Biodiversity scenarios for fragmented landscapes; freshwater connectivity and the future of fish diversity

FISHCON (www.nina.no/FISHCON)

Coordinated by Anders G. Finstad (NINA)

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Umeå University

IGB
Leibniz-Institute of Freshwater Ecology and Inland Fisheries
Research for the future of our freshwaters

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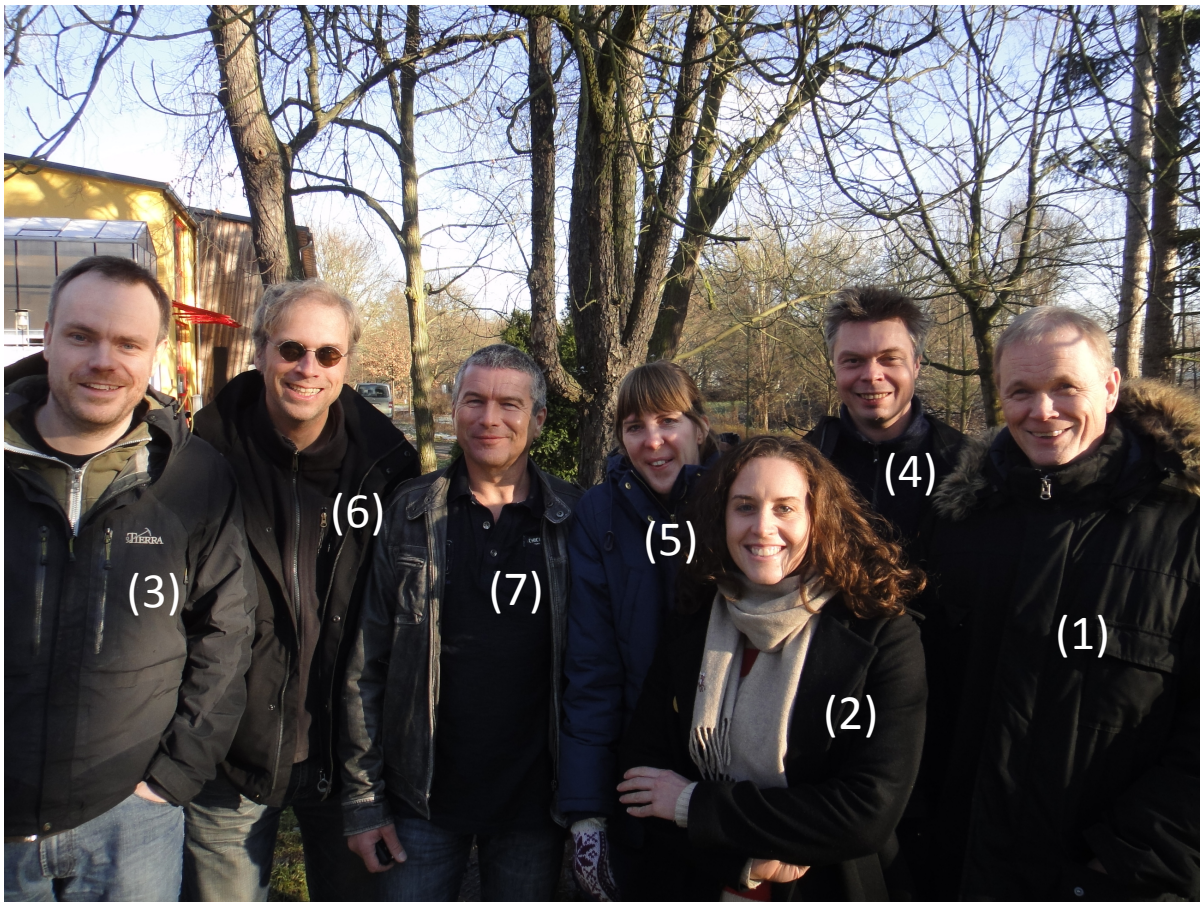
Core research team



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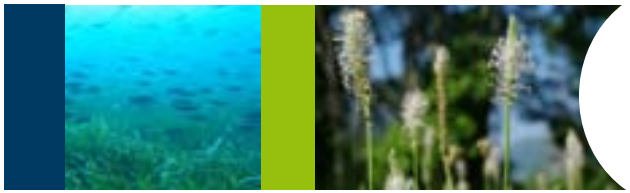

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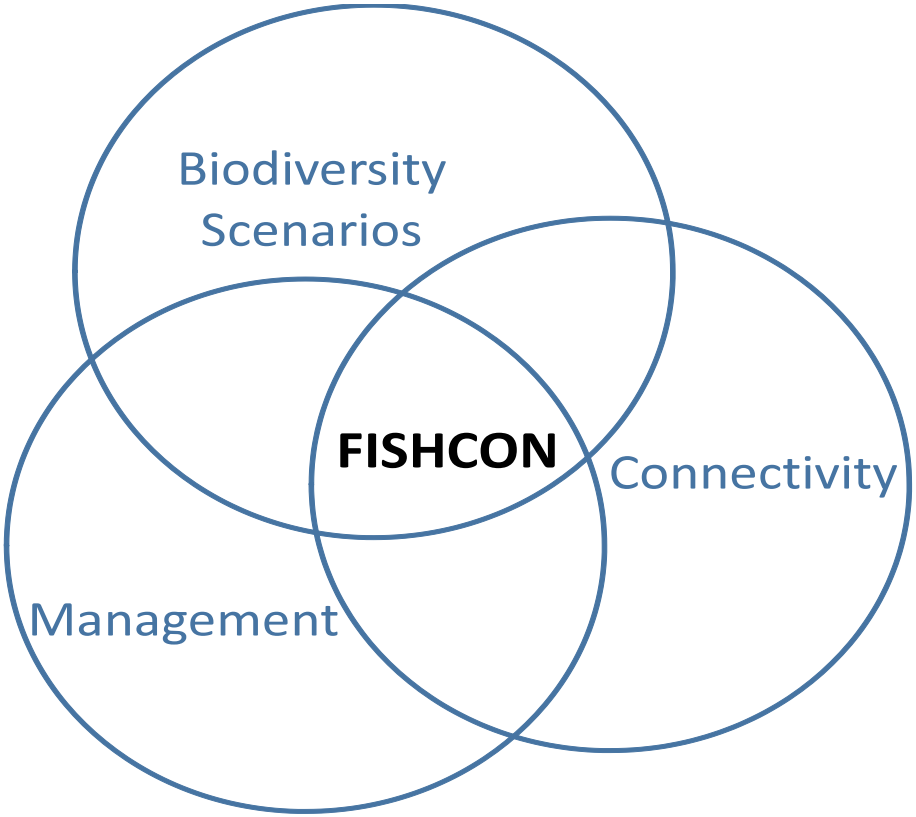
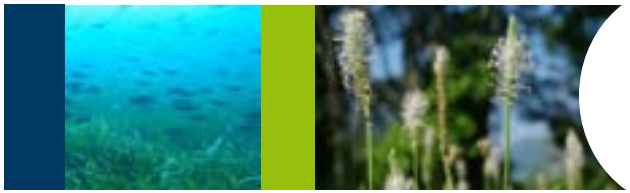


