The Danube Water Nexus project

DG Joint Research Centre H.1
European Commission

Context

European Union Strategy for the Danube Region (EUSDR):
COM(2010)715

- Connecting the region
- Protecting the environment
- Building prosperity
- Strengthening [capacities]

➔ JRC support to the Danube strategy

➔ Addressing the scientific needs related to the implementation of the EUSDR

➔ Strengthening the scientific cooperation in the Danube Region

➔ **"Water nexus" flagship cluster**

Protecting the Environment in the Danube Region

Reinforce integration across countries and policies

- **To restore and maintain the quality of waters** (pollution from organic, nutrients and hazardous substances, hydro-morphological alterations of rivers, lakes and delta)
- **To manage environmental risks** (managing balance between water demand and availability, extreme weather phenomena, water and climate adaptation, industrial accidents)
- **To preserve biodiversity, landscapes and the quality of air and soils** (protected areas and green infrastructure, management of solid waste, land cover monitoring and soil protection, preservation of forests, critical loads of air pollutants)

Context

DANUBE

The Danube Water Nexus (DWN) covers many water-related issues like water availability, water quality, water-related risks, the preservation and restoration of aquatic ecosystems, and biodiversity.

WATER

It also aims to analyze the interdependencies of different economic sectors competing for water, such as agriculture and energy.

NEXUS

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Why the Water Nexus?
Close the gap between projected water demand and supply

Match availability and demand of water in terms of competing objectives of the different sectors

- Look at the implications of water resources allocation and **water security**
- Move from concepts to implementation by proving that all economic sectors in the Nexus can profit from a **change in the planning process**

Agriculture

Energy

Environment

Industry

Tourism

Drinking water

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Understanding the Nexus

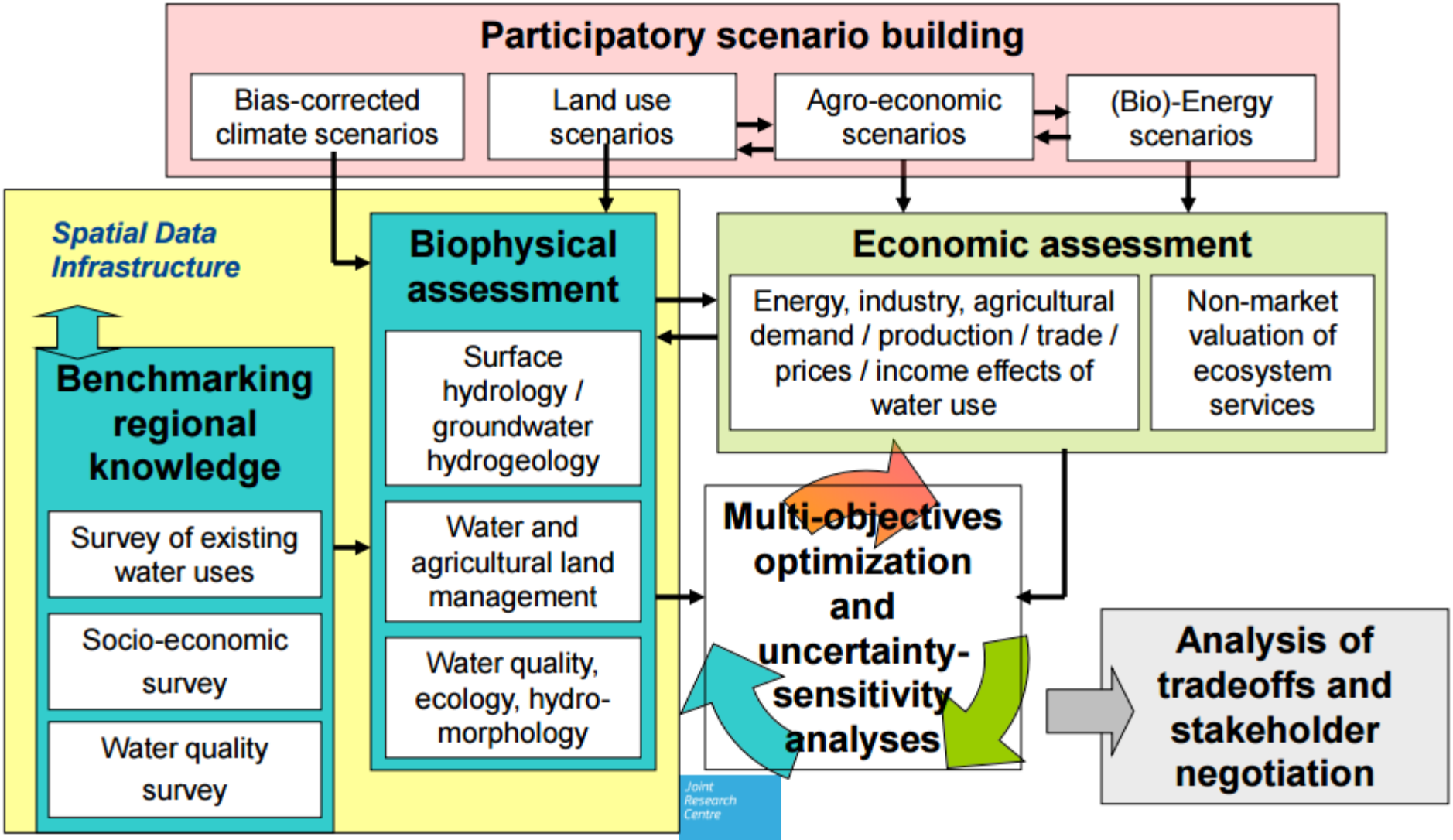
Characterize water availability under
- Present conditions
- Climate change
- Land use change

Characterize water demand depending on:
- Climate conditions
- Water pricing policies
- Economic development/investment options

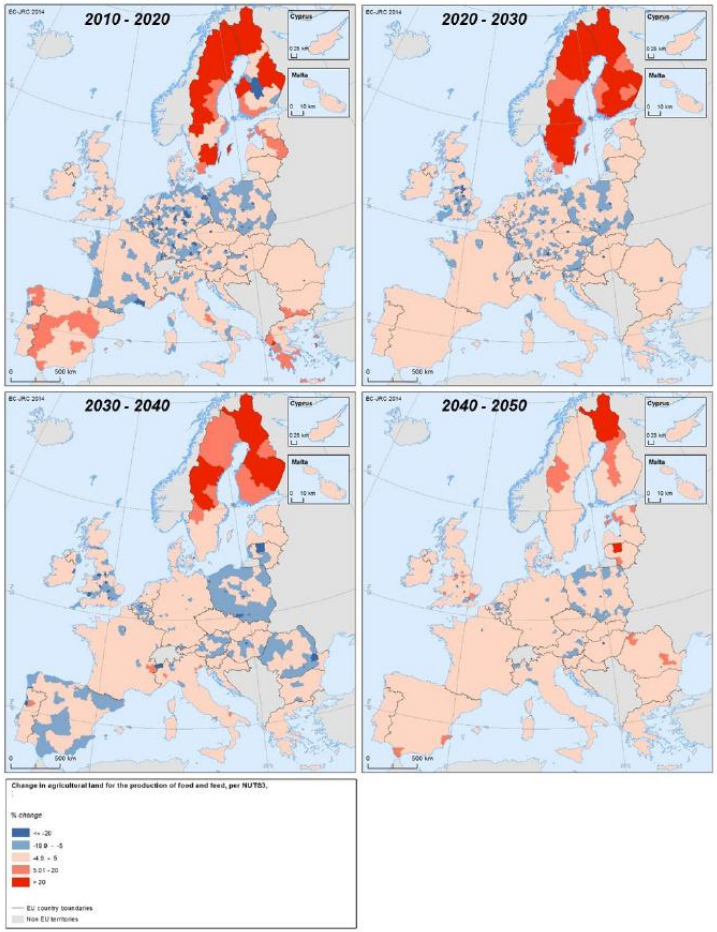
➔ A consistent "hydroeconomic" modelling framework

