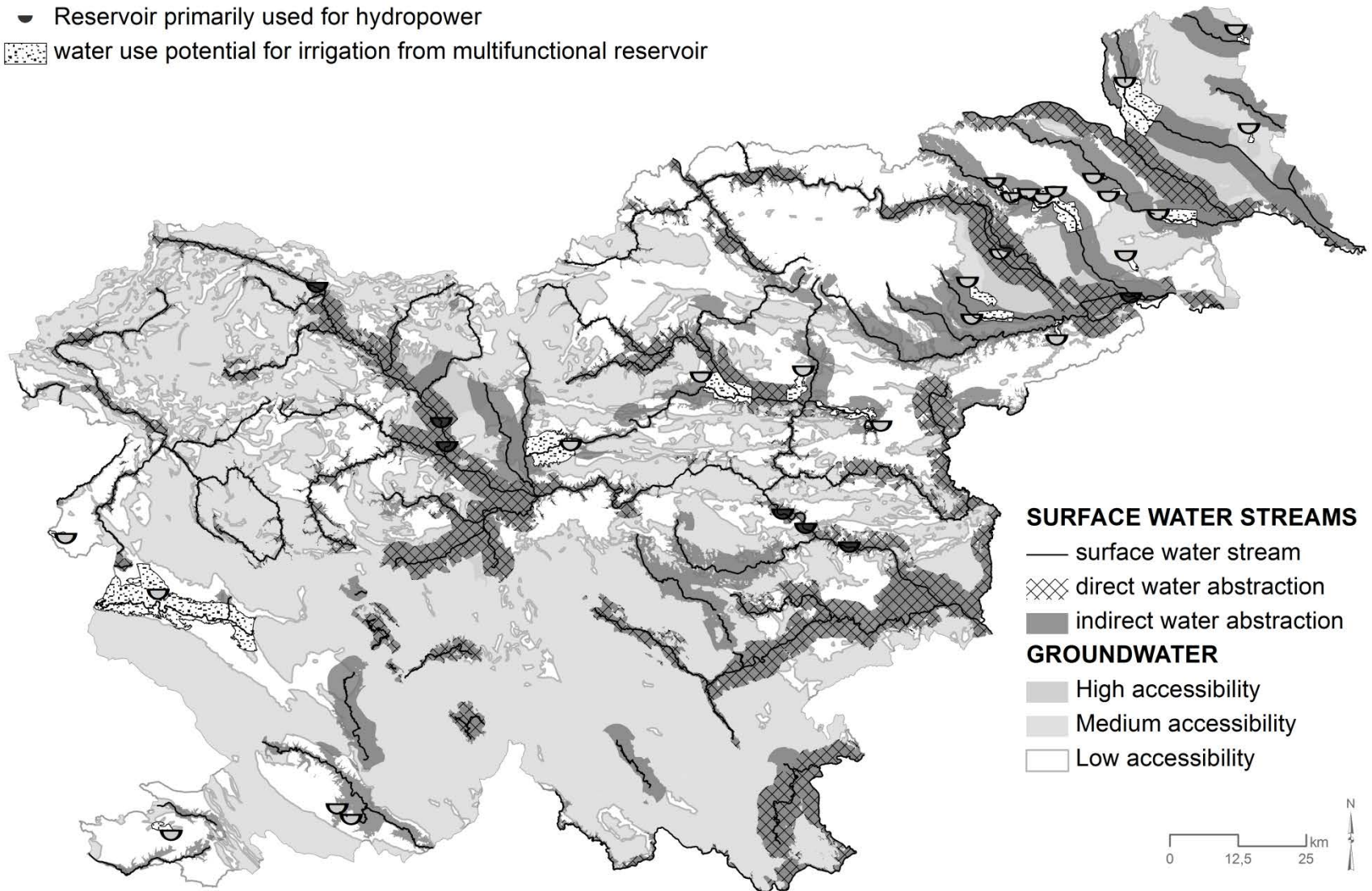
- 44 % utilised agricultural land = 194,935 ha
- 9,6 % of Danube and Adriatic Sea river basin at the area of Slovenia
- Water requirements: 0.56 l/s/ha contin. – 0.71 l/s/ha mediteran.



# RESULTS: HOW DOES IT LOOK LIKE?

## RESERVOIRS

- Multifunctional reservoir
- Reservoir primarily used for hydropower
- ▨ water use potential for irrigation from multifunctional reservoir



## SURFACE WATER STREAMS

- surface water stream
- ▨ direct water abstraction
- indirect water abstraction

## GROUNDWATER

- High accessibility
- Medium accessibility
- Low accessibility

# RESULTS: WHAT DOES IT MEAN?

## Surface water strams

### IRRIGATION DEVELOPEMENT

Impact area 125,964 ha: 41.5%

(52,330 ha) conditionally irrigable

**Dev. HOT-SPOTS** = fairly to v. g. pot.

- Spat. weight. RDP 14-20 impl. - LIS
- Stakeholder empowermentt

**Dev. LIMITED** = neg./limited pot.

- Spat. weight. RDP 14-20 impl. - SIS

### WATER MANAGEMENT

**Dev. HOT-SPOTS**

–abstraction 2021 ≠ adverse EI or endanger Good WB stat.

**Dev. LIMITED**

↑ abstraction 2021 = adverse EI or endanger Good WB stat.

- reservoir construction
- water demand management

# RESULTS: WHAT DOES IT MEAN?

## Reservoirs

### IRRIGATION DEVELOPEMENT

Reservoir purpose and use	Number	Potential (MM m <sup>3</sup> )	Potential (ha)
Used below	8	10	4,019
Not used	6	3.9	1,550
Irr. not planned	10	3	1,201
<b>Together</b>	<b>24</b>	<b>16.9</b>	<b>6,770</b>

### WATER MANAGEMENT

- establish official water use potentials of reservoirs
- Putting in order existing (legal or illegal) uses
- DDU 19 ≠ DDU26
- Article 48 of the Water Act = use for other than built purposes
- multifunctional use
- Proactive manager

# RESULTS: WHAT DOES IT MEAN?

## Groundwater

### IRRIGATION DEVELOPEMENT

Potential: **117,950 ha irrigable**

#### **Dev. LIMITED**

- Drinking water supply
- Low accessibility
- Abstraction license limits are reached administratively rather than hydrologically:

More reserved than actually used!

### WATER MANAGEMENT

Serious drawback to LIS development

#### **Dev. LIMITED**

–abstraction 2021 ≠ adverse EI or endanger Good WB stat.

= easily acc.: vulnerable chemical status

= medium to hardly acc.: vulnerable quantitative status

# THE CONCEPT: LATEST IMPROVEMENTS, APPLICATIONS

Latest improvements and applications:

- Surface water runoff capture potential added
- Applied for establishing permanently protected agricultural land
- Applied to establish drought risk map of Slovenia
- Applied taking into account land rating
- Not yet used for water management purposes!!
  - Difficult to get a review, acknowledgement, understanding, incorporate into water sector plans
  - Unsuccessful in incorporating it into existing data viewers
  - Challenging task for the future: the use of research results!
  - International application: maybe Danube is a good opportunity!

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**THANK YOU FOR YOUR ATTENTION !!**