Spatial modelling of freshwater species

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Yale

Challenges in freshwater distribution modeling

- **Spatial configuration and connectivity**

→ Nestedness of the environment

→ High spatial autocorrelation

→ Lack of range-wide predictors

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- **Heterogeneous species data**

→ Point data

→ Imperfect detections

→ Expert range information

Developing freshwater predictors

- Watersheds along the 1km HydroSHEDS network

Lehner et al. (2008)

→ Topography

→ Climate

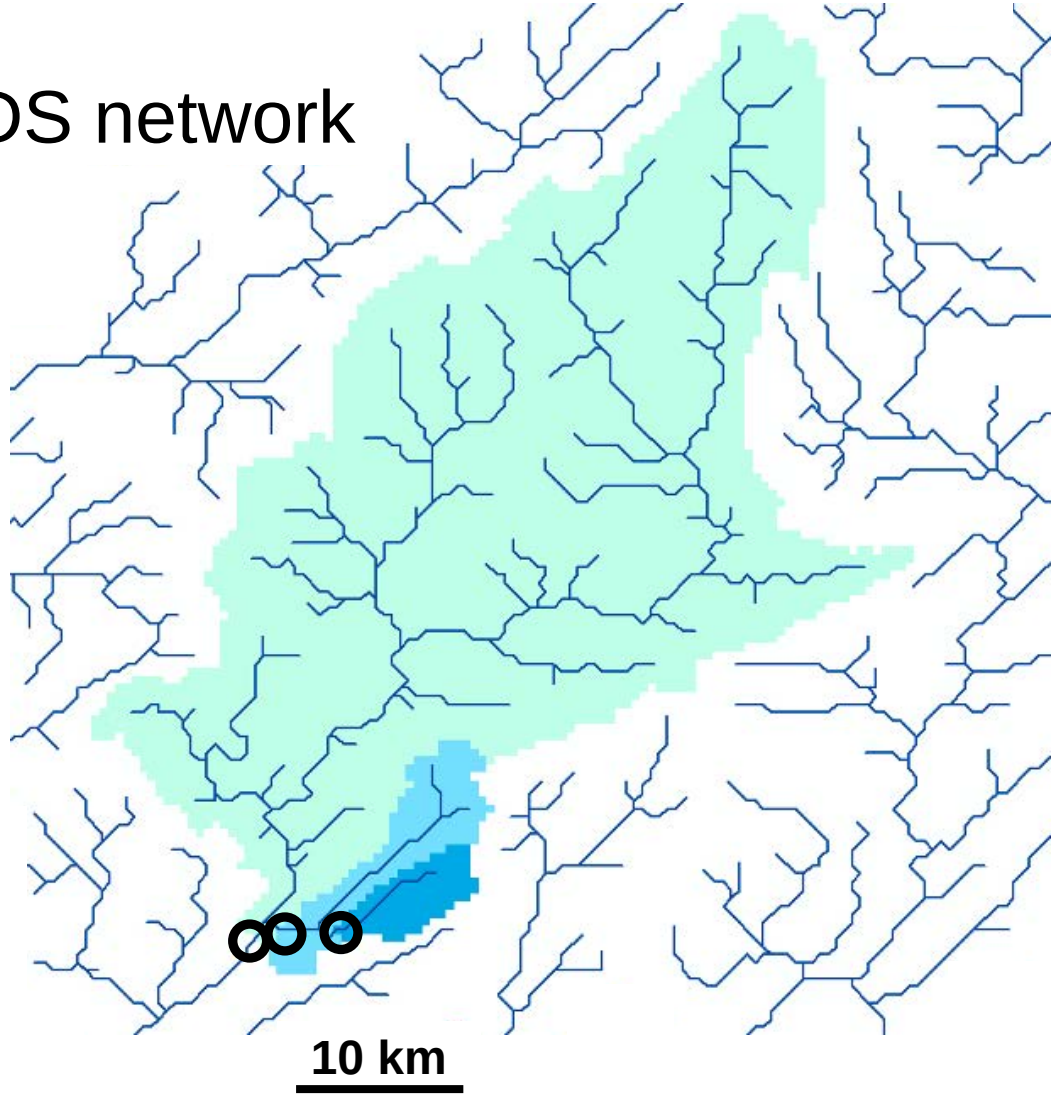
→ Land cover

→ Surface geology

→ Topology / network structure

- Extension to lakes & reservoirs of the Global Lakes and Wetlands Database

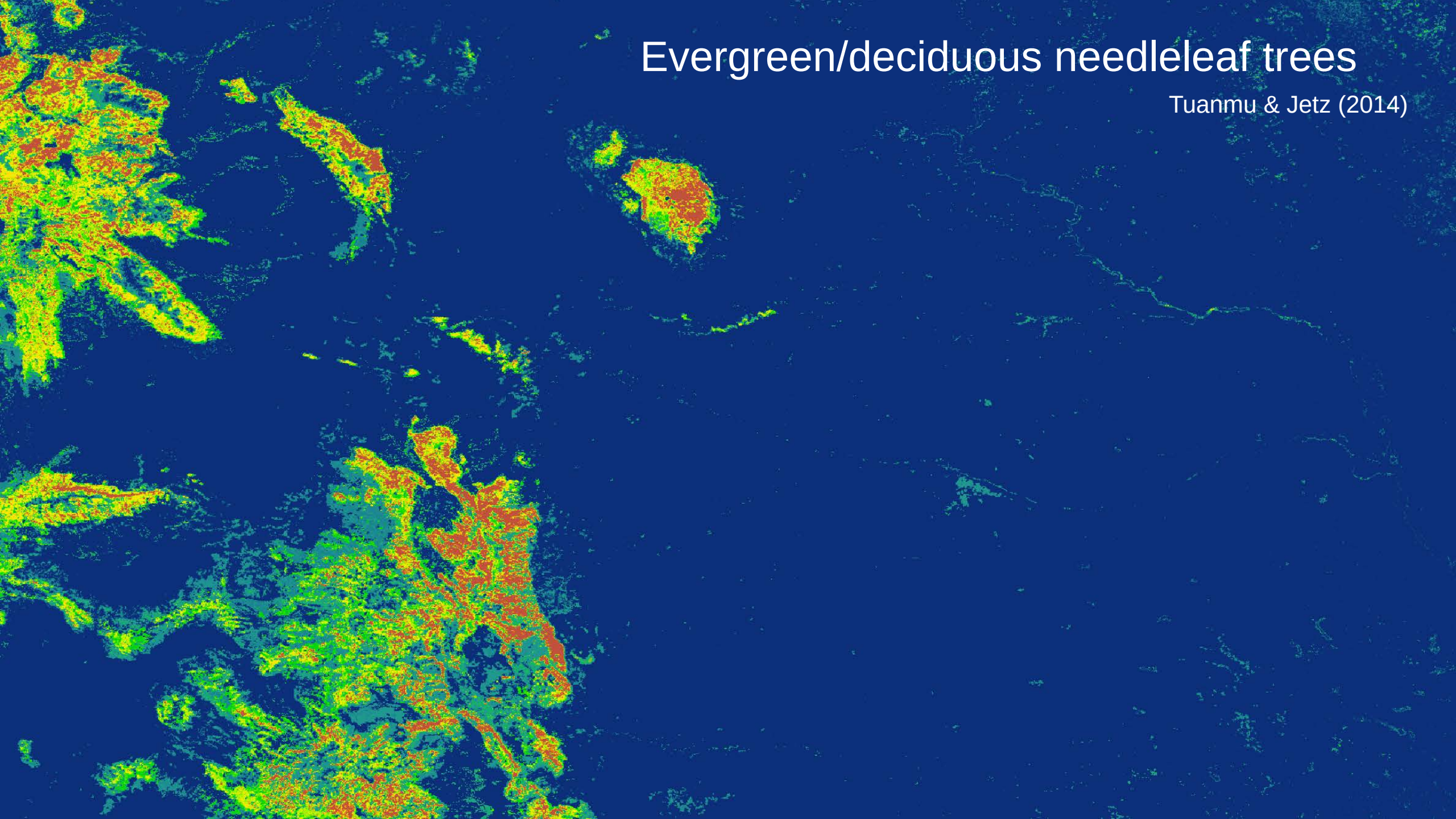
Lehner & Döll (2004)



Domisch et al. (in prep.)