FISHCON focuses on the crossroads between biodiversity scenarios, management actions and habitat connectivity



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- Freshwater biodiversity faces multiple interacting treats (e.g. climate and land-use change, anthropogenic translocations)
- Most predictions of biodiversity change ignore habitat connectivity
- Connectivity particularly important for freshwater organisms due to the dendritic structure of their habitat
- Management actions can be informed by scenarios

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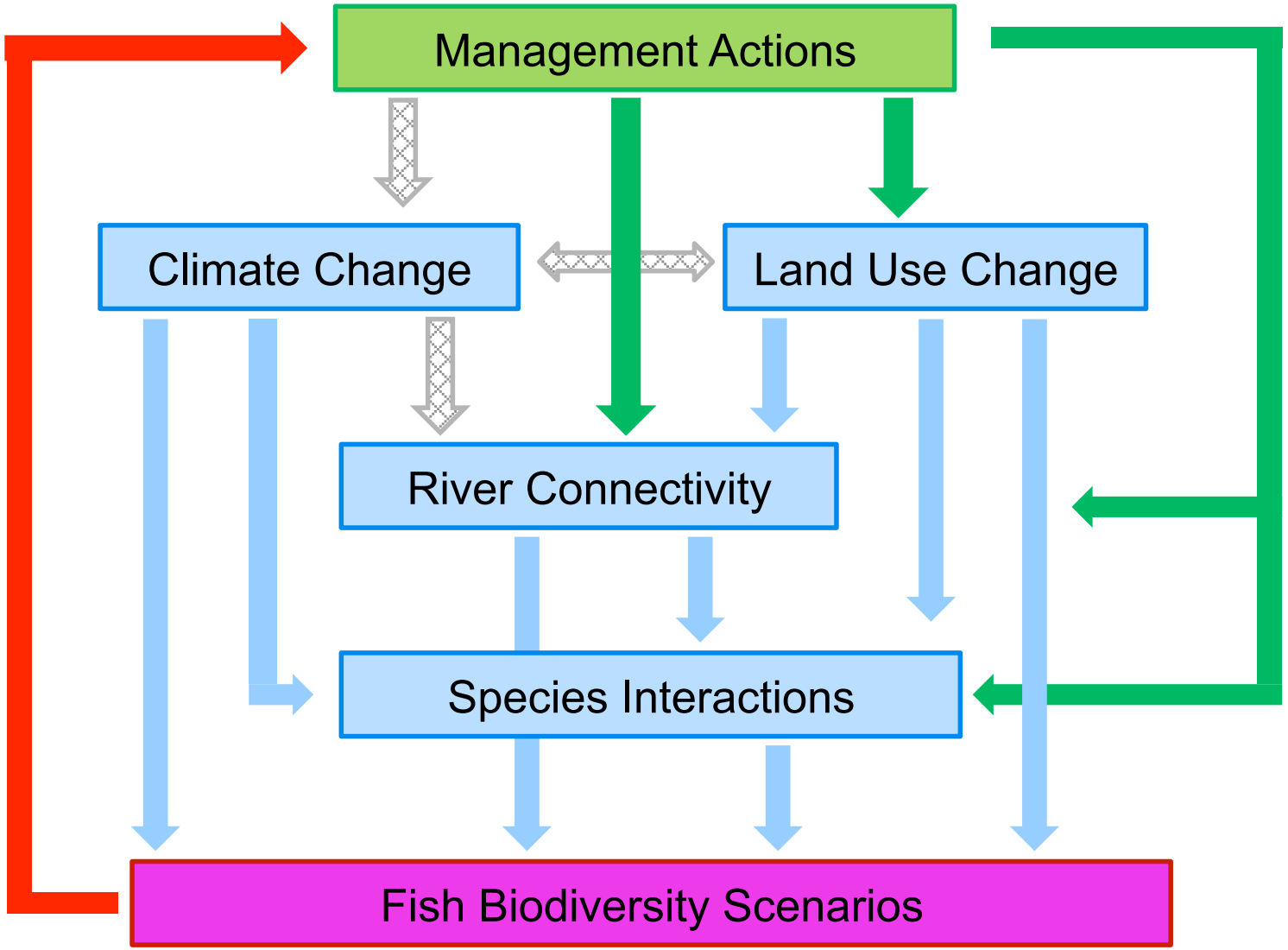
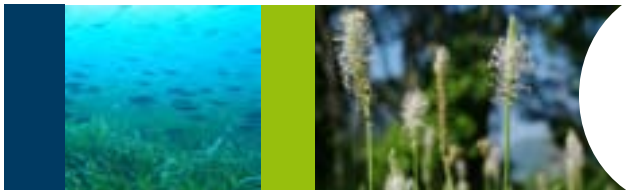

Management Actions
Climate Change
Land Use Change
River Connectivity
Species Interactions
Fish Biodiversity Scenarios



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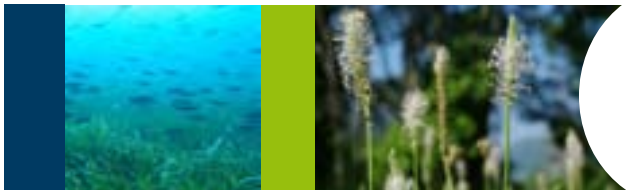
Example on the importance of connectivity for scenario building