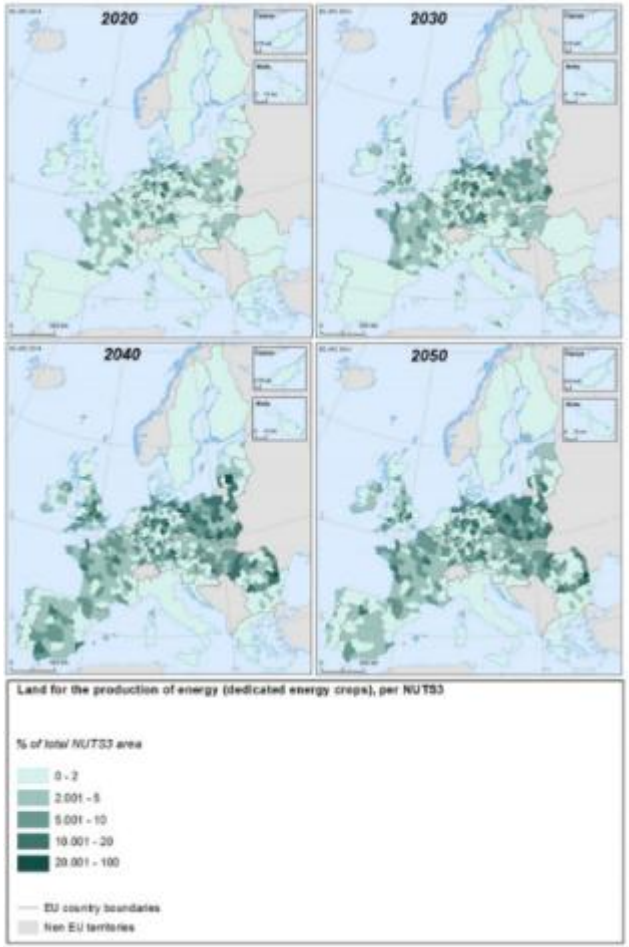
From baselines to solutions

An hydro-economic assessment of impacts of scenarios for sectoral water use in 2030



Land allocation model - LUISA





Baranzelli et al., 2014
http://publications.jrc.ec.europa.eu/repository/bitstream/JRC94076/lb-na-27018-en-n.pdf

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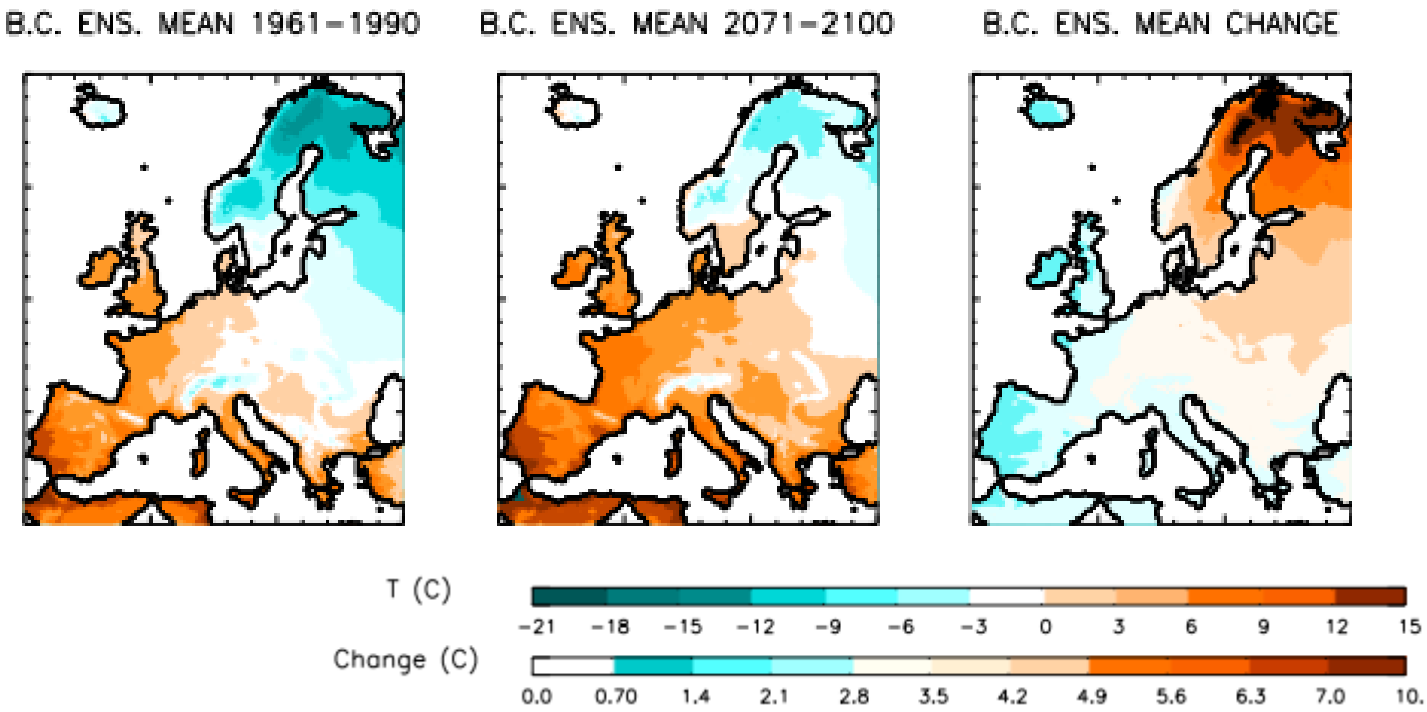
Climate scenarios

