



Mapping the natural values and ecological rehabilitation potential of Sweden's bypassed river reaches



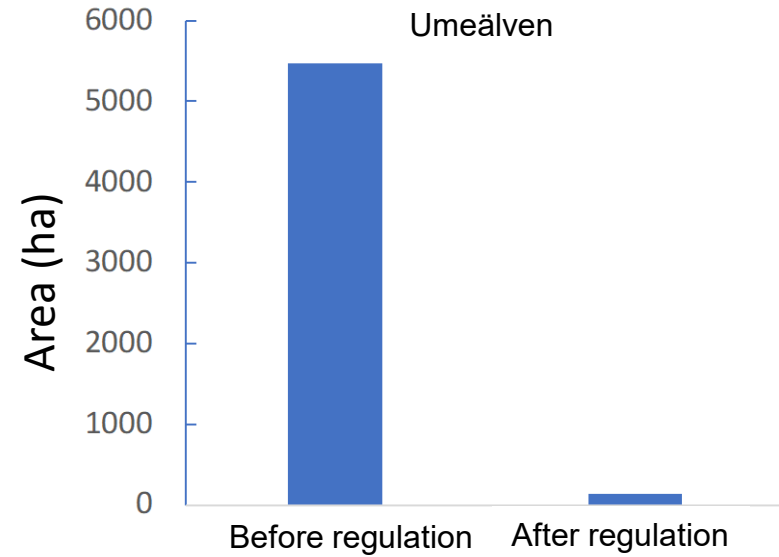
Roland Jansson¹, Joel Segersten², Åsa Widén^{1,2}, Serena Donadi², Erik Degerman^{2,3}, Birgitta Malm Renöfält¹, Andreas Karlsson Tiselius¹, Sofi Lundbäck¹.