Evergreen/deciduous needleleaf trees

Tuanmu & Jetz (2014)



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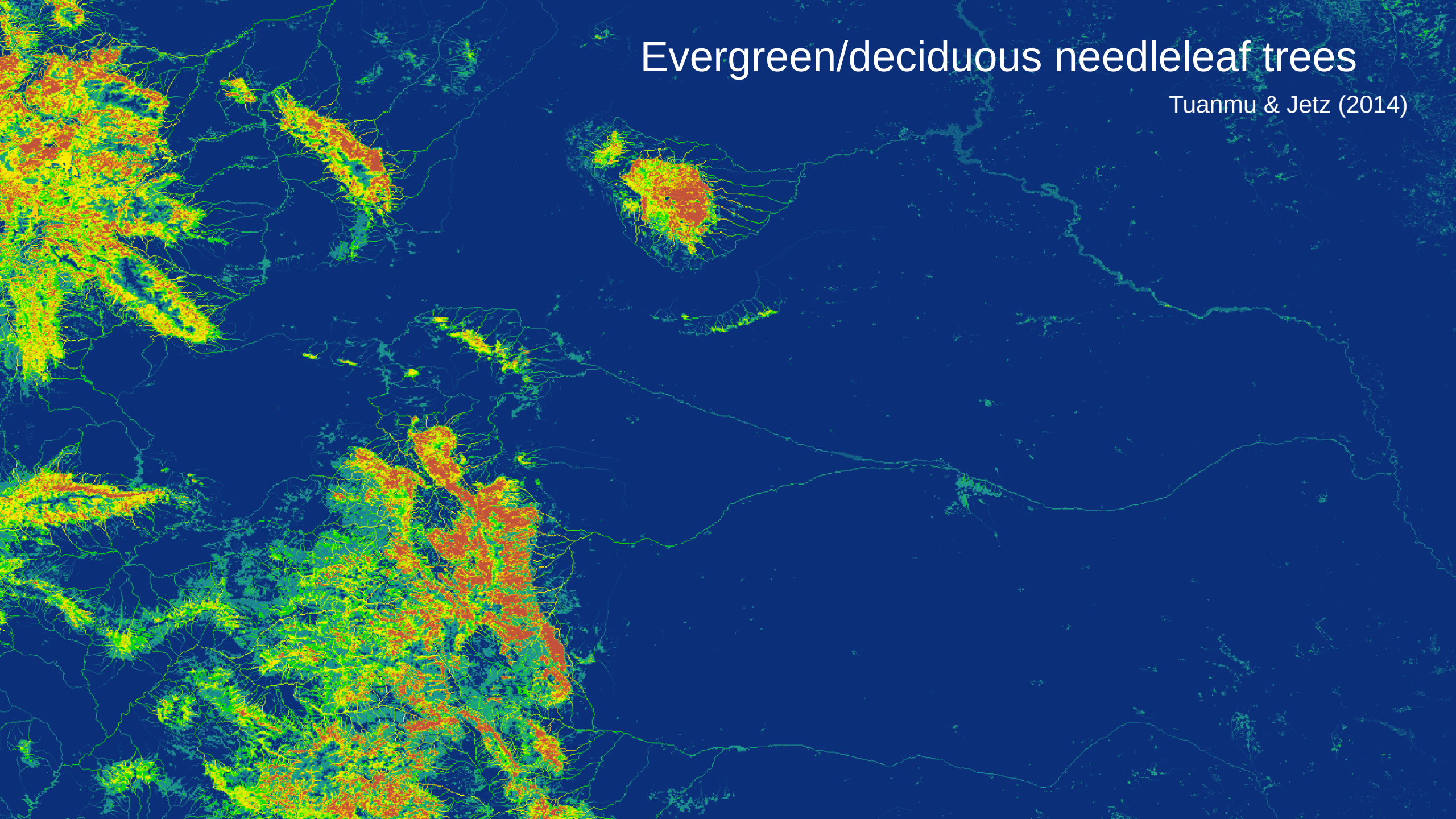
