Environmental flow and riparian vegetation – examples from hydropower rivers of Finland

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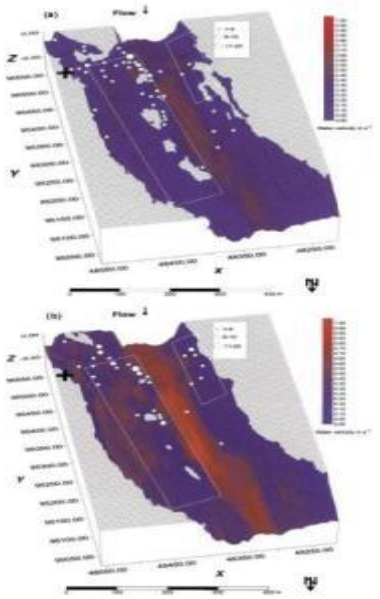
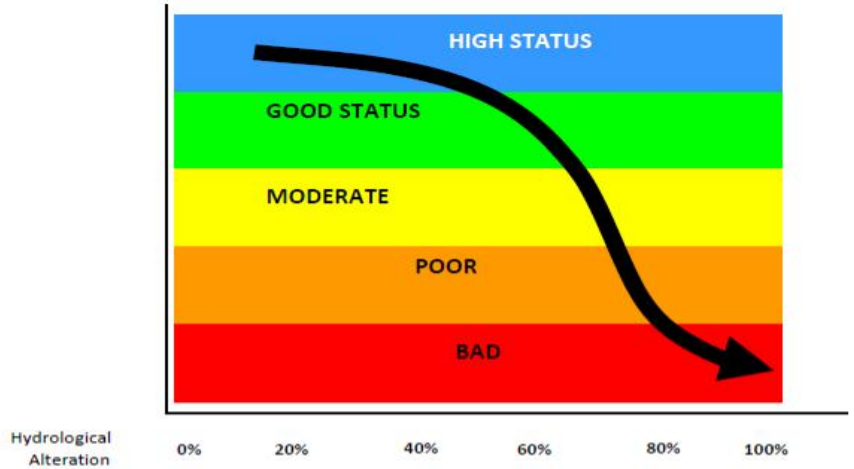
Environmental flow concept

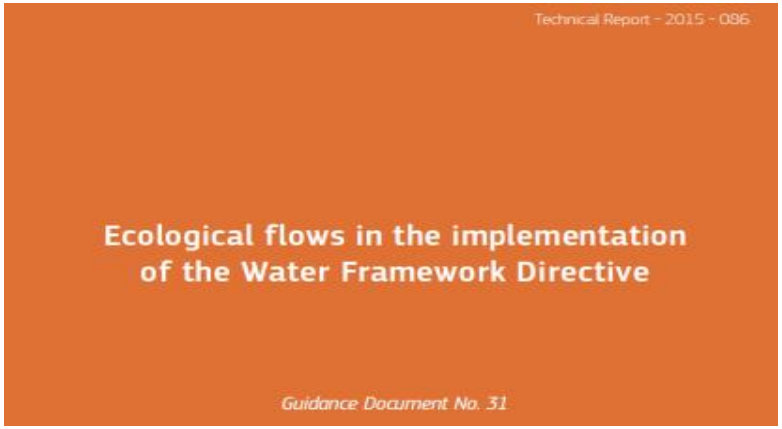
- The river flow can be altered by using dams and weirs to regulate the natural rhythm of flow
- The organisms living in rivers and riparian areas have adapted to natural dynamics of river
- Even small changes in natural flow can significantly undermine the river ecosystem due to sensitive balance between biota and environmental conditions in the river
- The basic idea of the environmental flow is to maintain the quantity, quality and duration of the flow sufficient to maintain the river and riparian ecosystem in a good state
- Environmental flow methods are used to protect vulnerable fish species, riparian vegetation, water quality and groundwater