¹Umeå University, ²Swedish University of Agricultural Sciences, ³Norconsult AB

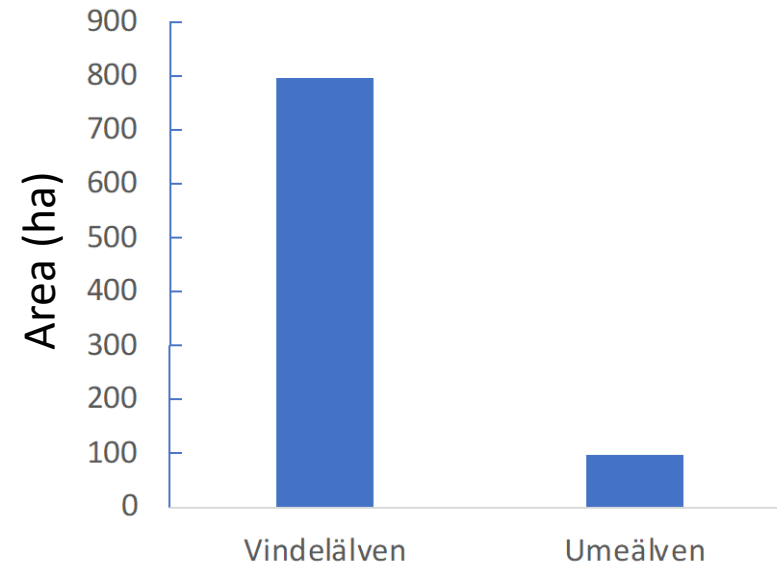


Loss of riverine ecosystems due to regulation

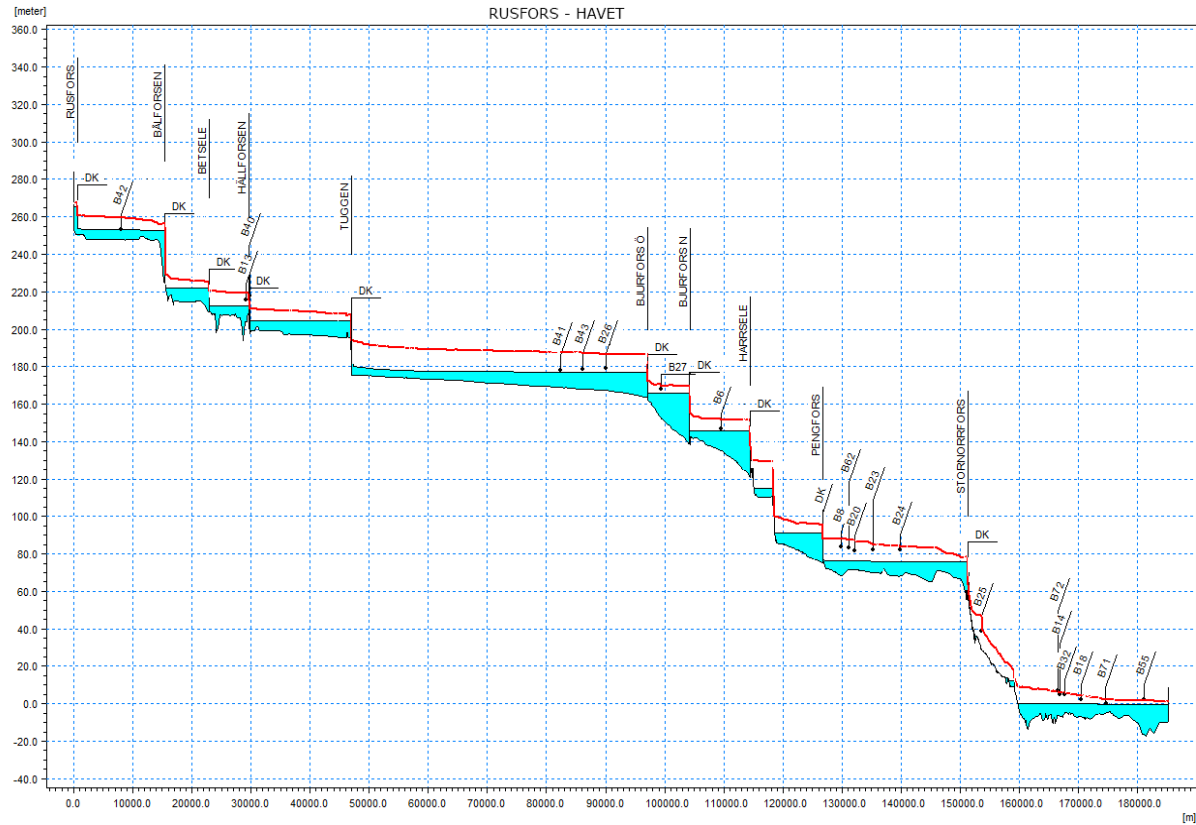
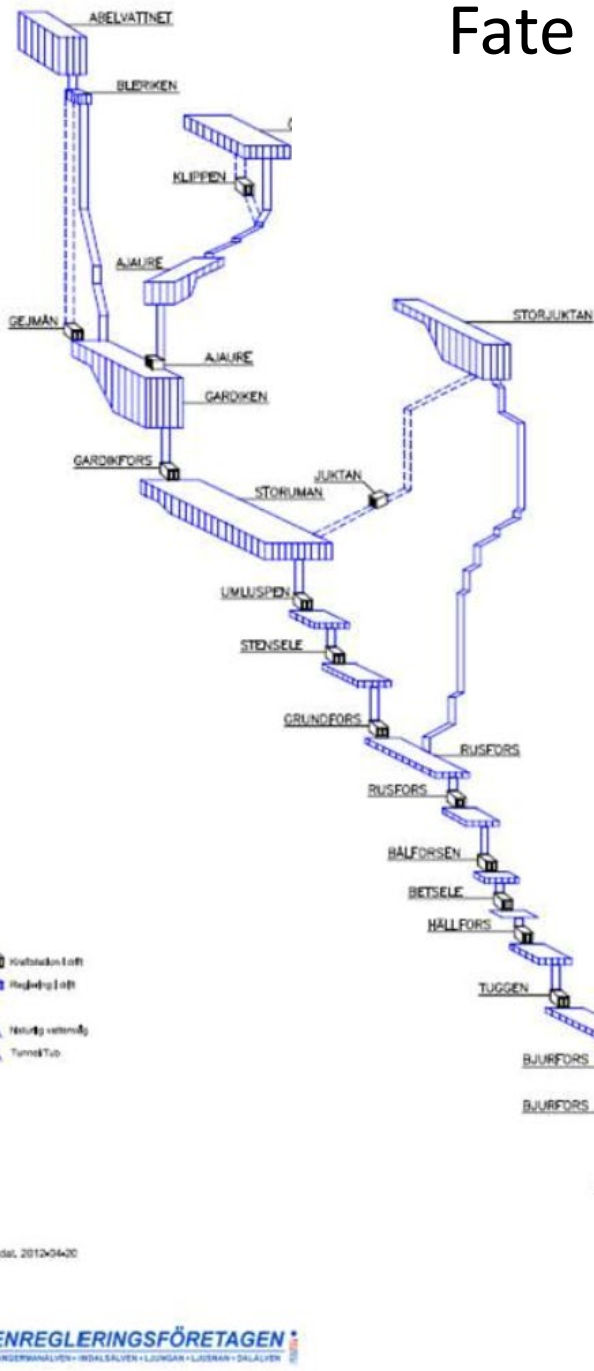
Rapids



Riparian vegetation



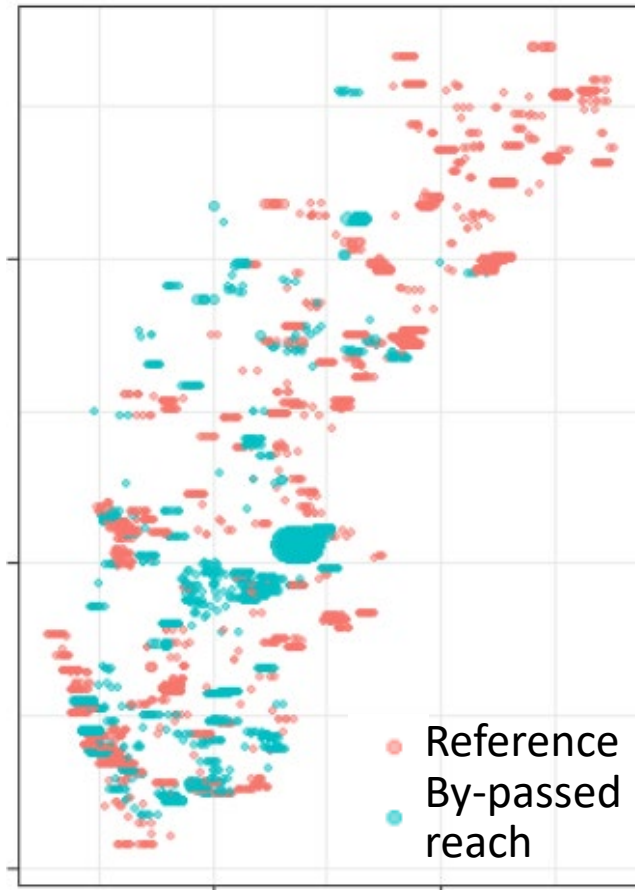
Fate of rapids and water falls



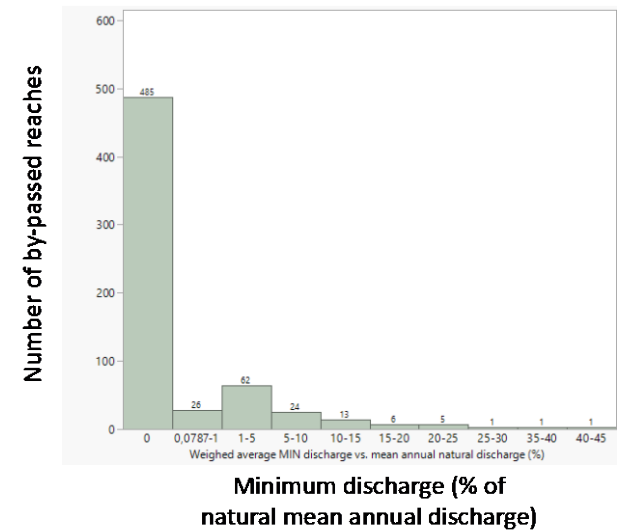
- Dammed over in reservoirs
- At hydropower stations: **By-passed** (flow diverted) or otherwise modified