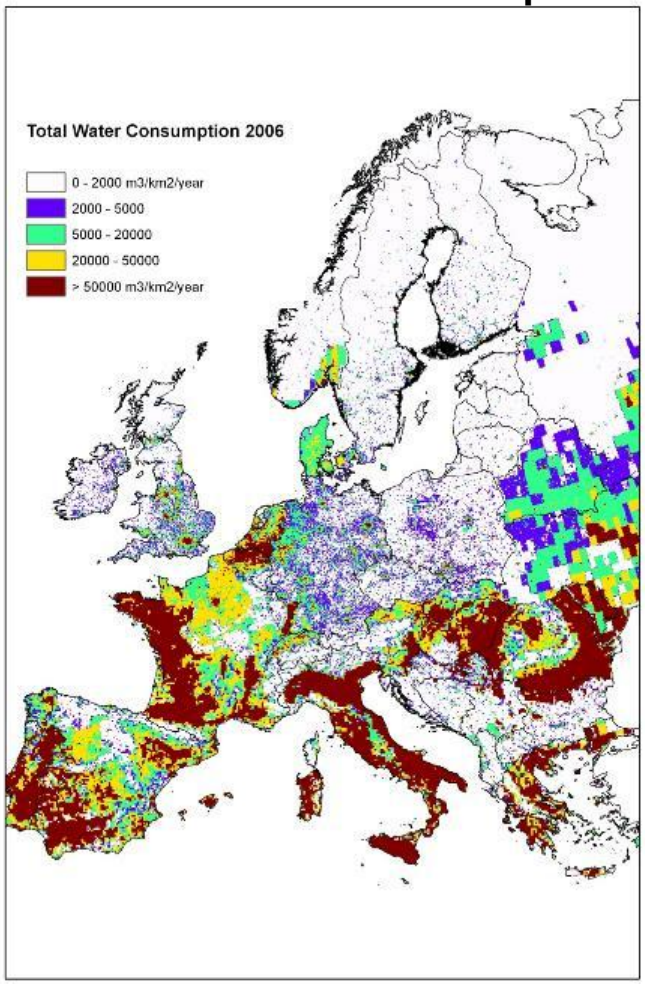


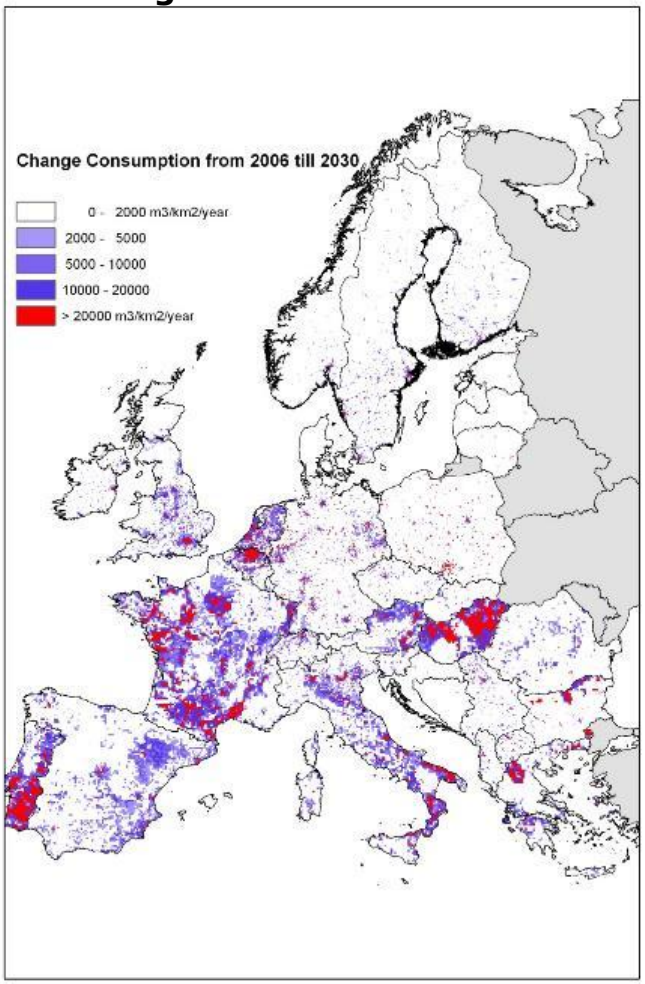
Dosio et al., 2012
DOI: 10.1029/2012JD017968

