

AQUACROSS Project

Quantitative assessment of Driver–Pressure–State chains –Danube floodplains

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The AQUACROSS project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642317.

Outline

- Background & objectives
- DPSIR-framework to quantitative D-P-S assessment
- Available data
- Analysis procedure
- Summary & outlook

Background

- Multiple policy targets: Consider multiple EU legislations that are relevant for large river-floodplain systems
  - EU water (WFD) ~70% heavily modified – focus on main stem
  - EU nature legislation (HD and BD)– focus on floodplains (~ 120 sites)
  - EU TEN-T Regulation for navigation – claims good navigation status of waterways
  - EU floods directive – focus on floodplains for sustainable flood mitigation
  - …
- Conflicts between different targets and socio economic benefits are widely recognised
- Specific data are collected for each policy target
- So far no detailed analysis on the synergies and trade-offs between biodiversity and other targets based on available data

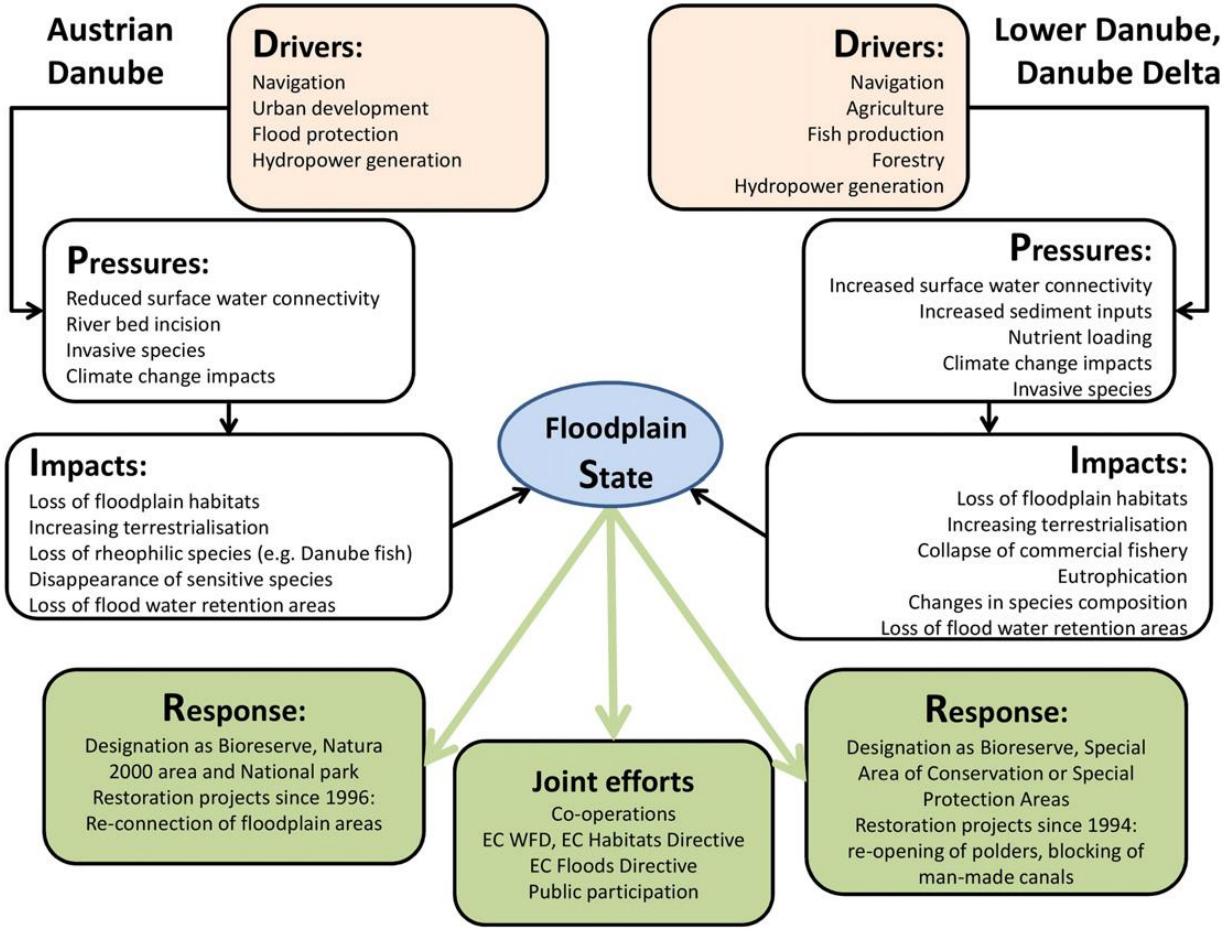
Objectives

- Quantify importance of main drivers and pressures along the navigable Danube for the status of different aquatic biodiversity components

- Final models can be used for predictions – basis for management and restoration

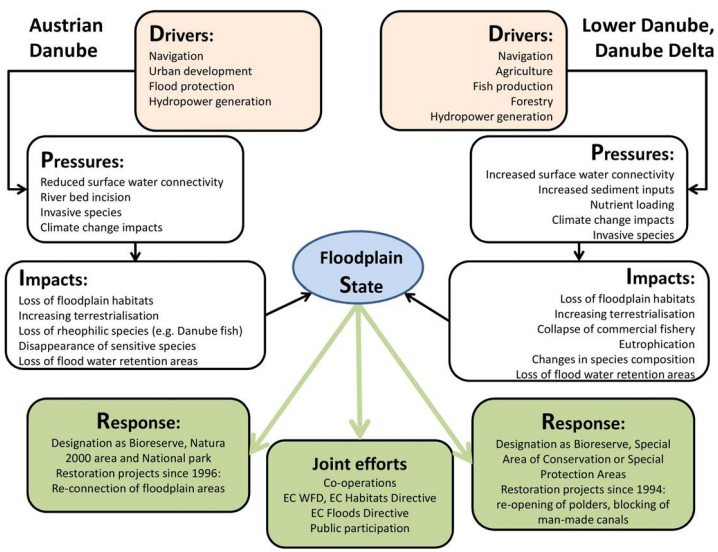
DPSIR–framework to quantitative D–P–S assessment

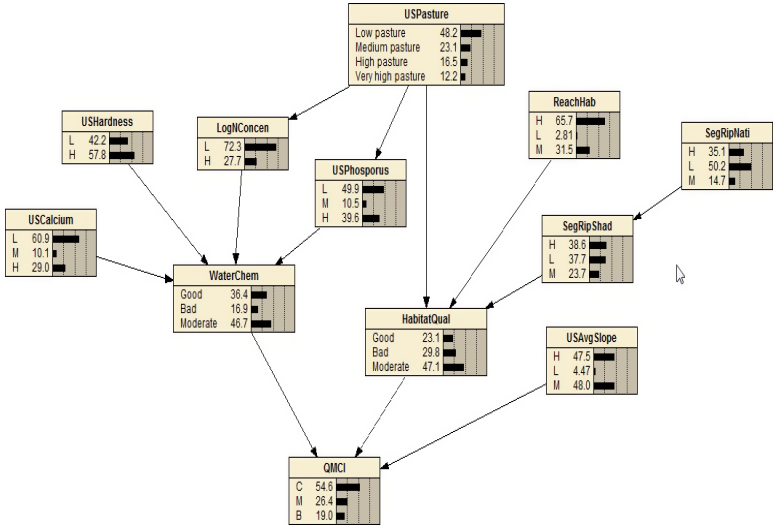
- describing the interactions between society and the environment