By-passed reaches in Sweden

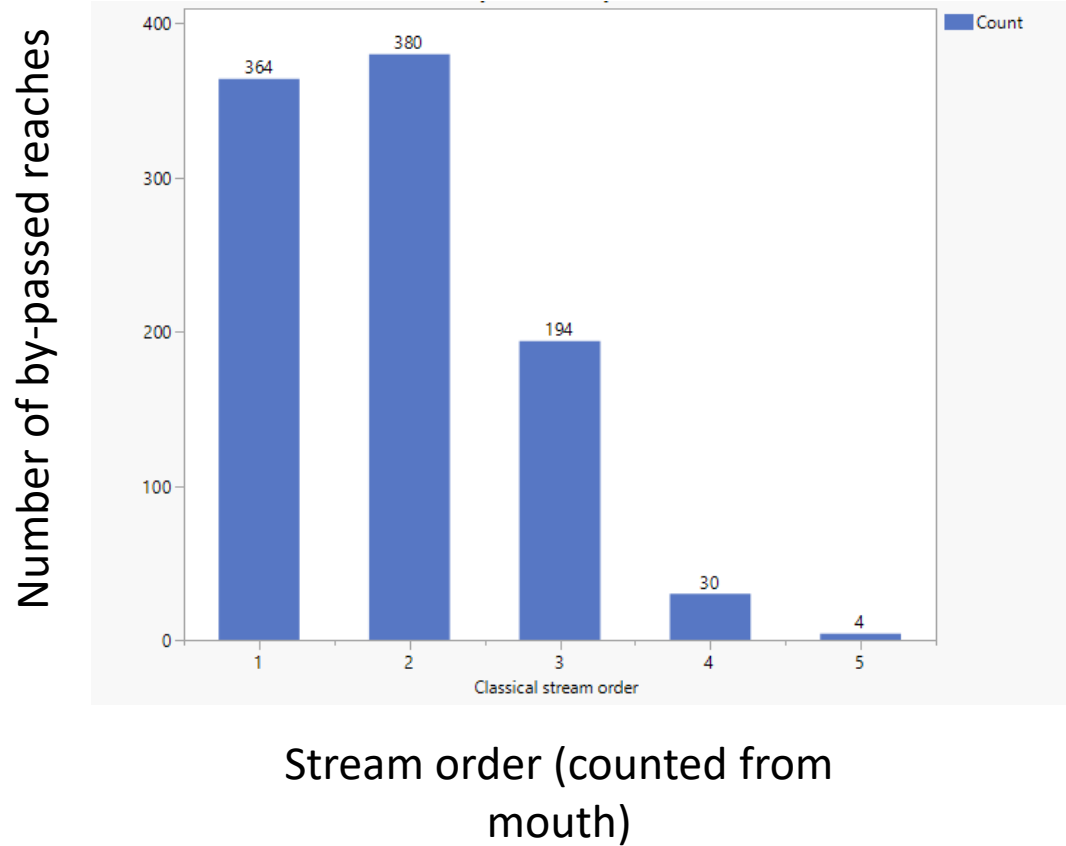


- 964 bypassed reaches longer than 30 m in Sweden
- 800 rapids laid dry
- Length: mean 1319 m, median 319 m
- 73% lack any minimum discharge
- Minimum discharge: mean 8.3% of mean annual discharge