Climate scenarios

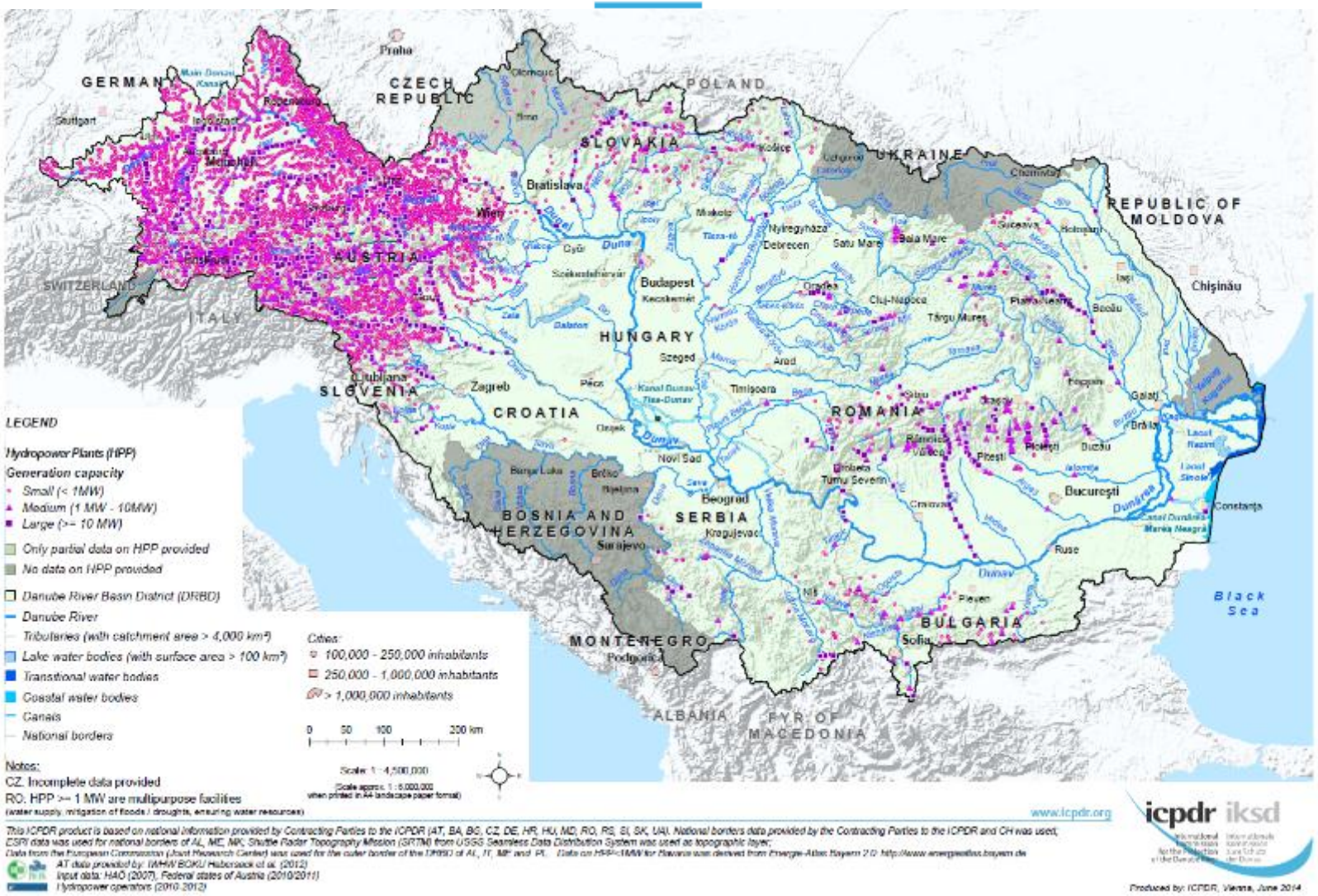
European

Water consumption 2006 and changes until 2030

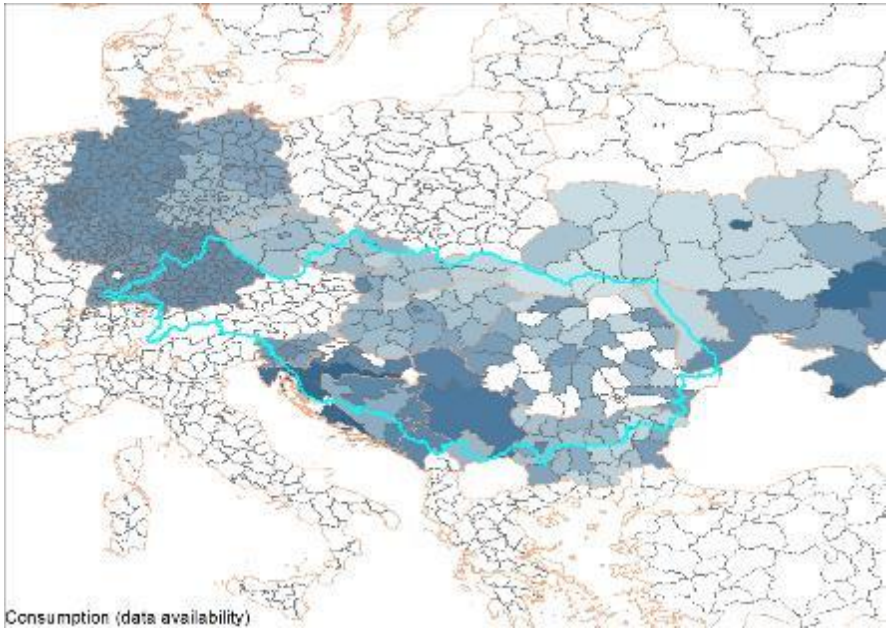


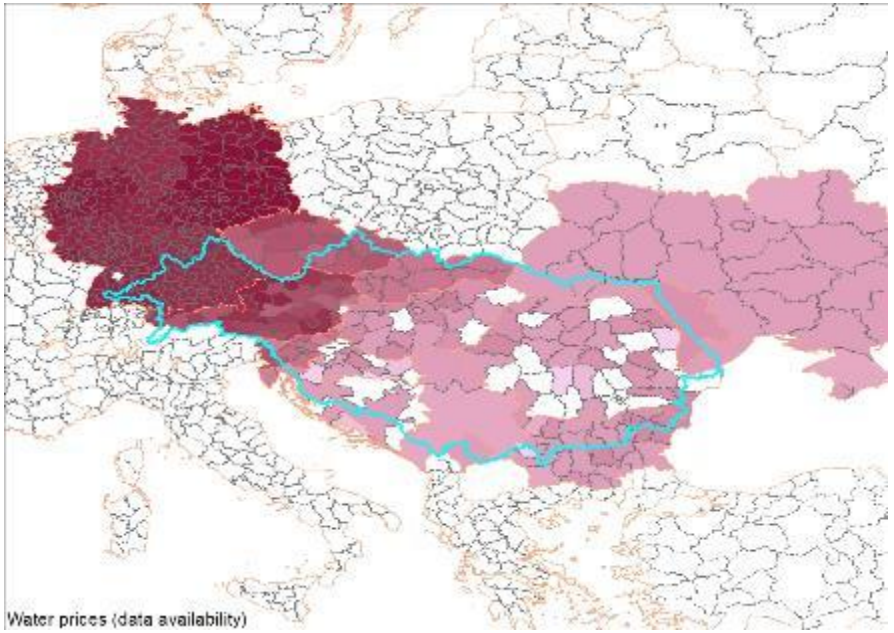


Hydropower plants



Water consumption per capita and water price by Nuts 3 for countries in the Danube RB (Overlay 2012-2000)





see Reynaud, 2015

Nexus questions in the Danube

Focus areas:

- Environmental protection
- Navigation
- Agriculture
- Energy

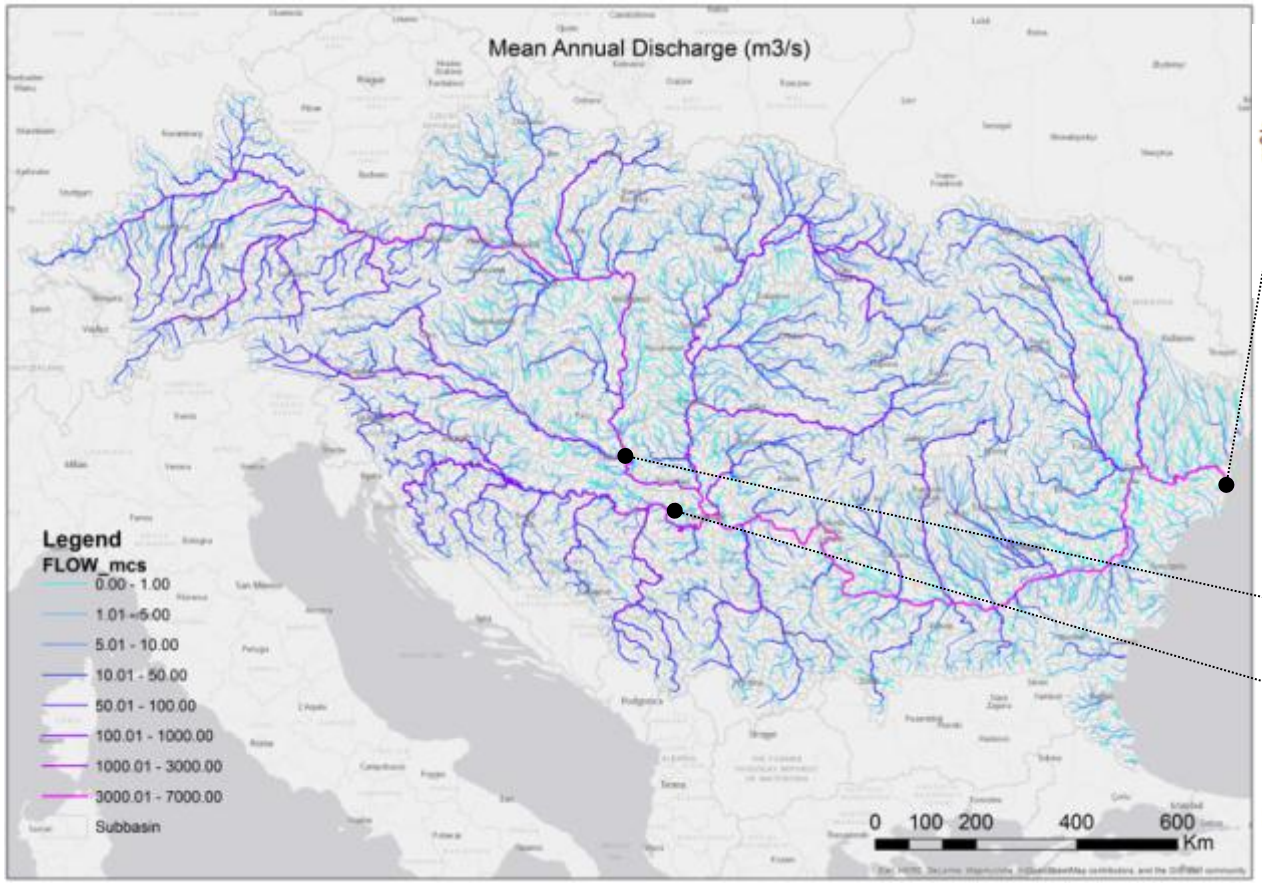
"What if…" through scenario simulations

- Irrigation expansion (more irrigated area; fuel crops; effect of climate change)
- Competition between irrigation and energy water demand (Sava pilot study)
- Impacts of water demand on low flows, ecosystems and navigation
- Optimal nutrient management (pilot Upper Danube)