from Hein et al. STOTEN 2016

DPSIR–framework to quantitative D–P–S assessment



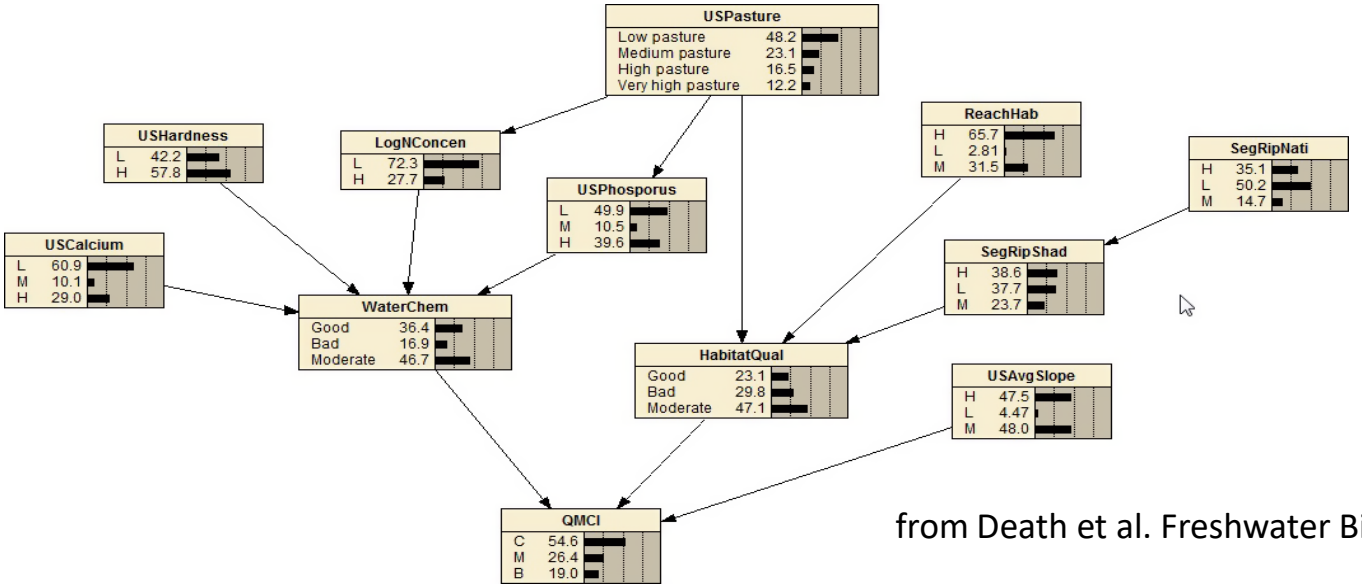


DPSIR-framework

D-P-S assessment

- Framework to network
- Descriptive model to quantitative (data-based) model
- Quantify importance of drivers and pressures

selection of method – Bayesian Network



from Death et al. Freshwater Biol. 2015

- Possibility to model hierarchical structure – D-P-S chain
- Good graphical representation
- Often used as basis for management and restoration
- High flexibility regarding input data
- Good model performance

Data within the hierachical structure

Austrian Danube

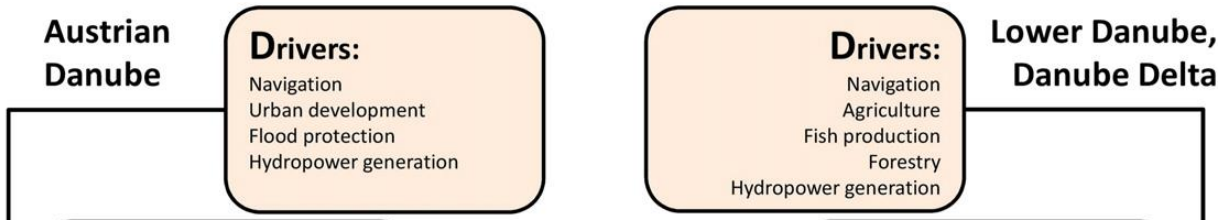
Drivers:
Navigation
Urban development
Flood protection
Hydropower generation