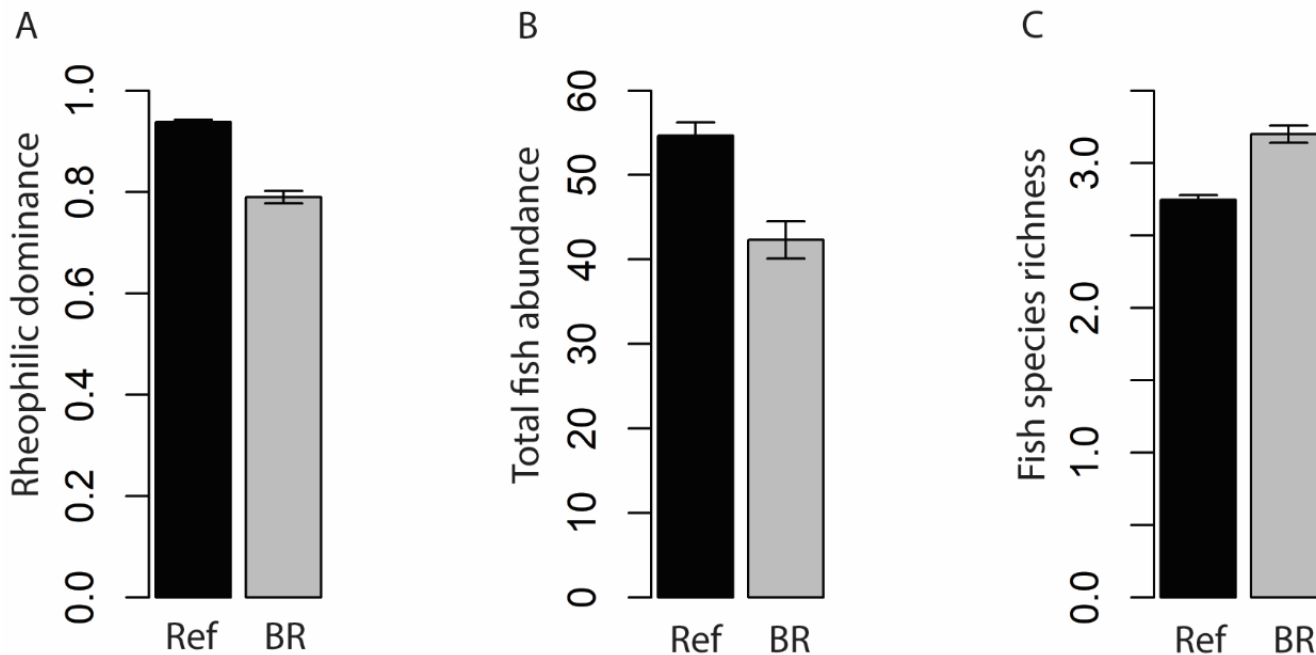




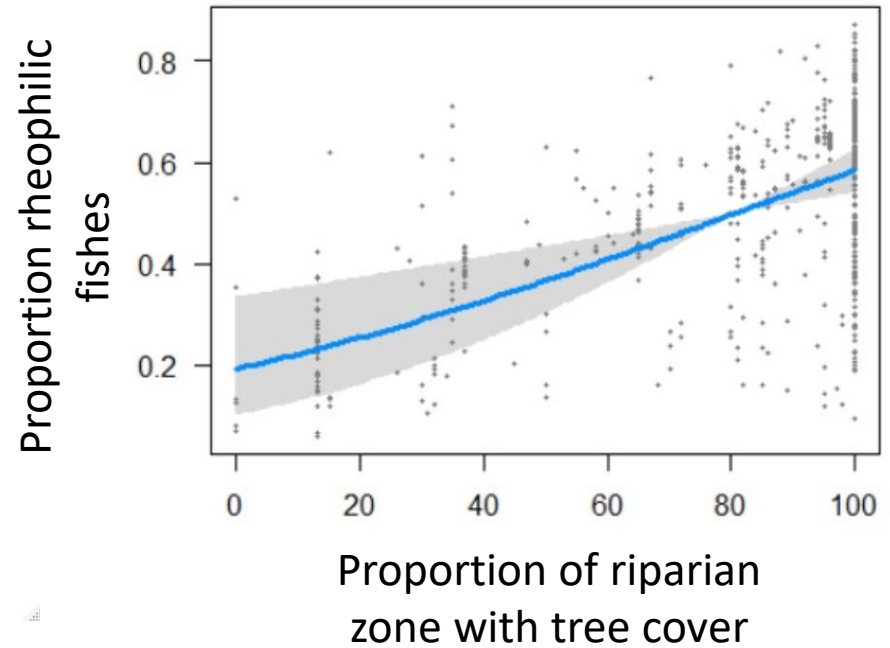
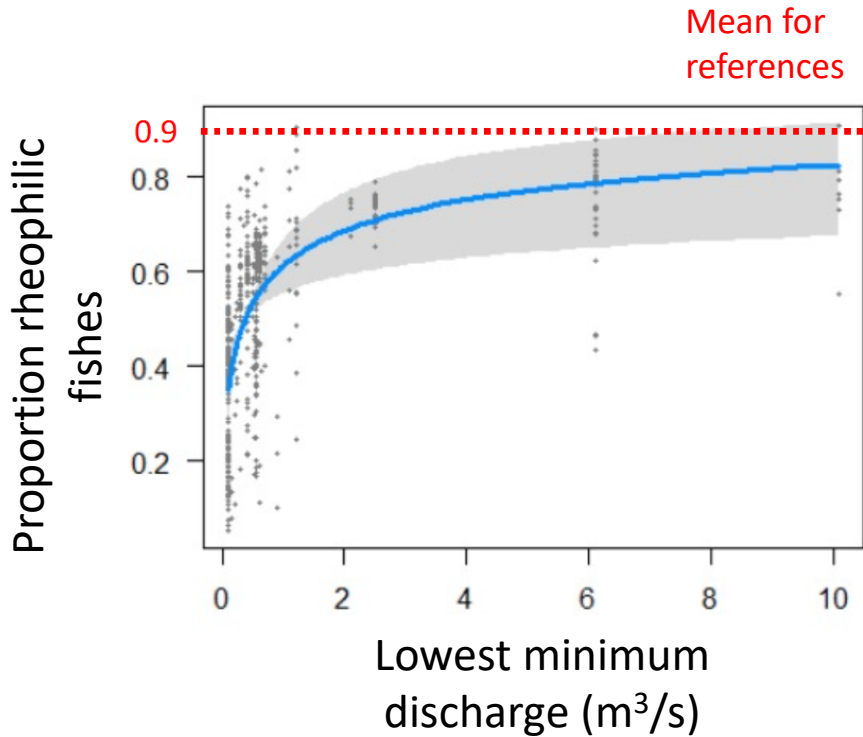
Position in the catchment of by-passed reaches – most are close to the mouth



Fish communities in bypassed reaches



Minimum discharge release and tree covered riparian zones enhances communities of rheophilic fishes