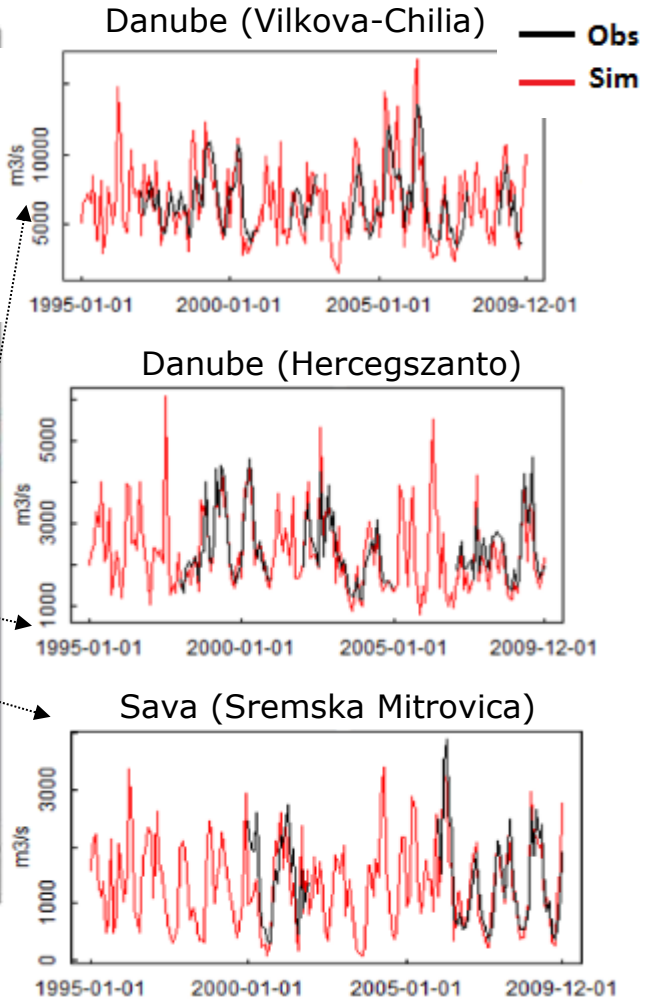
Results -WATER

Discharges in each river (1995-2009) at different spatial and temporal scales

Mean Annual discharges (1995-2009)



Monthly dicharges (m3/s)



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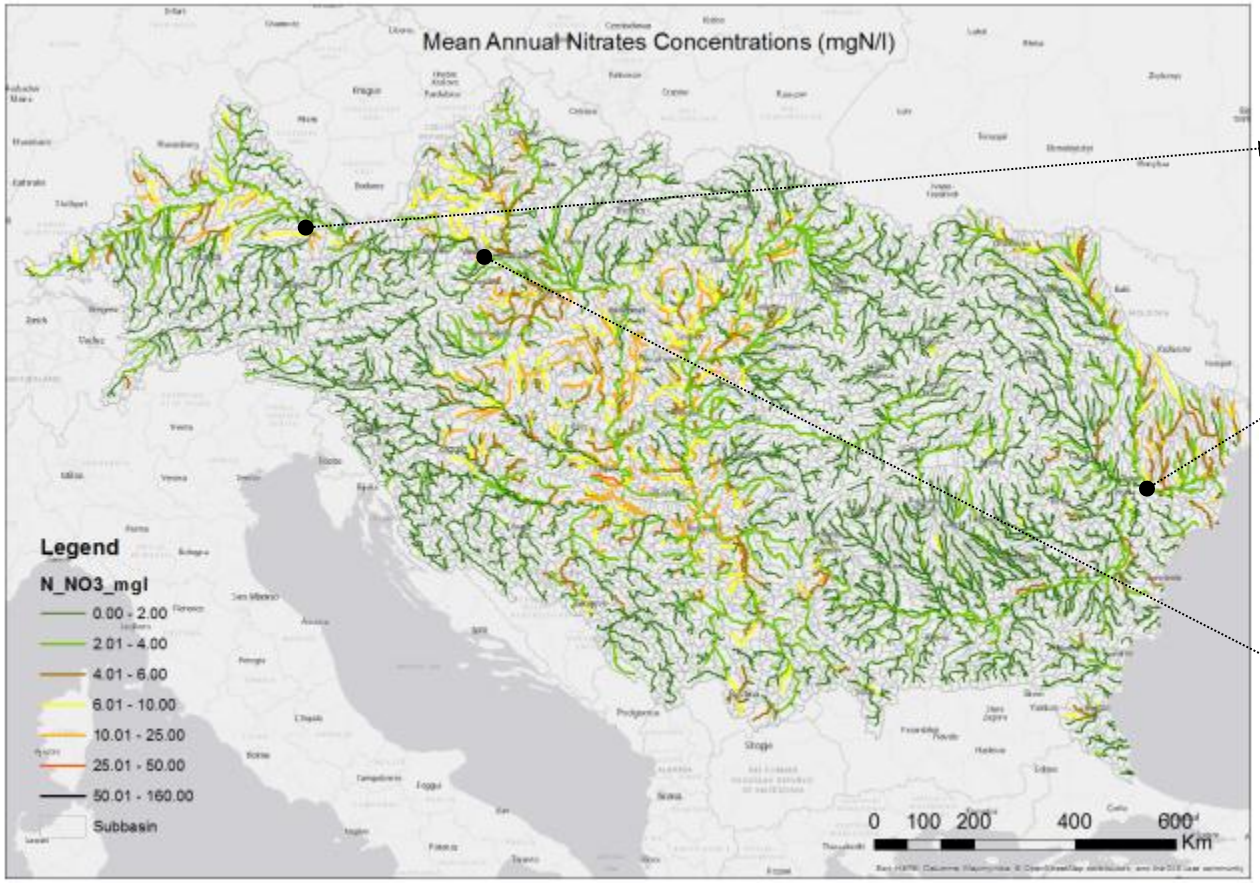
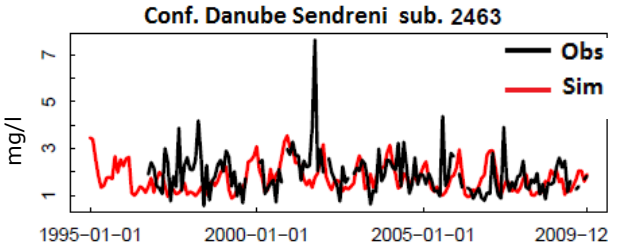
Results -NUTRIENTS

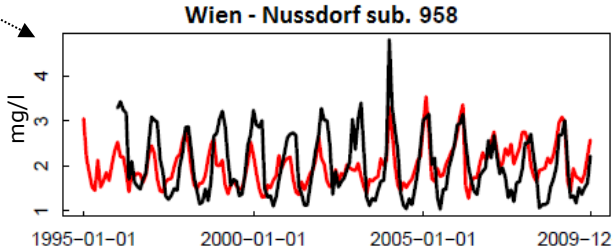
Concentration of nutrients in each river (1995-2009) at different spatial and temporal scales