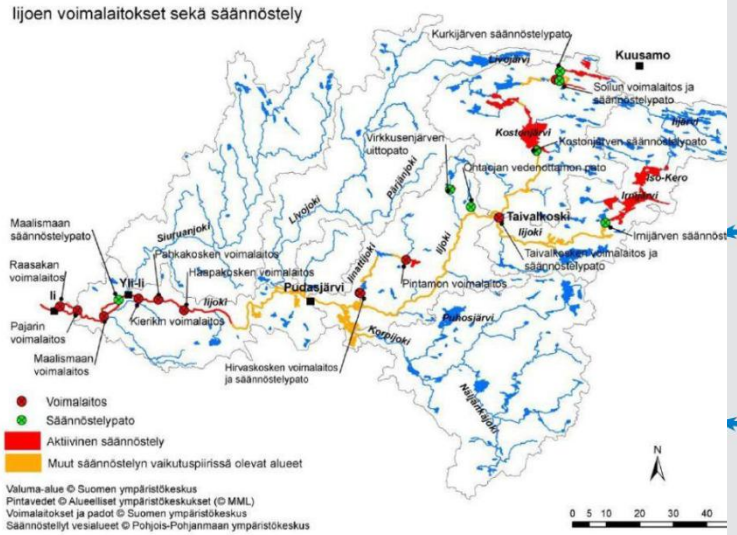
EU, WFD and Ecological flow

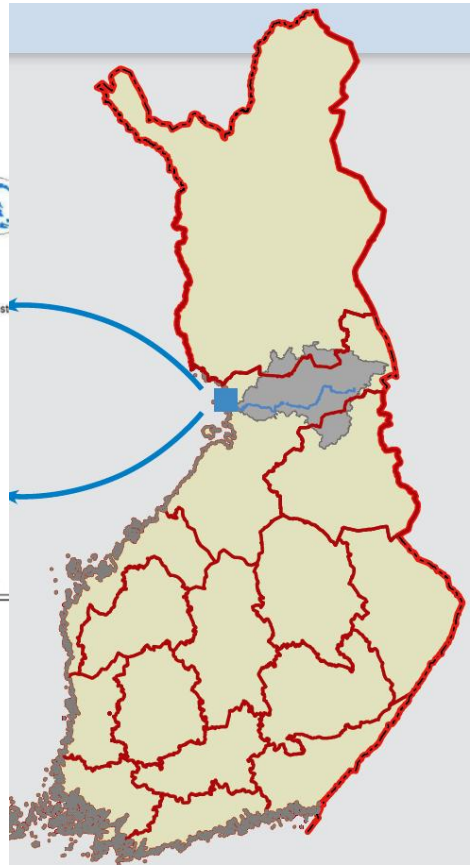
- Based on a Blueprint to Safeguard Europe's Water Resources
- Guidance published in 2015
  - Ecological flows are defined as "a flow regime consistent with the achievement of the environmental objectives of the WFD"
  - Practical examples how to apply