Drivers:
Navigation
Agriculture
Fish production
Forestry
Hydropower generation

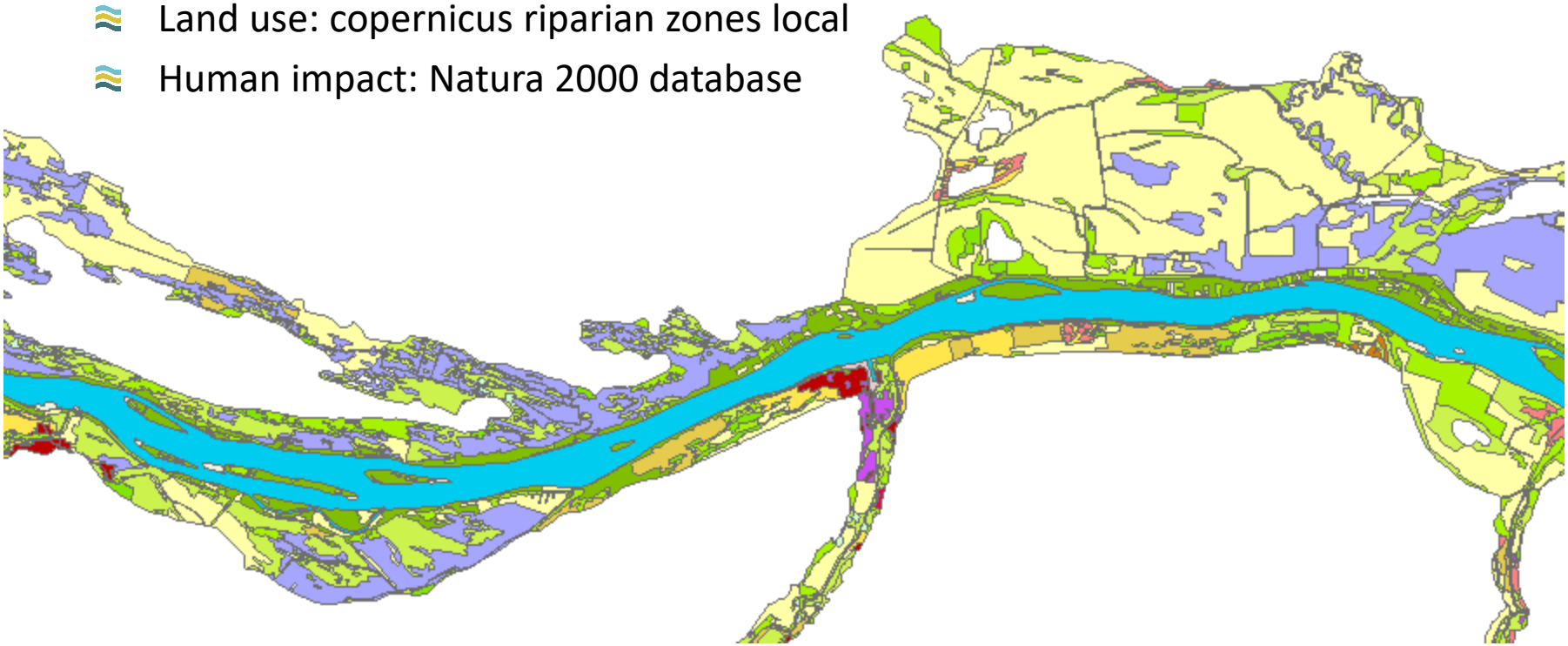
Lower Danube, Danube Delta

- Navigation: critical locations, navigation class
- Hydropower: position, production and impacted channel lenght