Northern pike distribution in Sweden under climate change

Hein et al. 2011 *Diversity & Distributions*



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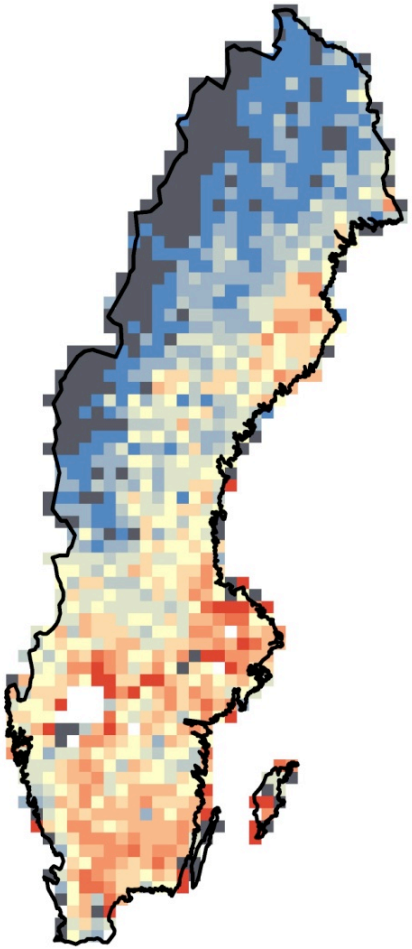
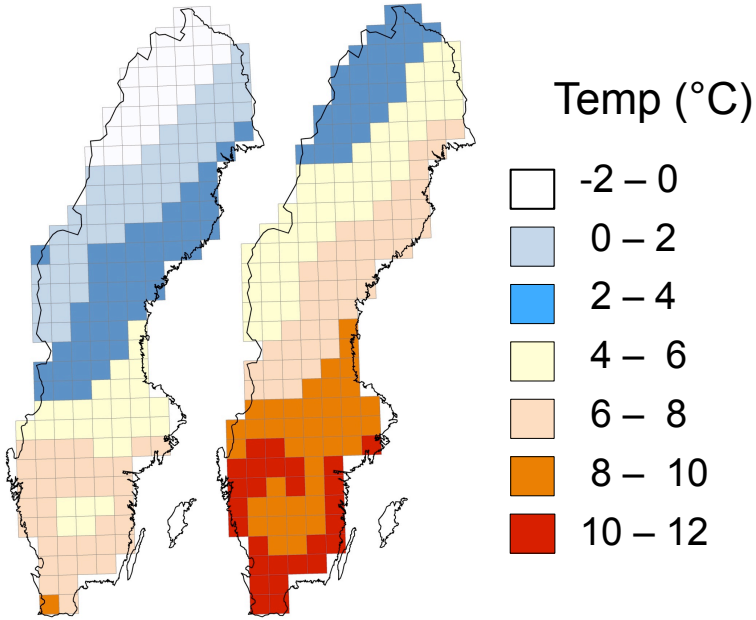
Current Pike Distribution

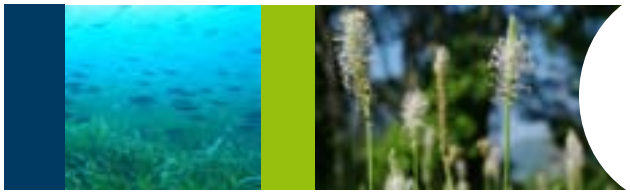


Projected Air Temperatures

1961-1990 2091-2100



Hein et al. 2011 *Diversity & Distributions*



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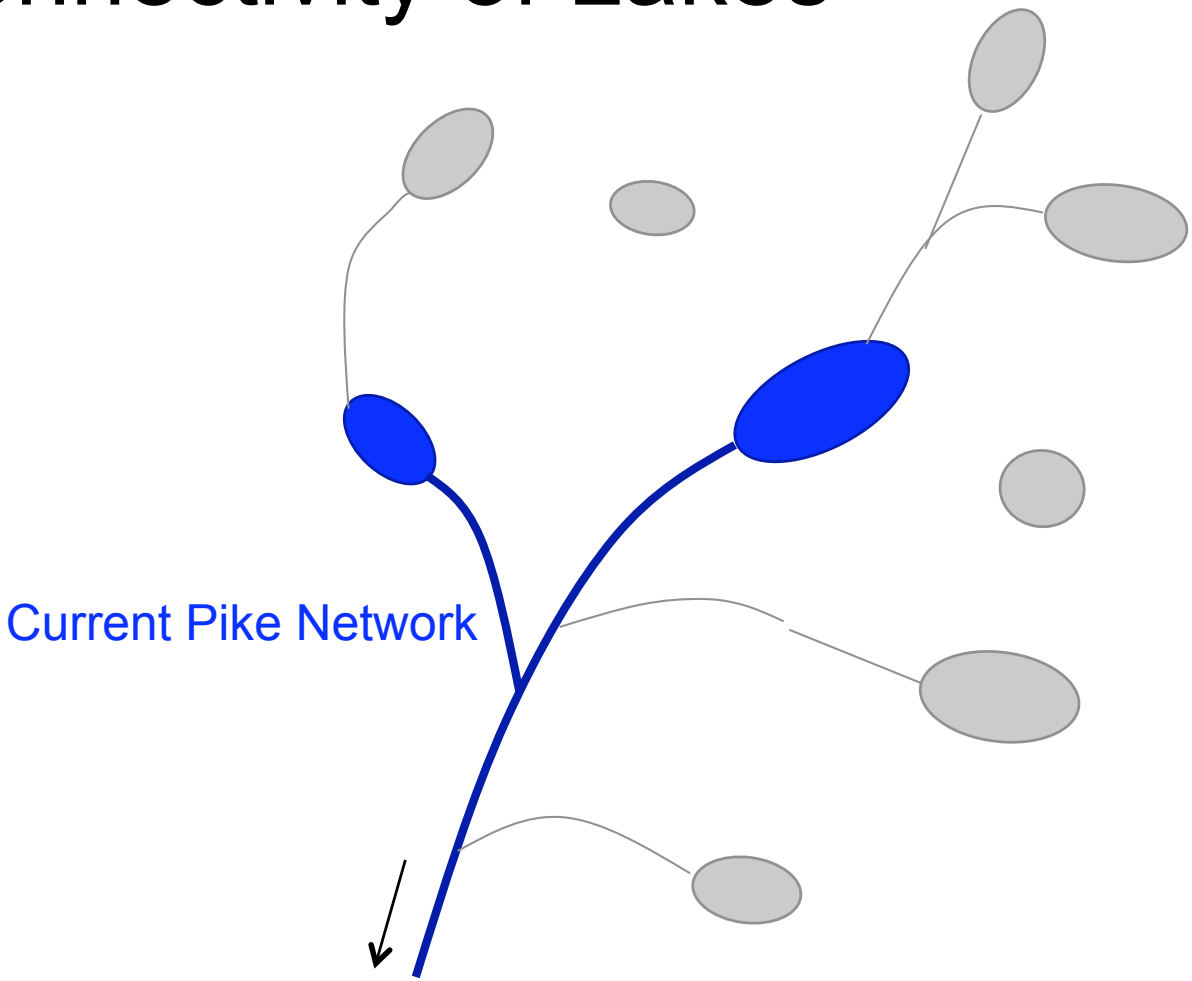
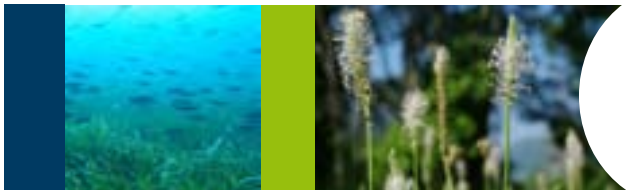
Connectivity of Lakes