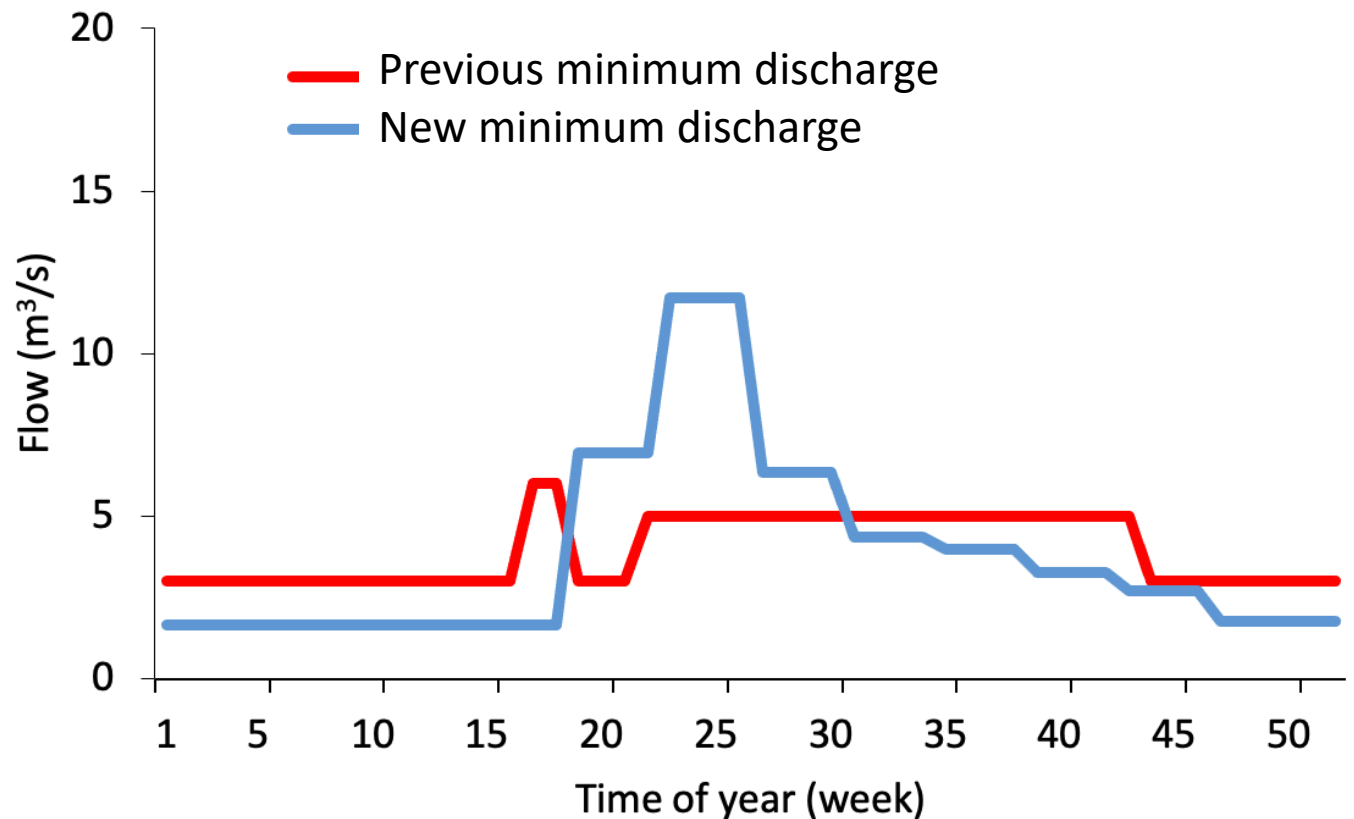
Aspects of flow needed to support different ecological and hydromorphological functions:

- Wetted channel (*aquatic habitats*)
- Minimum flow velocity (*lotic habitats*)
- Discharge needed to provide variation and diversity in velocity, depth and hydraulic conditions (*species richness, refugia during low flows*)
- Peak water-levels needed create and rejuvenate habitat (*riparian plant communities*), and maintain *land-water interactions*
- Peak flows needed to mobilize sediment to *create and rejuvenate habitat*



Introducing seasonal flow variation in Juktån, Ume River

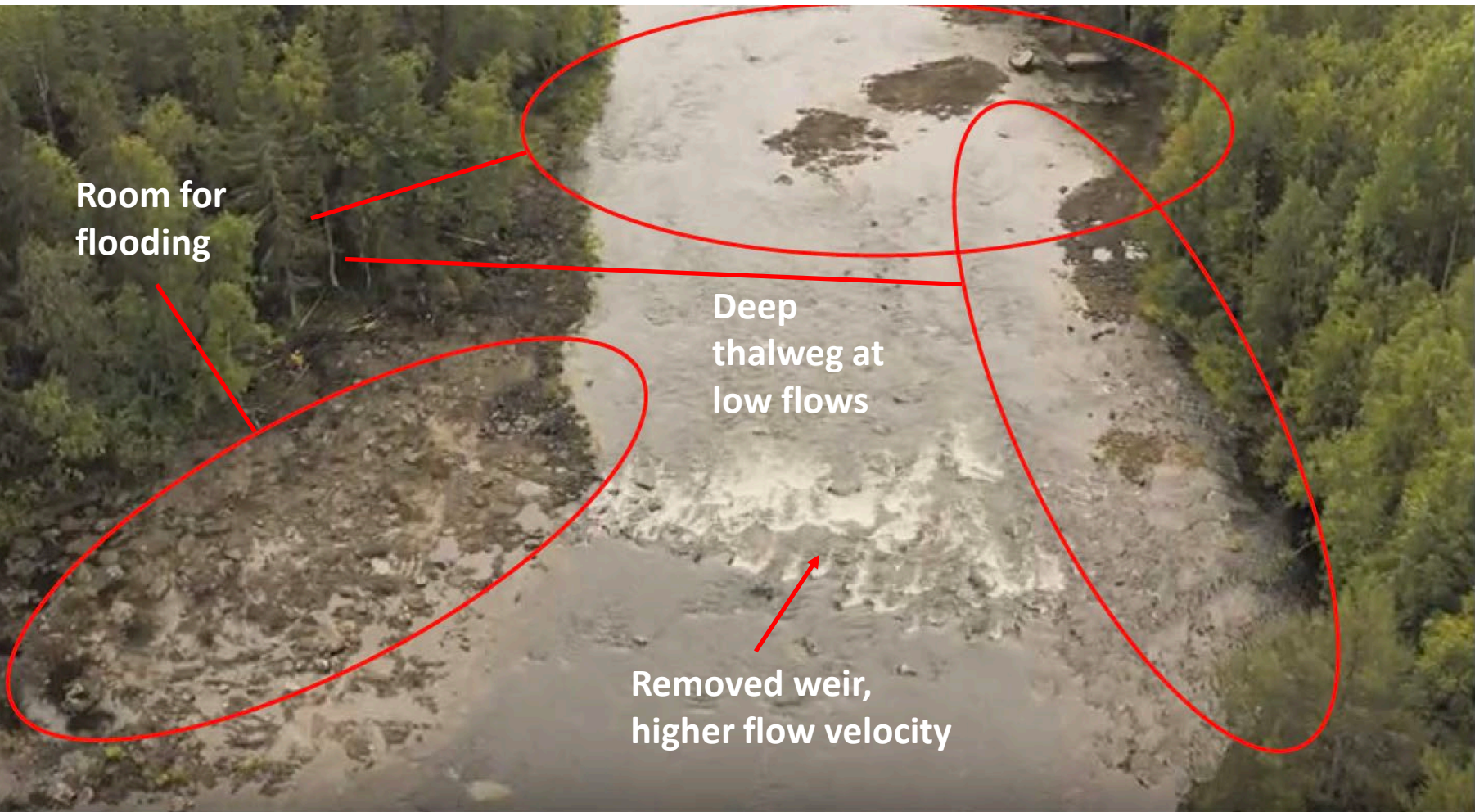
- 68 km long bypassed reach
- 12% of mean annual discharge, weirs to raise water levels
- Previously: 3 m³/s in winter, 5 m³/s in summer
- Since 2021: seasonal flow variation, timing follows local runoff