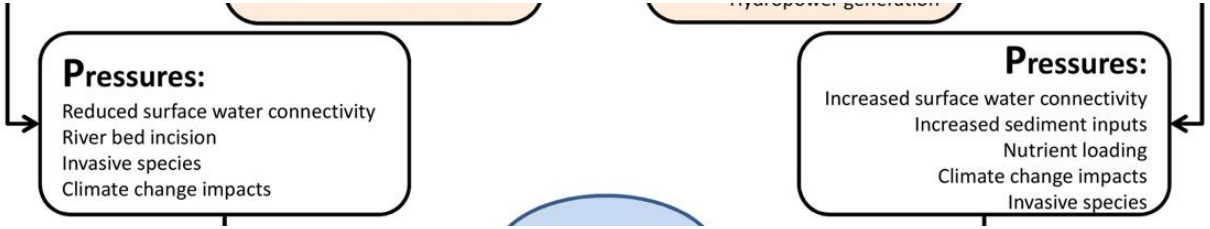
Data within the hierachical structure



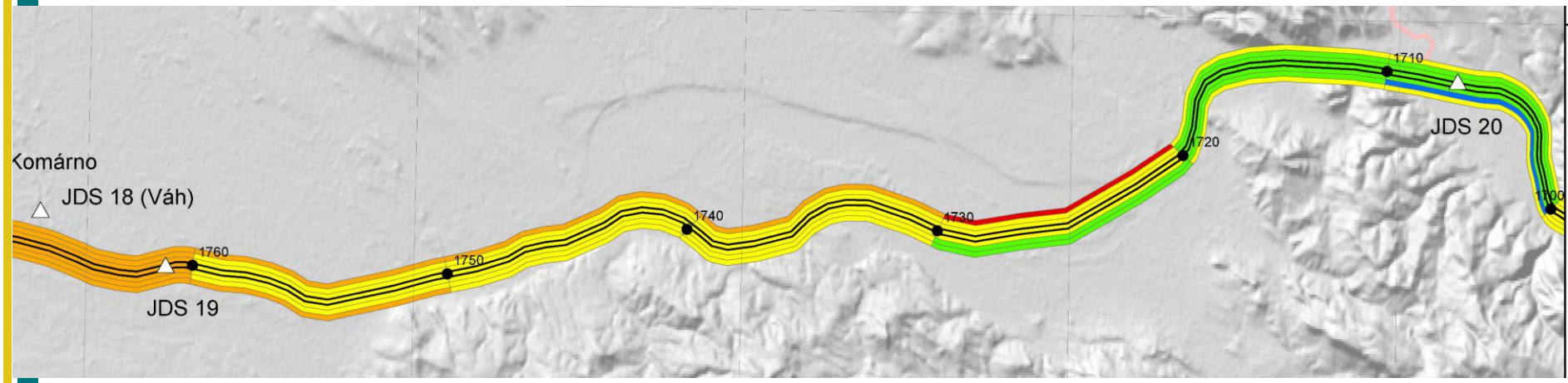
- Land use: copernicus riparian zones local
- Human impact: Natura 2000 database



Data within the hierachical structure



- WFD/JDS: quantifies hydromorphological pressure, 10 km stretches– quantification of impact of artificial structures, levees, hydropower plants, land use … on the hydrology and morphology of floodplain, banks and channel