Hein et al. 2011 *Diversity & Distributions*



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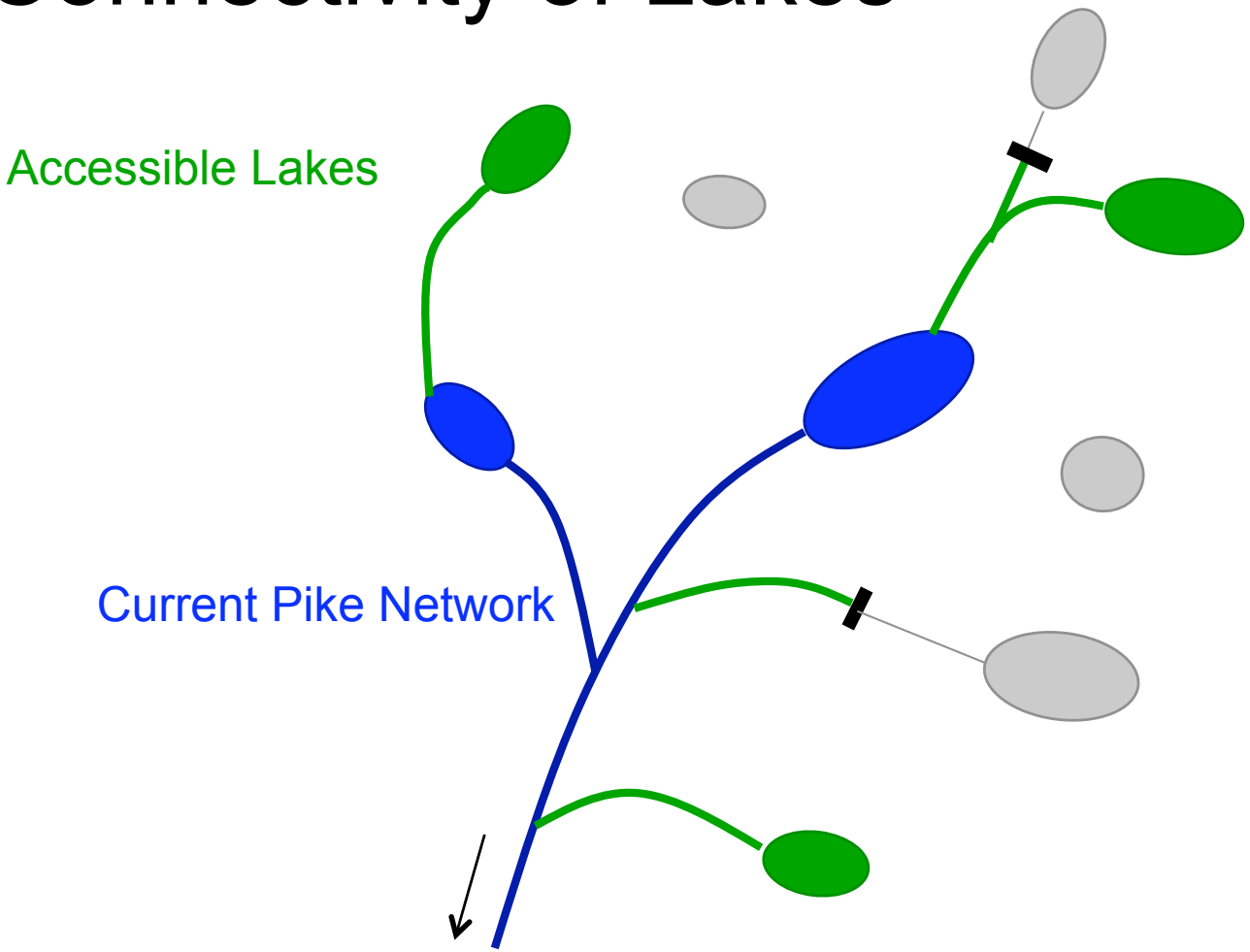

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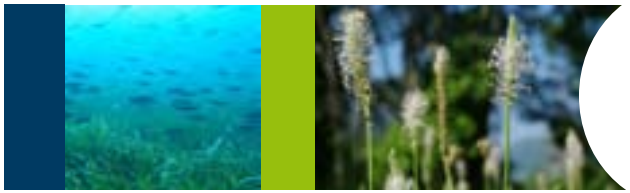