Mean Annual concentrations (1995-2009)



Monthly concentrations mg/l





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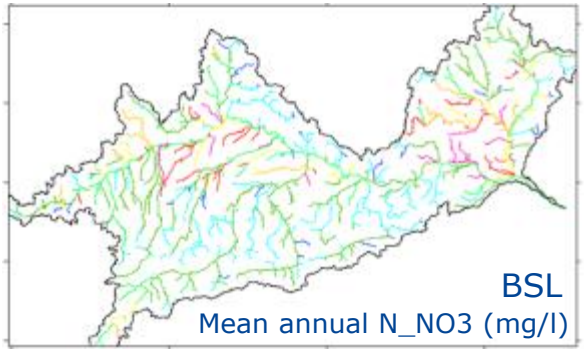
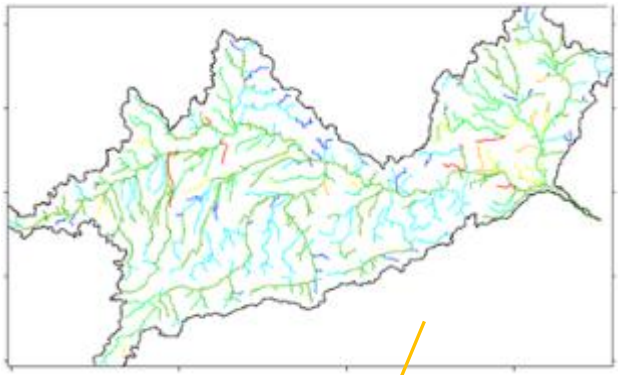
Optimization tool

Before Optimization

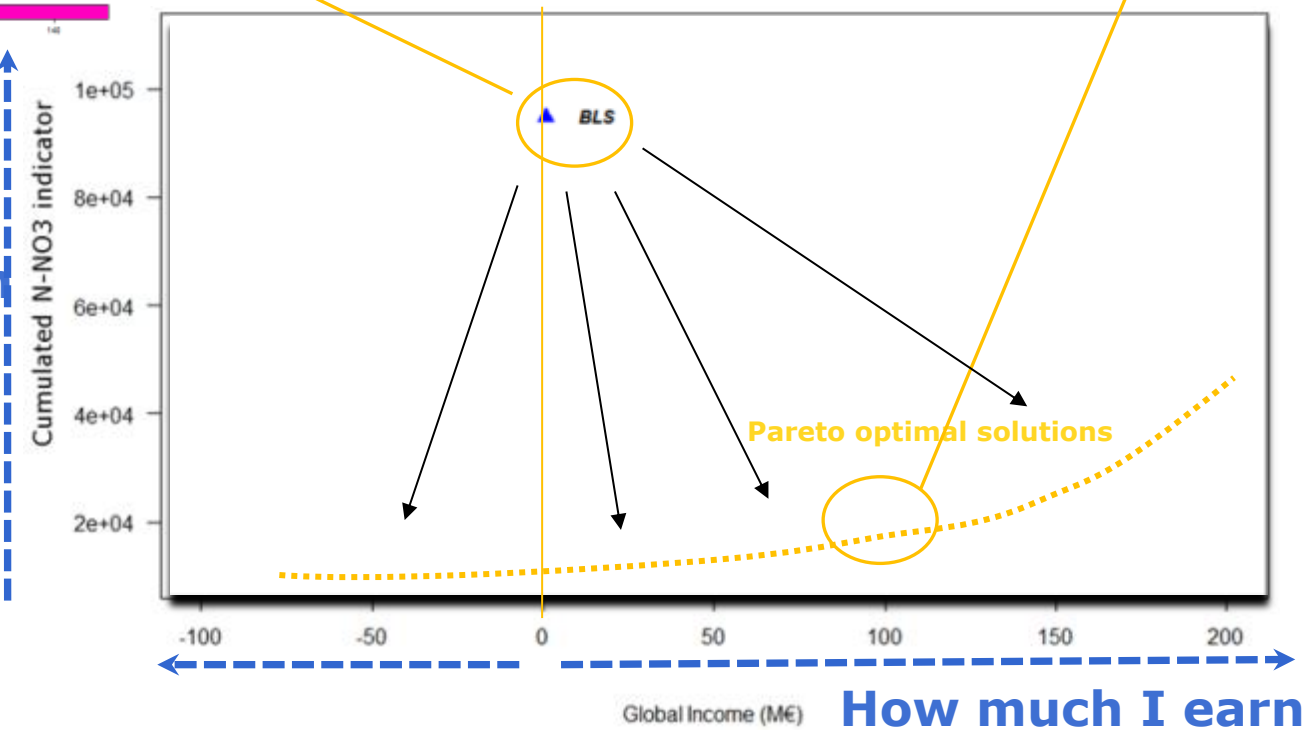


UPPER DANUBE (132,000 km2)

After Optimization



How much can I pollute?



How much I earn?