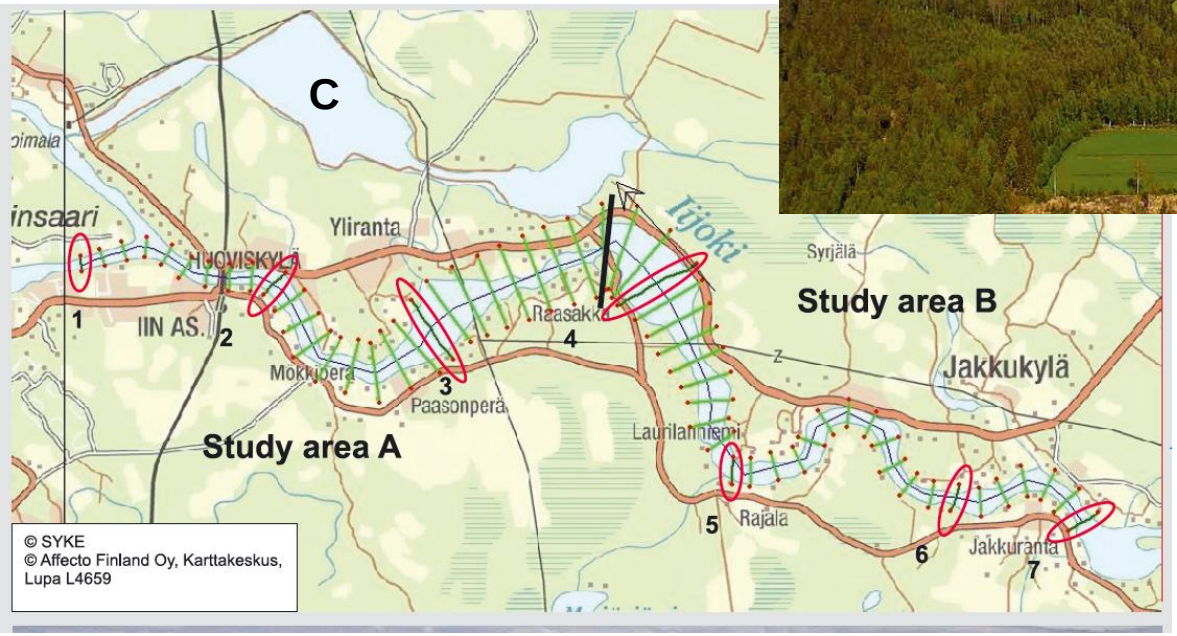
Heavily modified and fully developed large rivers - evaluation of possibilities to restore riparian vegetation by e-flow



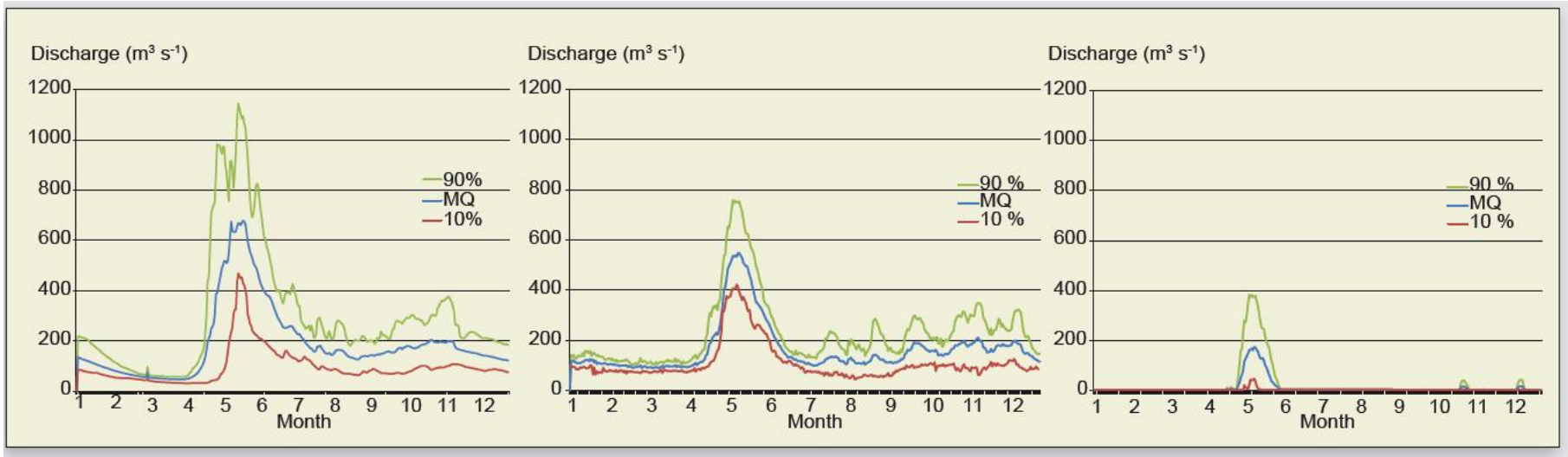


- Iijoki riverbasin
  - Area 14 191 km^2
  - MQ 174 m^3/s
  - Regulated lakes upstream
  - Free flowing middle part (protected by law)
  - Fully constructed downstream stretch with five powerplants