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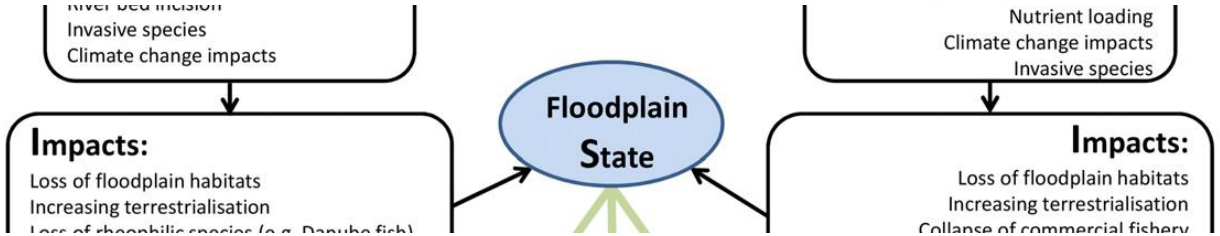
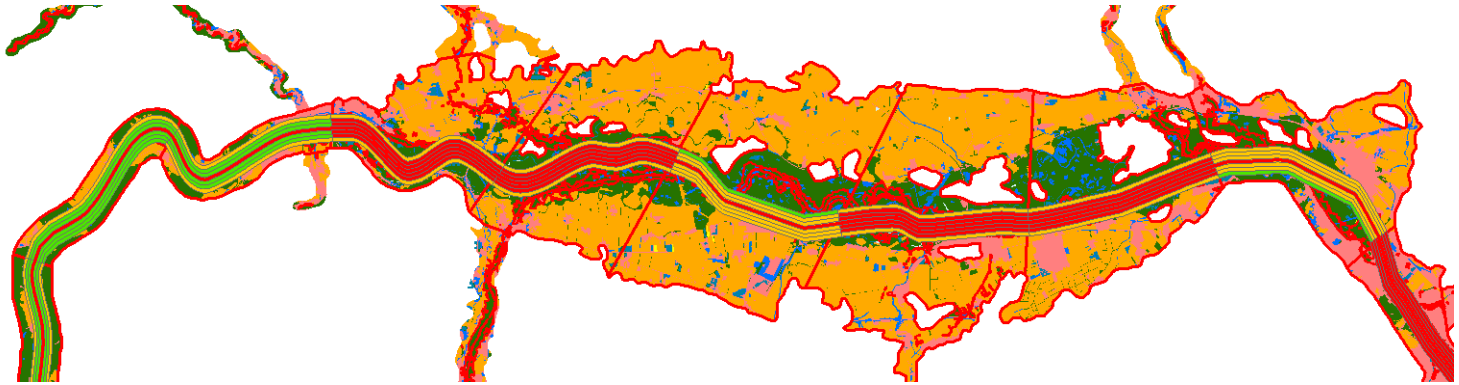


- Biodiversity indicators from HD and BD (~120 Natura 2000 sites) – conservation status, area/population size (based on monitoring data and local expert knowledge)