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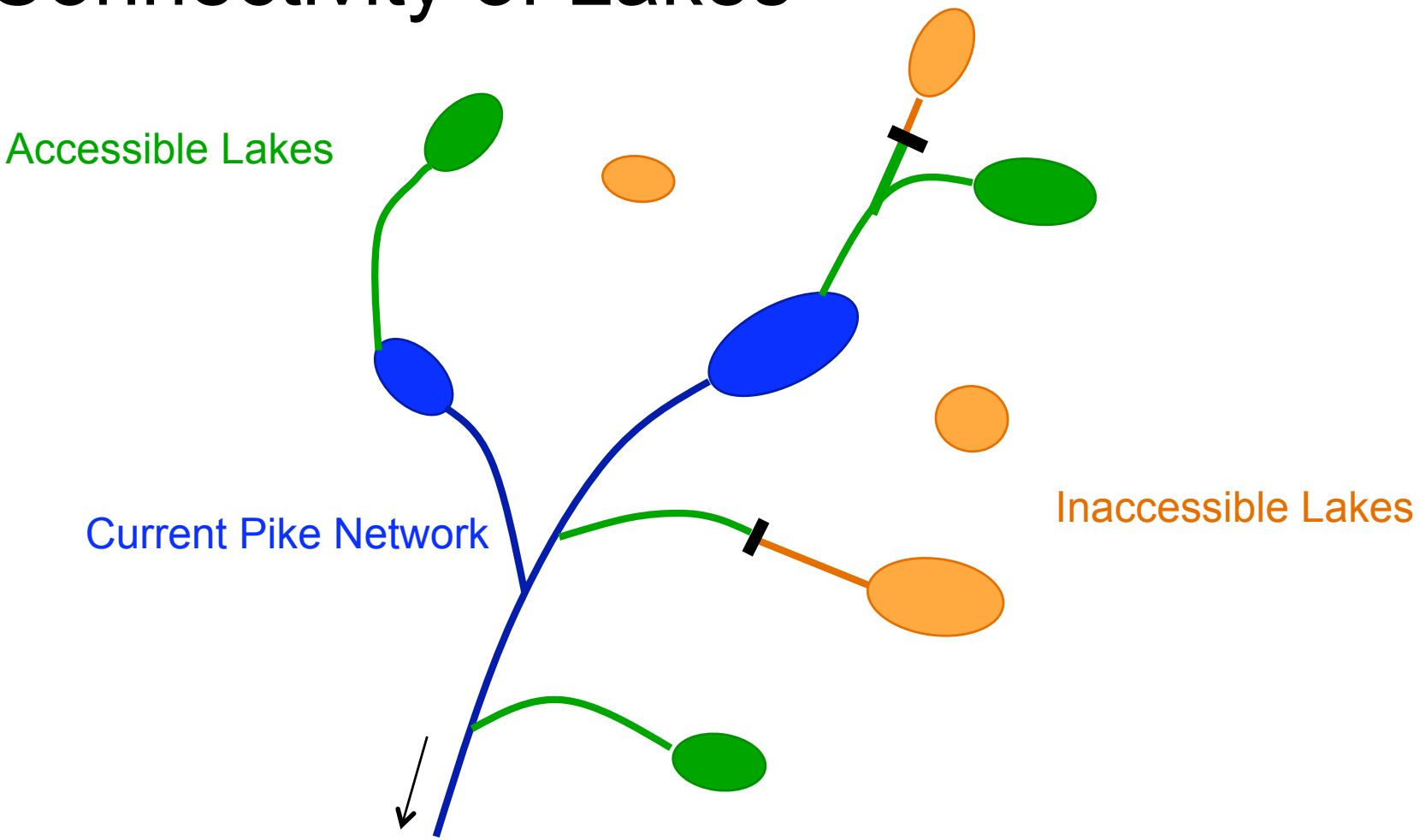
Connectivity of Lakes



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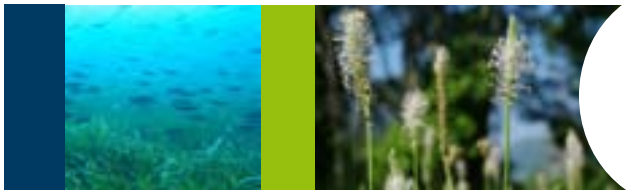

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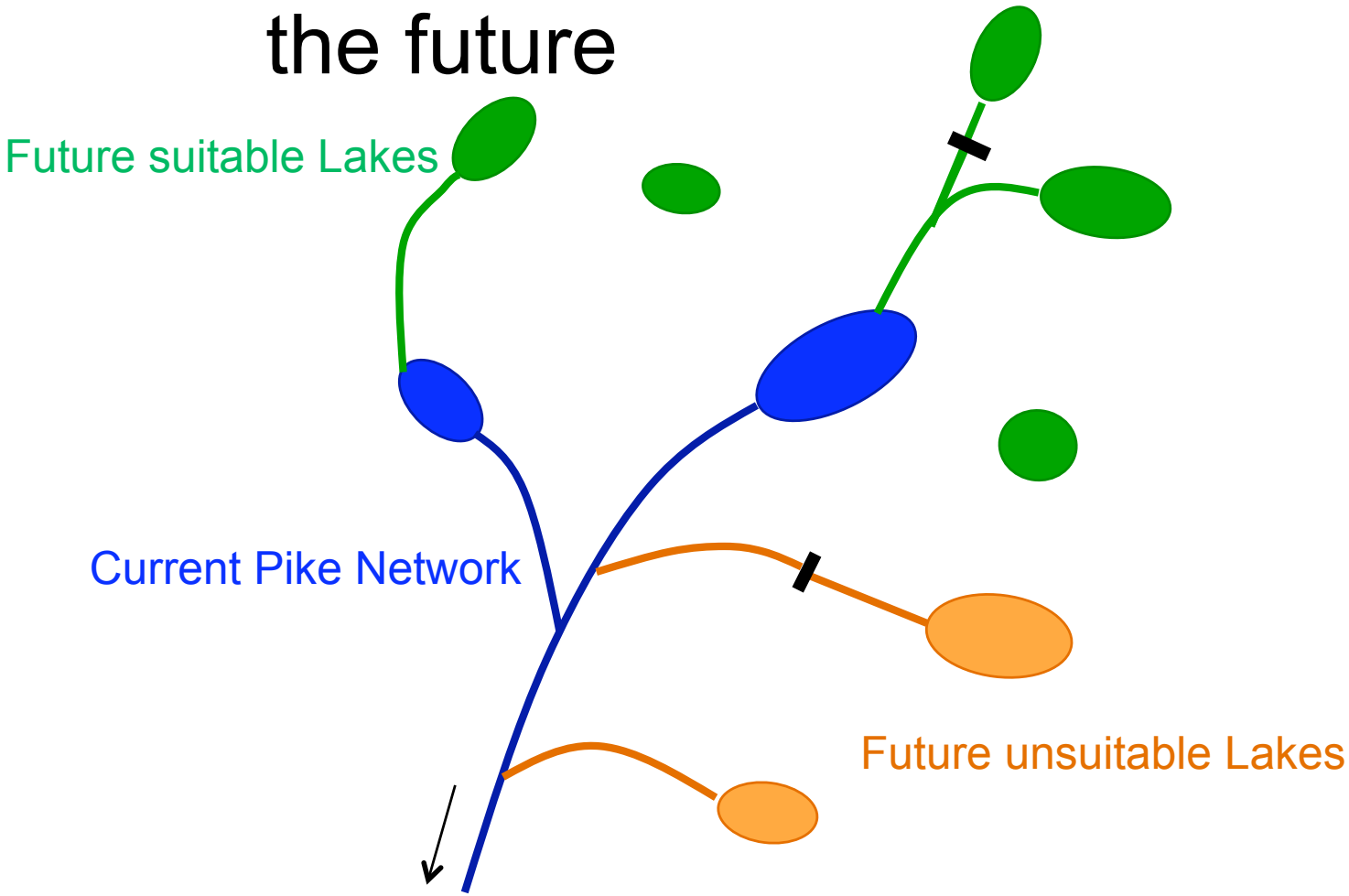
Predicted suitable habitat in the future