- A: Old river channel with bottom weirs
- B: Current river channel with raised water level
- C: Artificial channel above HEP



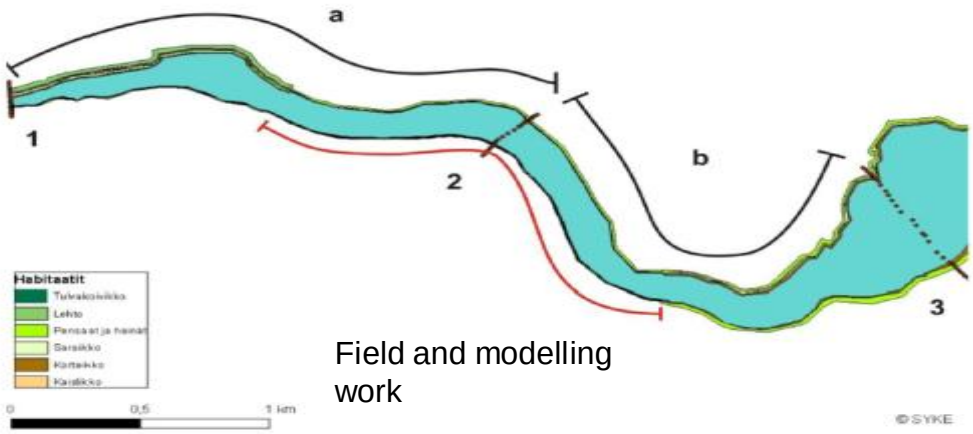
- Blue line = Cross-sections for model
- Red line = Cross-sections for vegetation



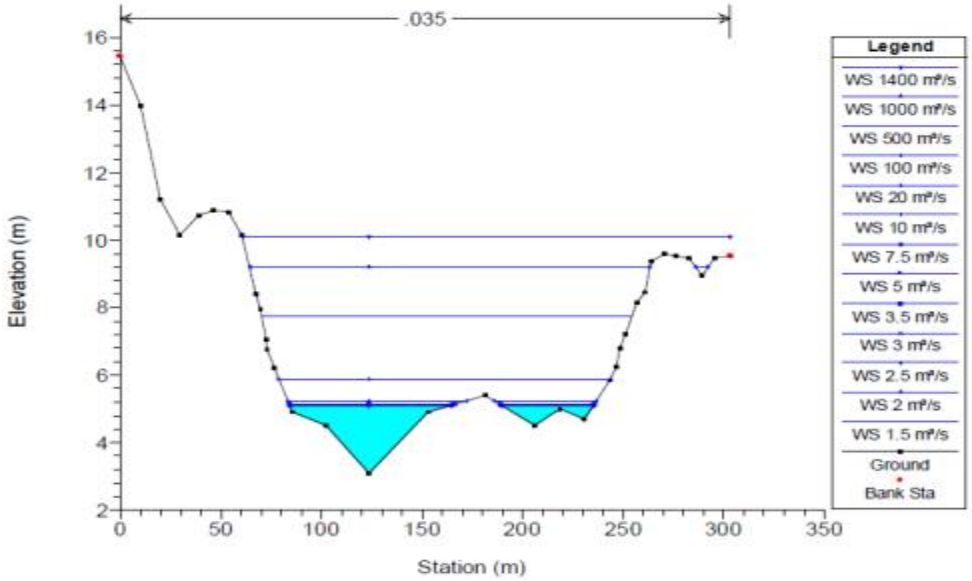
Reference flow (1949-58)

Study area B (main channel) flow 2004-2010)

Study area A (old river bed) flow 2004-2010)



Field and modelling work



Focus on two riparian biotopes

- Flooded birch (Betula pubescens) dominated forests
- Sedge (Carex acuta etc.) dominated meadows