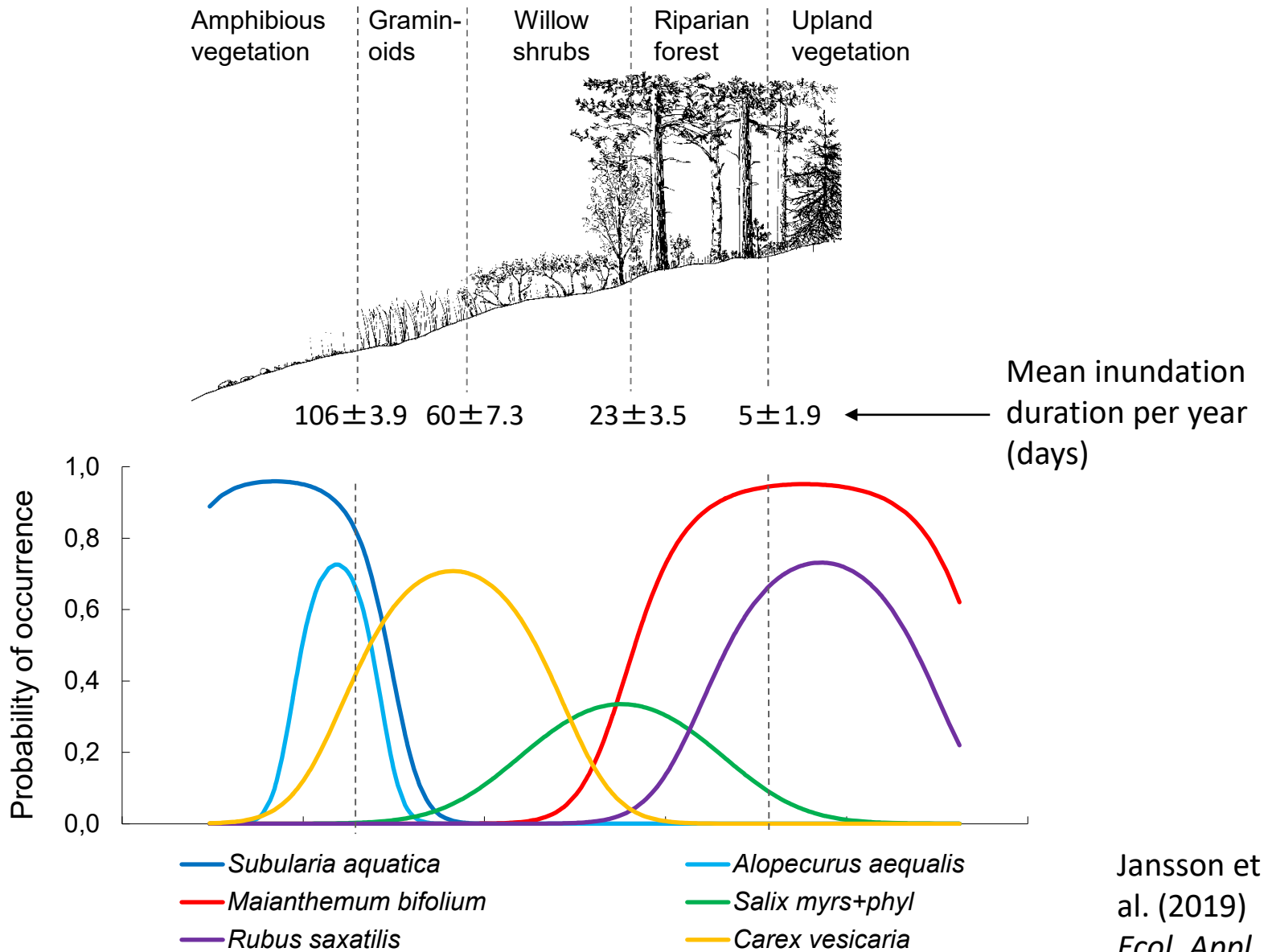
Channel adapted to seasonal flow variation – providing ecosystem functions at low and high flows



Channel adapted to seasonal flow variation – providing ecosystem functions at low and high flows