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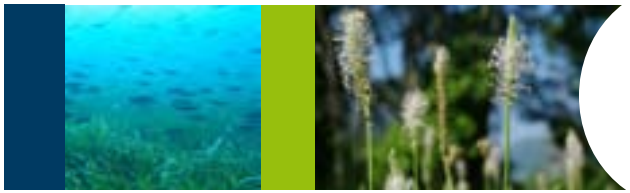

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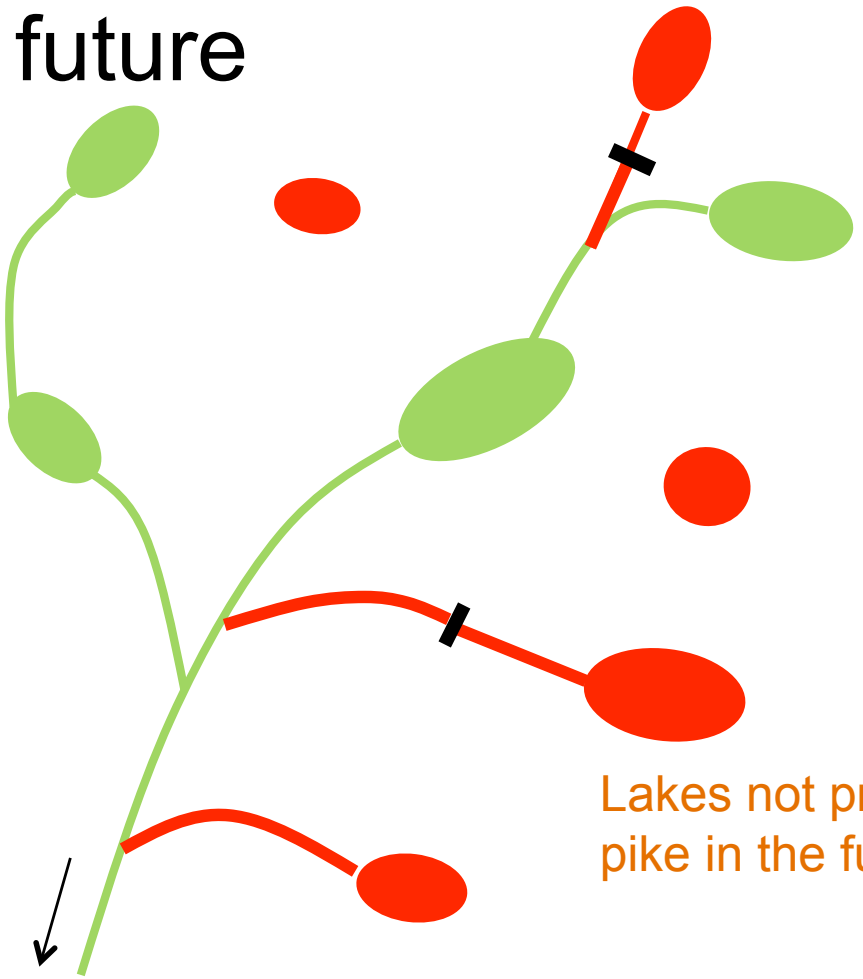
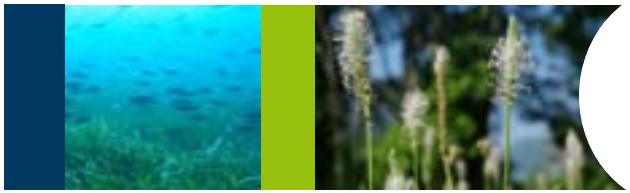
Predicted suitable habitat in the future