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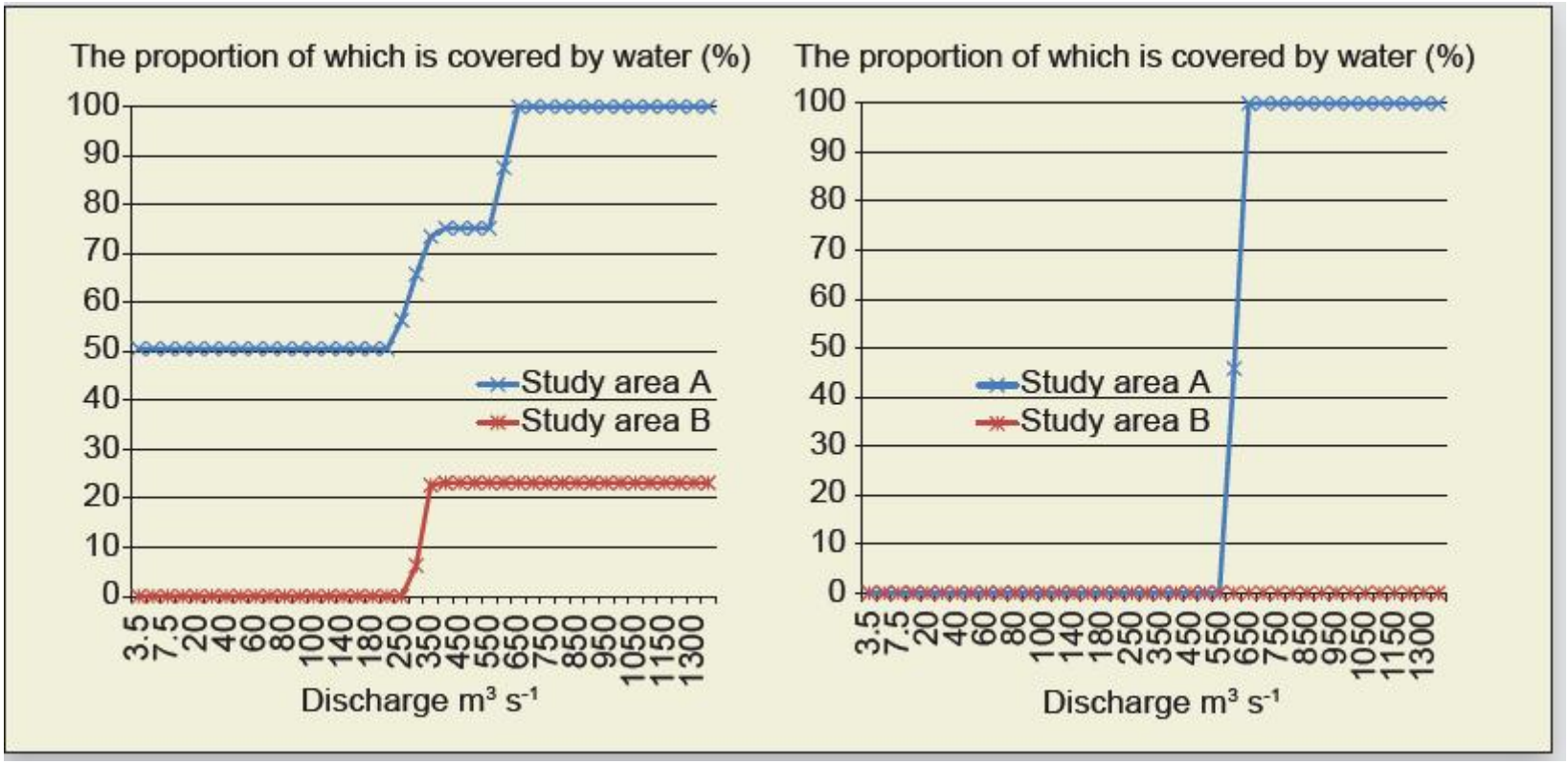


Share on flooded meadows versus flow (A=old river bed, B =regulated channel)

Share on flooded forest versus flow (A=old river bed, B =regulated channel)