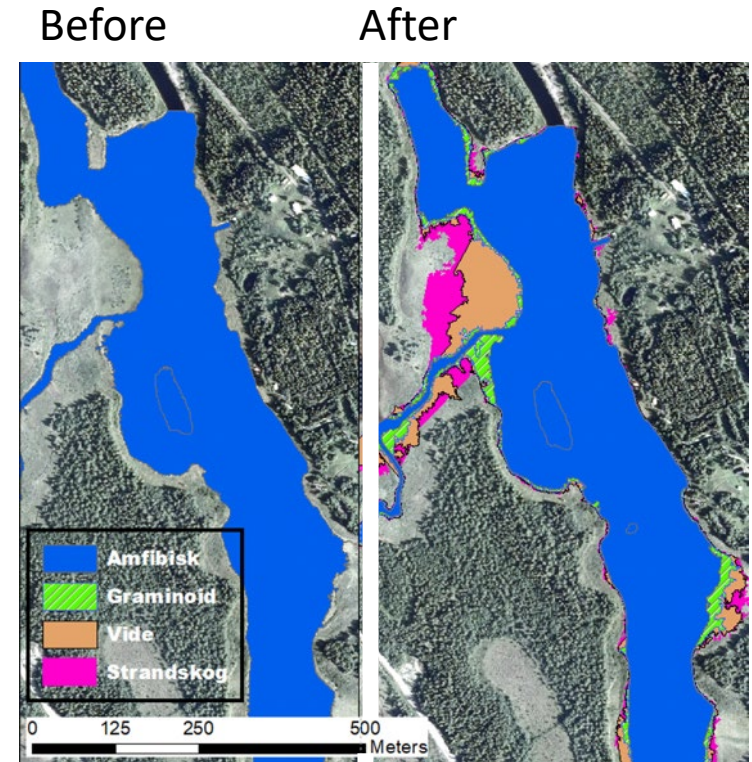
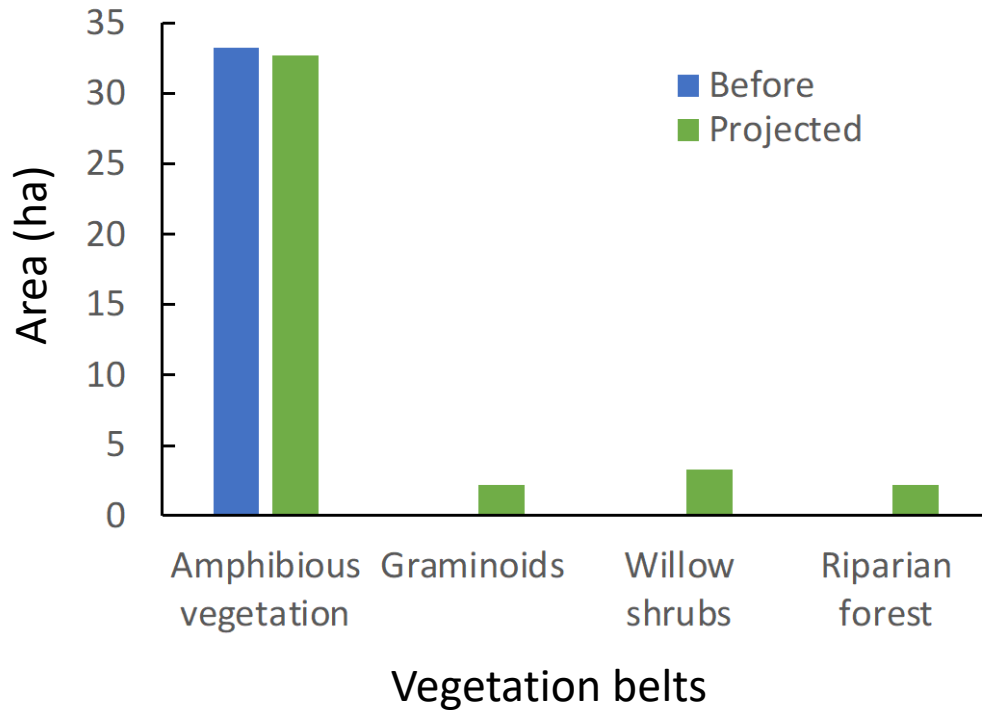


Projected responses of riparian vegetation.



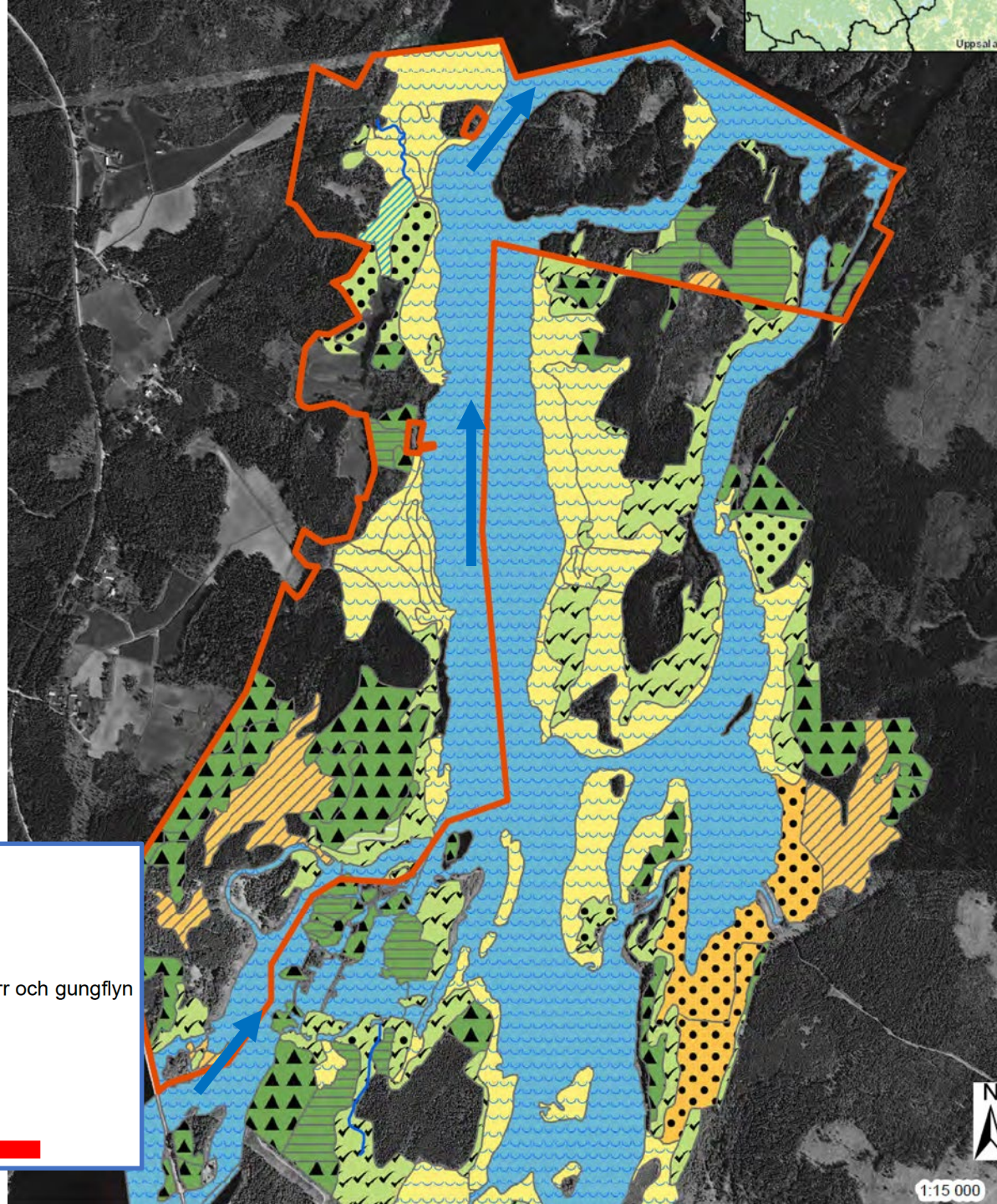
Jansson et al. (2019)
Ecol. Appl.