Lakes predicted to hold pike in the future



Lakes not predicted to have pike in the future

Hein et al. 2011 *Diversity & Distributions*



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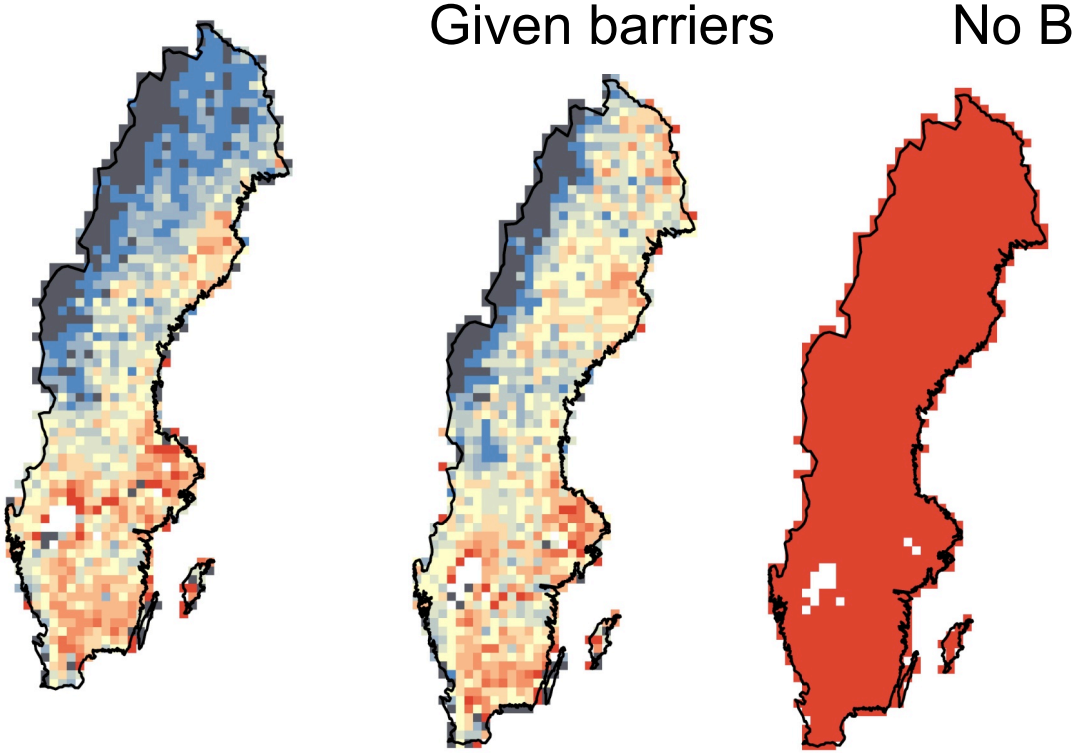
1961-1990
Observed

2091-2100
Predicted
Given barriers

2091-2100
Predicted
No Barriers

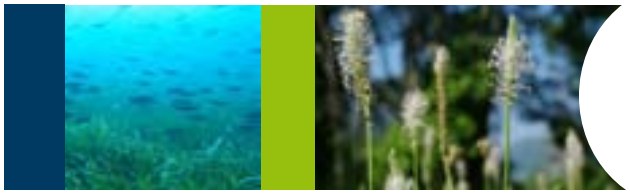


Percent
Pike Lakes

- 0
- 1-10
- 10-20
- 20-30
- 30-40
- 40-50
- 50-60
- 60-70
- 70-80
- 80-90
- 90-100

Pike Predicted to invade 9100 Lakes

Hein et al. 2011 *Diversity & Distributions*



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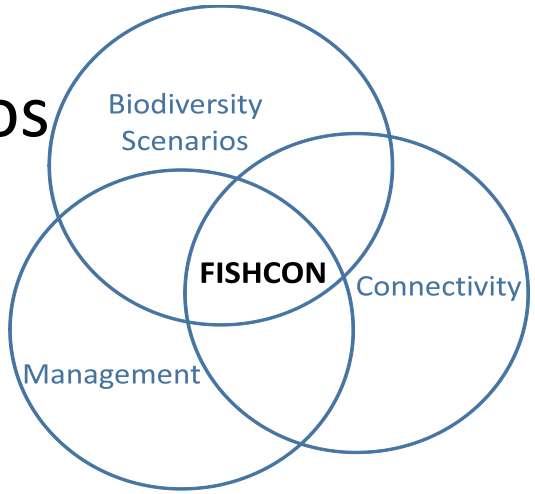
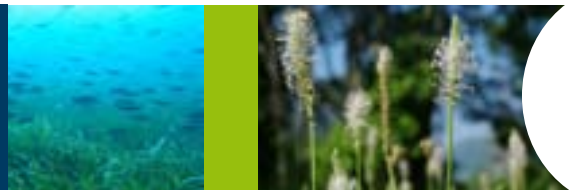
FISHCON main goal

Build integrated scenario models for freshwater fishes and to explicitly link present day management of habitat connectivity to future biodiversity scenarios



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Sub-goals

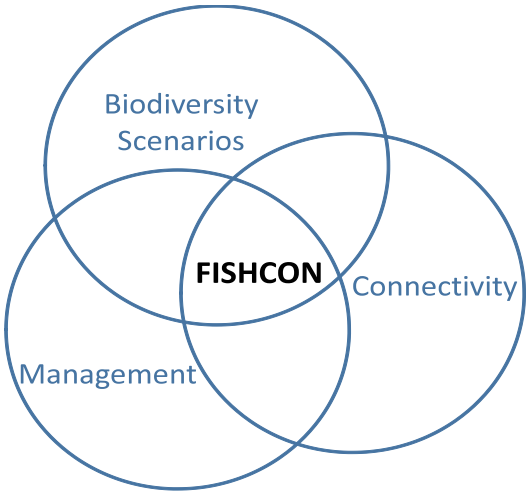
(i) Develop distribution models for freshwater fishes along natural and anthropogenic gradients that explicitly include dispersal limitations

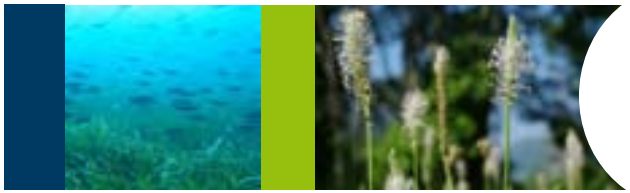
(ii) Provide integrated biodiversity scenarios based on climate and land-use projections

(iii) Downscale scenarios to management relevant scales (e.g. water basin management areas)

(iv) Possible strategies for managing habitat connectivity and their consequences utilizing downscaled scenarios and local stakeholders involvement

(v) Investigate how local mitigation actions affect biodiversity on multiple scales





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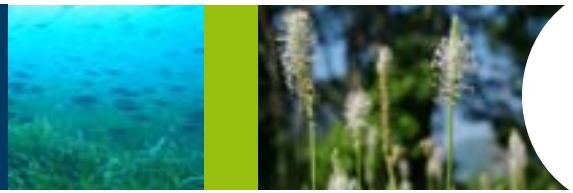
Project organized into three work packages

- **WP 1: Developing and calibrating integrated fish dispersal models**
- **WP 2: Linking ecological and evolutionary mechanisms to local biodiversity management**
- **WP 3: Integrating management options in biodiversity scenarios**

North European freshwaters and local water basin management areas (Germany, Sweeden and Norway) the workbench of the project