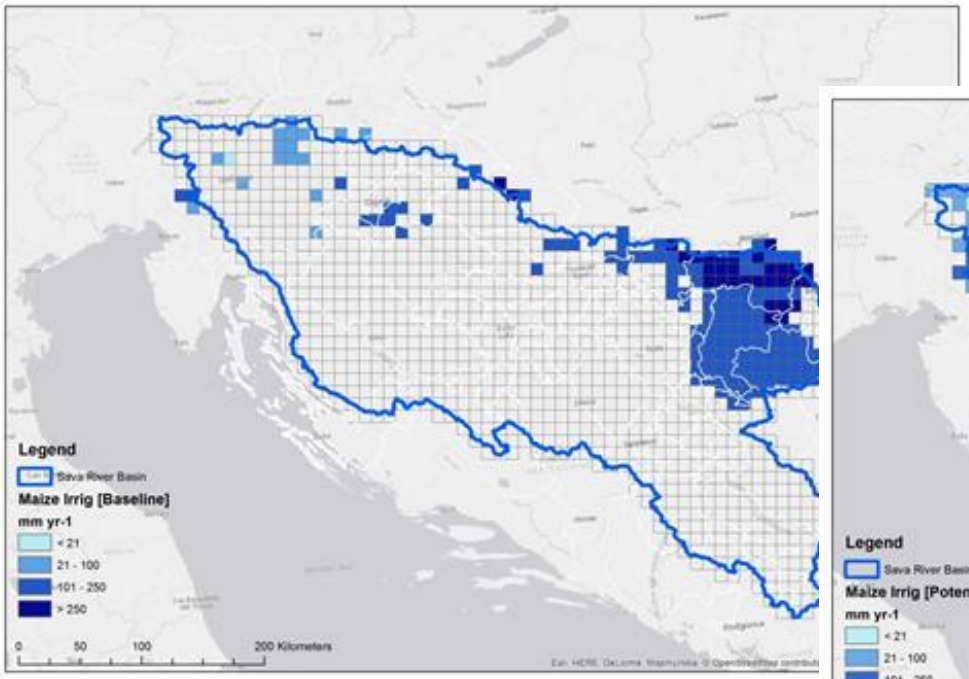
Pilot Sava Water Nexus assessment

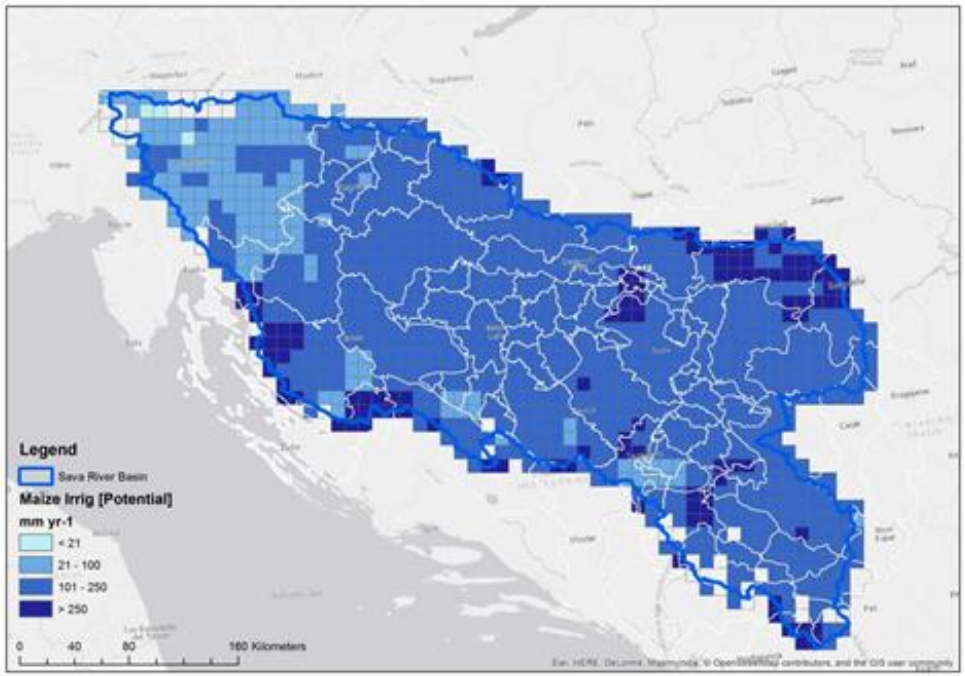
UNECE – ISRBC study

JRC contributing with hydrological model simulations

- Crop yields as a function of irrigation (EPIC model)
- Impact of irrigation scenarios in terms of water availability
- Change in hydropower production depending on water availability
- Effects of climate change

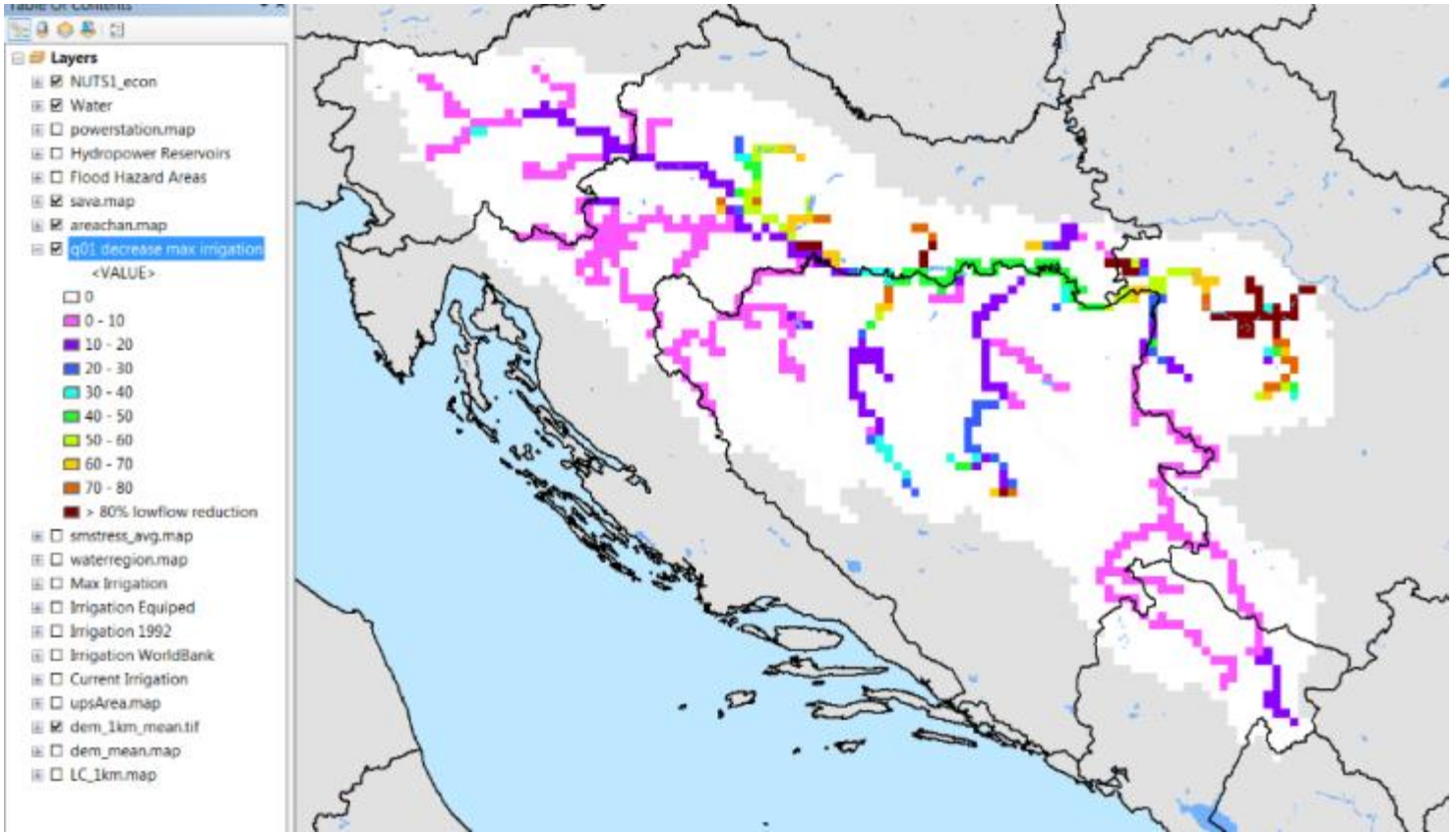
Annual Water Demand for current (left) and the optimum maize irrigation scenario