Final results

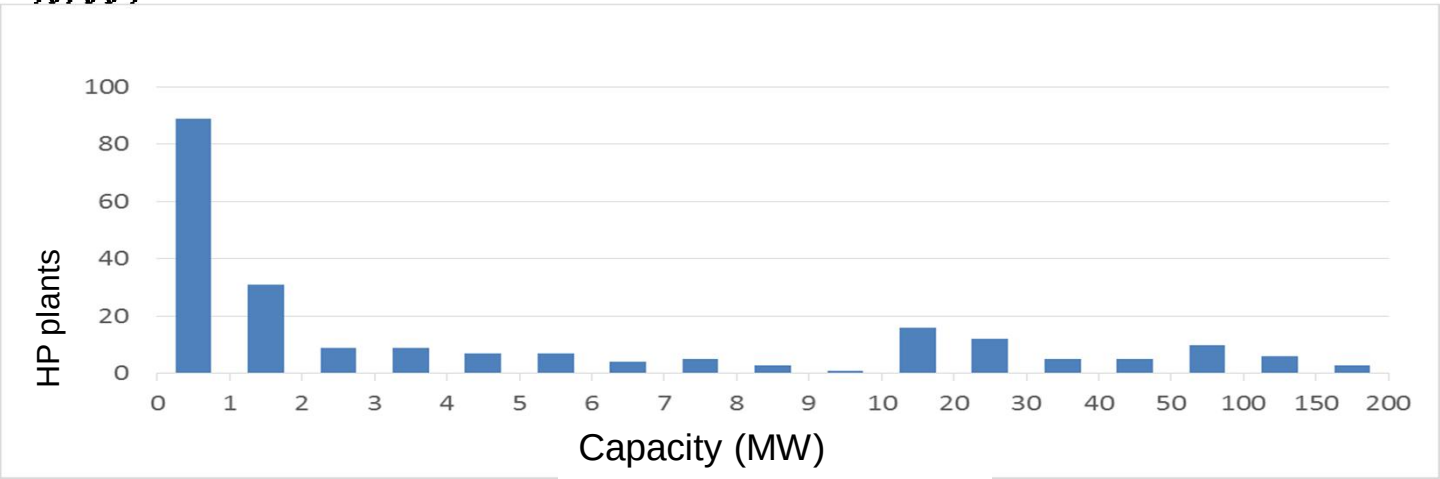
- Environmental flow built up of two components: basic flow (minimum 7.5 to 30 $m^3 s^{-1}$ and maximum 80-300 $m^3 s^{-1}$) spring flood (consecutive 14-day duration 650 $m^3 s^{-1}$ at flow rate in excess).
- The basic flow enables sufficient flow conditions for the sedges and the annual spring flood allows for the preservation of viable flood forest.
- The changes in the flow in study area B do not have significant changes in the environment without changing the regulation of headwater lakes and restoring river slopws.

Conclusions

- Riparian vegetation can be restored at old river channels by increasing flow and keeping flood dynamics
- Fully constructed hydropower channels are impossible to restore without harmful effects on hydropower use
- Traditional approach with gross-sections and hydraulic models is time demanding task

To be continued in Finland

- EU Commission:
  - **Finland should continue the work on defining ecological flow, and make sure that this is implemented in all RBDs. The revision of all existing hydropower permits should be done to ensure the achievement of WFD objectives, in particular in relation to ecological flow, fish passes and other mitigation measures**
- Recent survey by Sarnola & Suhonen, ÅF Consults (2015). Environmental flows of hydropower plants (in Finnish).
- Questionnaire survey of 222 hydropower plants (more than 0,1 MW)



Current situation in Finland

- The majority of the minimum flows is discharging from the power plant to the main river channel.
  - Most of the minimum flows are constant throughout the year (45 %) or are varying due to season (25 %).
- 53 power plants have had zero flows during the last three years.
  - Majority zero flows weekly or monthly with an average length of less than 24 hours.
  - Main reason for zero flows is the normal operation of the plant.
- At least 7 power plants have sloping (more than one meter difference to next dam) on river stretch
  - Completely dry river stretch

Thank you!

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