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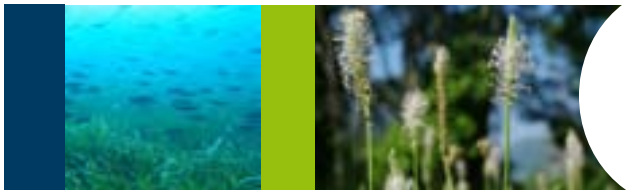
WP 1: Developing and calibrating integrated fish dispersal models (three tasks)

- Task 1.1 Freshwater fish biodiversity and connectivity: modelling dispersal (*connectivity, stream gradients, anthropogenic barriers*)
- Task 1.2: Freshwater fish biodiversity and environmental factors: modelling multiple drivers (*interactions between the biotic and abiotic environment, including climate change and land-use*)
- Task 1.3 Integrating dispersal scenarios with environmental drivers (*overlay possible dispersal range with future niche range*)



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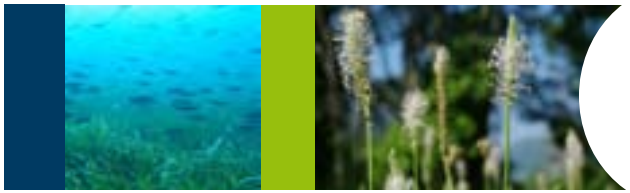
WP 2: Linking ecological and evolutionary mechanisms to local biodiversity management (three tasks)

- Task 2.1 Deriving detailed site specific predictions for local management (*for selected areas - downscale and tailor models from task 1.3 management relevant scales*)
- Task 2.2 Mechanistic analyses of ecological interactions (*empirical and theoretical models for ecological interactions following species range shifts under environmental change, to be contrasted with 1.2*)
- Task 2.3 Mechanistic analyses of evolutionary responses (*empirical and theoretical models for evolutionary responses following species range shifts*)

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WP 3: Integrating management options in biodiversity scenarios (two task)

- Task 3.1 Management responses to detailed site specific predictions *(through local workshops identify management responses to local scenarios from WP2 – e.g. dispersal barrier construction or removal)*
- Task 3.2 Integrating management responses in European and regional scenarios *(feed back management responses into biodiversity scenarios and address effects on multiple scales)*

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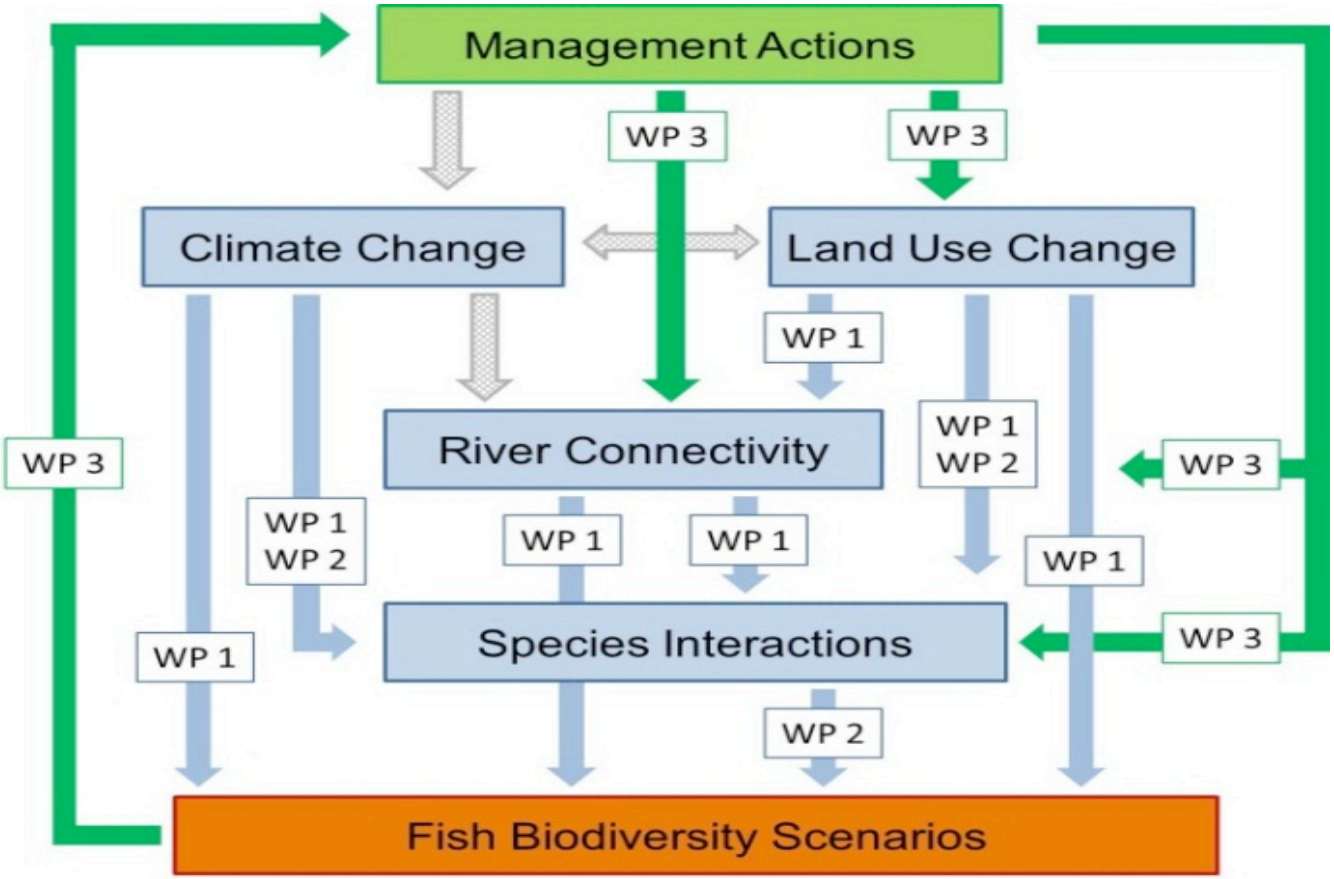

Overview of FISHCON: Multiple drivers of ecosystem change influence biodiversity scenarios (Grey arrows represent underlying processes not directly addressed by the proposal)

Thank you for your attention

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