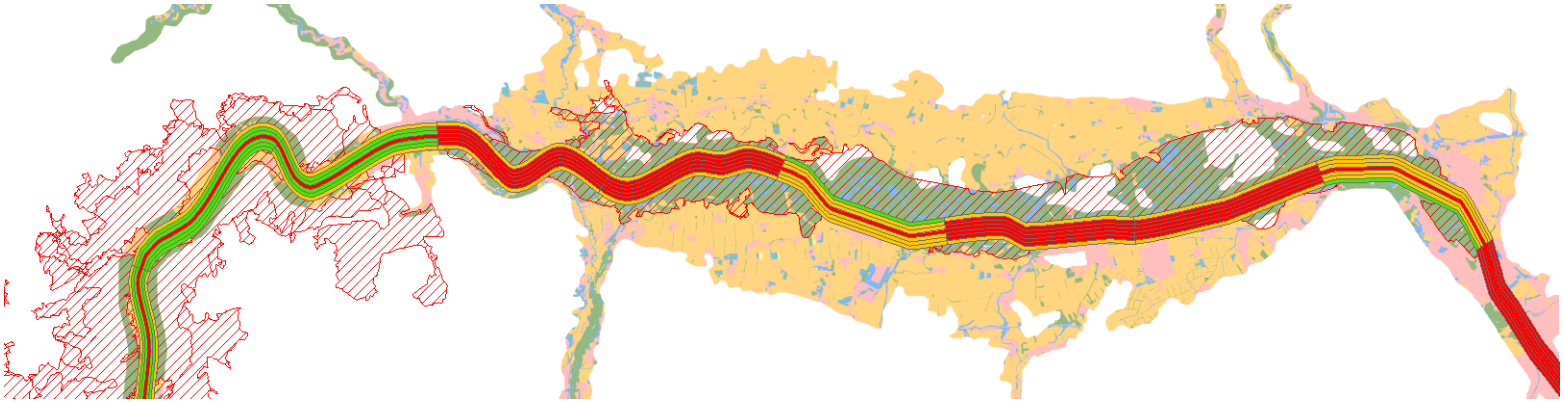
Analysis: Driver–Pressure link



correlation		hydro-morphological alteration		
		CH	BA	FP
driver	Navigation status			
	Hydropower			
			p<0.05	
			p<0.01	

- Significant correlation between hydro-morphological status of banks (BA), channel (CH) and floodplain (FP) and drivers

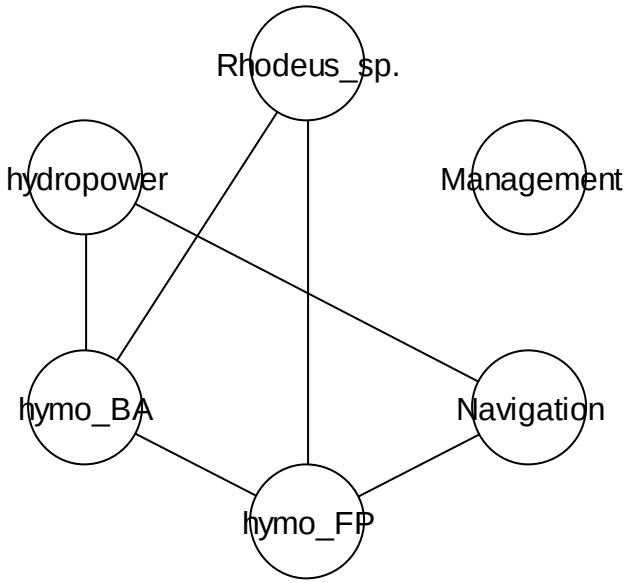
Analysis: Pressure–State link



correlation		hydro-morphological alteration		
		CH	BA	FP
status fish	Zingel zingel			
	Gobio albipinnatus			
	Rhodeus sp.			
	Misgurnus fossilis			
population waterbird	Alcedo atthis			
	Haliaeetus albicilla			
			p<0.05	
			p<0.01	

- Significant correlation between hydro-morphological status of banks (BA), channel (CH) and floodplain (FP) and status and population size of protected species