Projected responses of riparian vegetation in Juktån, Ume River

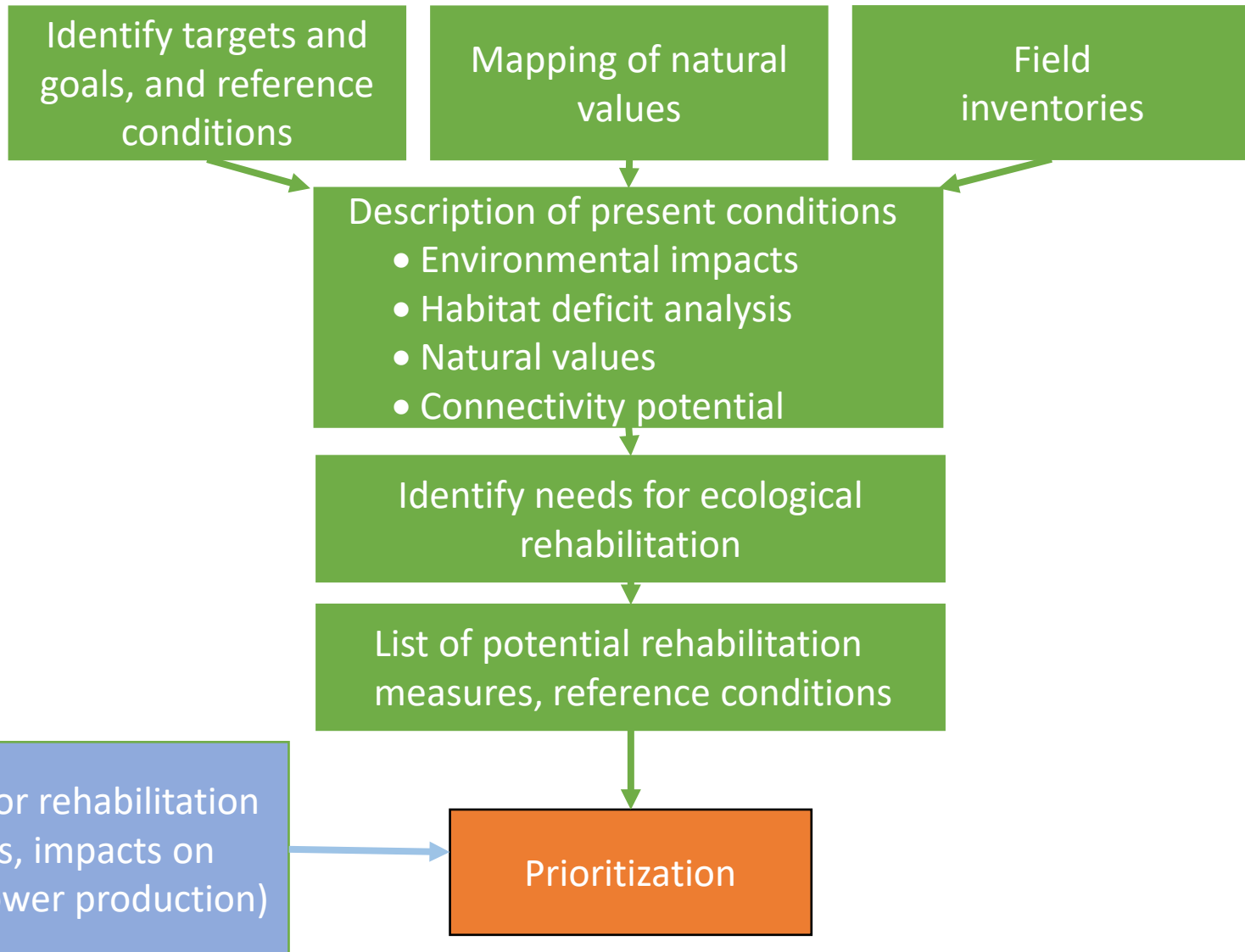


Bredforsen nature reserve, Dal River

Projections of flood pulses (magnitude and duration) needed to maintain and restore riparian forests with deciduous hardwood trees



Road map to implementation of ecological rehabilitation of by-passed reaches



Conclusions

- Rapids and water falls have been lost as a result of regulation
- Most by-passed reaches lack any mandated minimum discharge
- By-passed reaches are primarily located in the lower reaches of river systems
- Minimum flows can bring back rheophilic fish fauna
- With seasonal variation in flow, riparian vegetation and other aspects of functional ecosystems can be rehabilitated
- With systematic work to identify rehabilitation potential, great scope for ecological rehabilitation of by-passed reaches



Roland Jansson
Umeå University



Åsa Widén
Umeå University, SLU



Sofi Lundbäck
*Umeå University,
County Adm. Västernorrland*



Erik Degerman
SLU, Norconsult



Joel Segersten
SLU



Serena Donadi
SLU



Dag Wisaeus
AFRY



Marcus Bryntesson
Anders Berglund
County Adm. Västernorrland

Jani Ahonen
SLU
Andreas Karlsson Tiselius
Umeå University



Länsstyrelsen
Västernorrland



Norconsult 