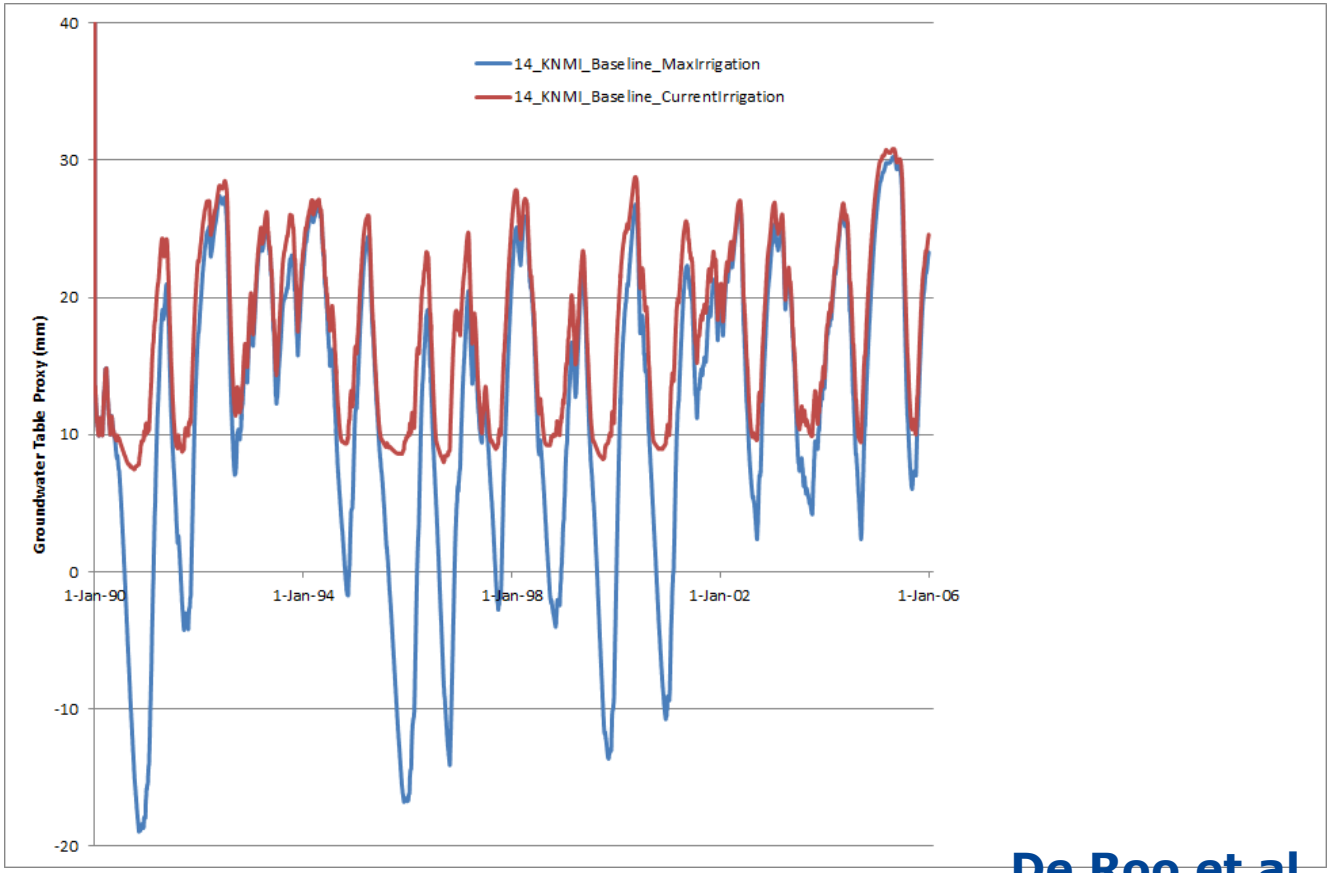
UNECE, 2015
De Roo et al., in prep.

Effect of increased irrigation on low flow (1st percentile) under current climate (1990-2005)



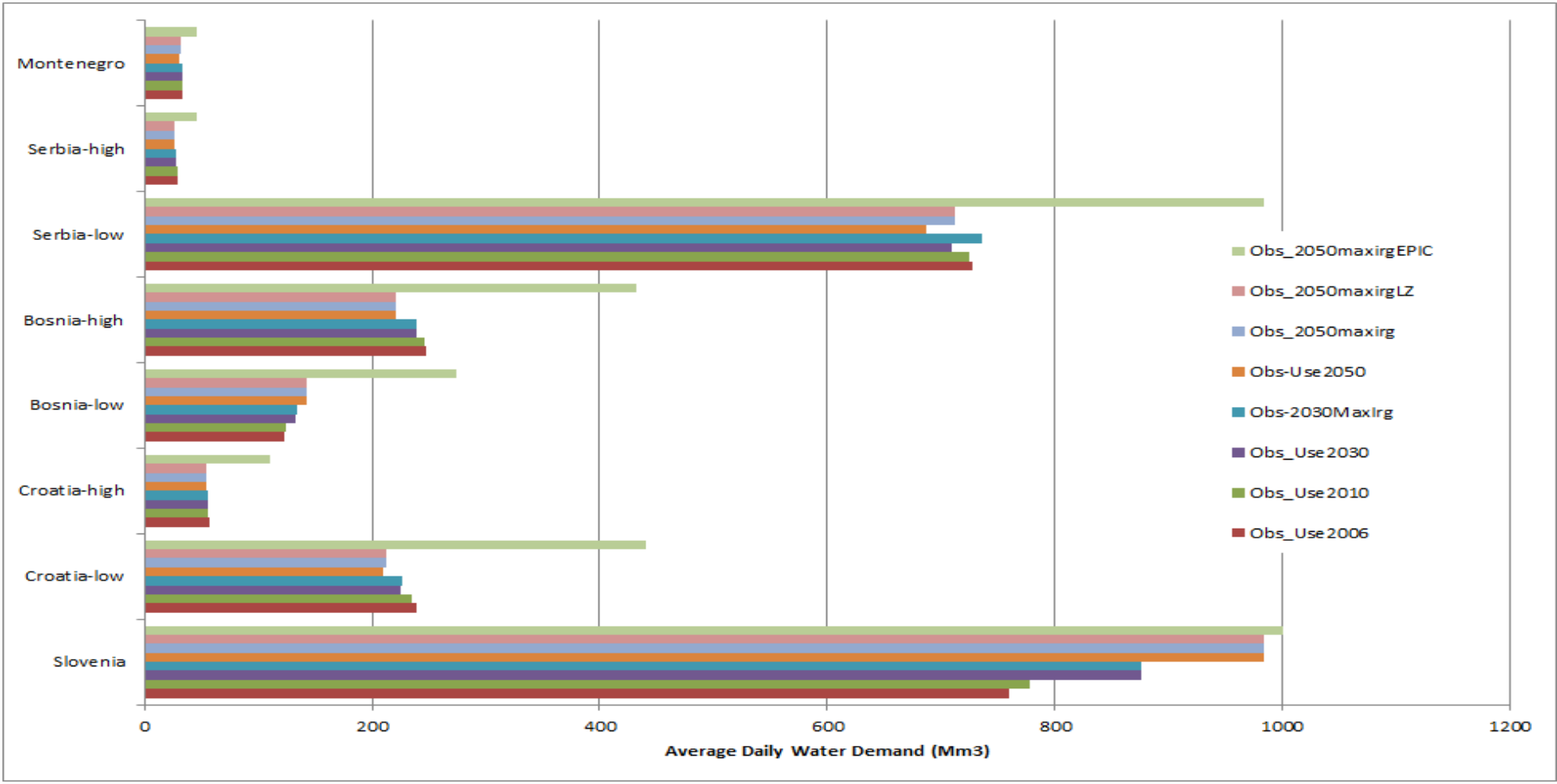
De Roo et al., in prep.

Effect of increased irrigation on groundwater resources (current climate, 1990-2005)



De Roo et al., in prep.

Projected changes in water demand



De Roo et al., in prep.

Danube Water Nexus: key messages

- Water accounting: improve gathering , sharing and use of available data of water availability and demand
- Develop best possible scenarios of water use in a multiple policy and sector framework
- Develop an analytical framework to support trade-off analysis and negotions among different stakeholders
- Involve all possible interested parties in the further developments of the DWN

Access and Exchange

Data, outputs, maps and attributes of findigs will be accesible approximatly in February 2016 in the water portal http://water.jrc.ec.europa.eu/

However some preliminary outputs, maps and attributes are available at:

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