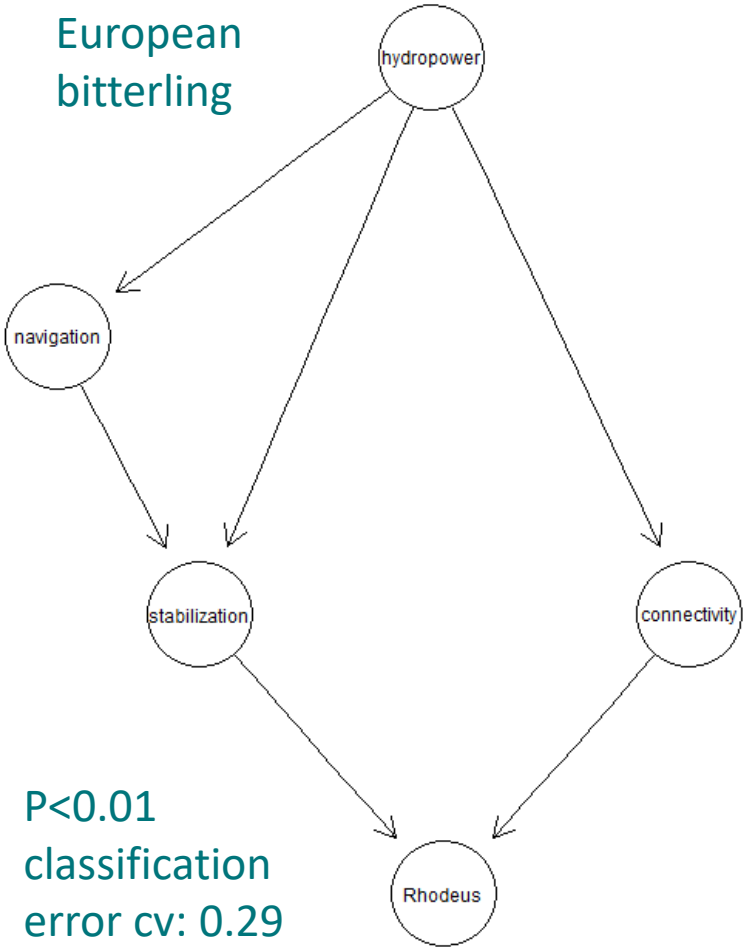
Analysis: D-P-S model – R, bnlearn



- Selection of variables – select relevant parameter (e.g. Jonckheere-Terpstra test)
- Development of the model structure based on data (e.g. AIC or BIC scores)
- Fit (learn) parameter of the network conditional on its structure (mle, bpe)
- Validate – e.g. significance of variables, classification error, cross-validation,…

Analysis: Preliminary examples – fish

Stagnophilic – European bitterling



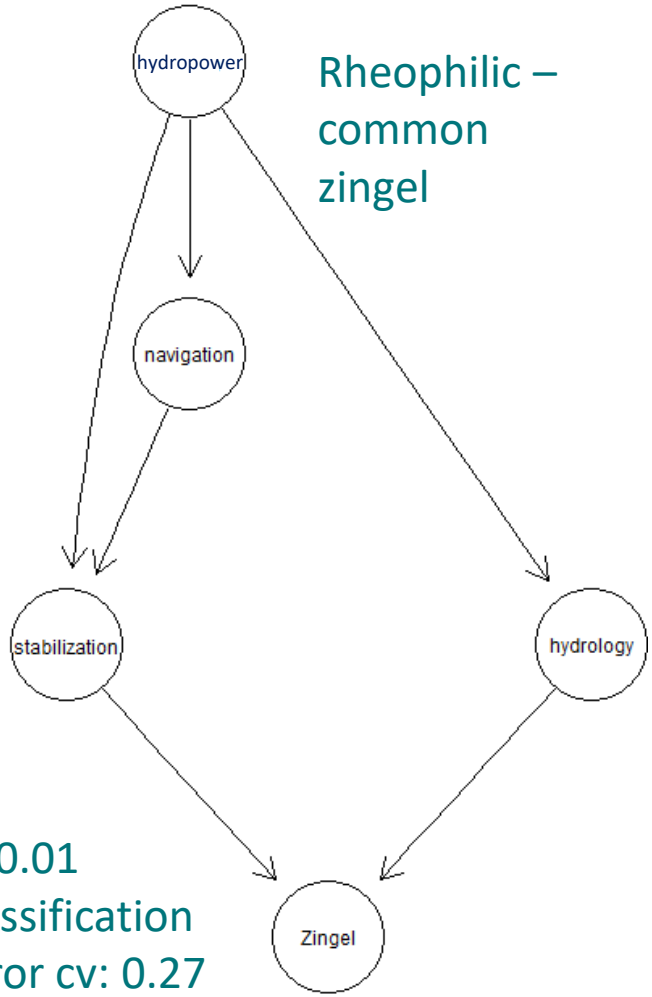
P<0.01
classification error cv: 0.29

Driver

Pressure

State

Rheophilic – common zingel



P<0.01
classification error cv: 0.27

Summary & outlook

- Quantify the impact of drivers and pressures on the status of biodiversity components across the Danube
- Can be used for predictions – basis for management and restoration
- So far focus on aquatic biodiversity (fish and waterbird) – can principally be extended to floodplain habitats and other protected species.

Questions?

Suggestions?

Comments?

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