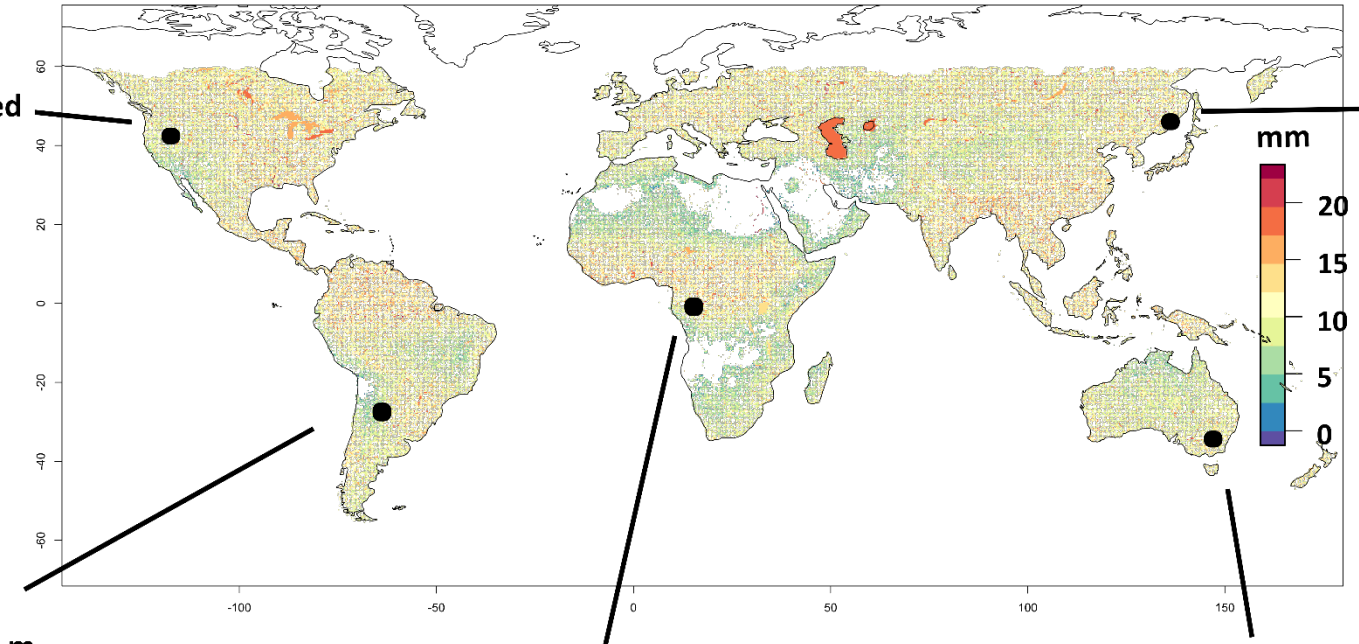
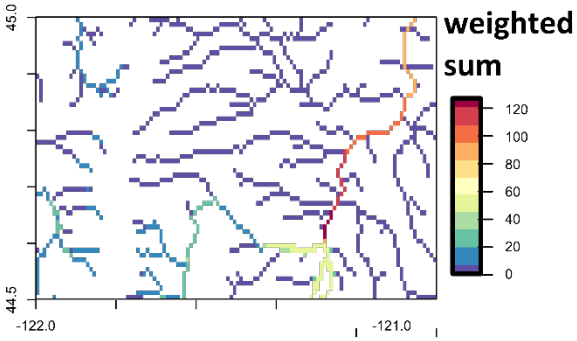


Near-global freshwater environmental predictors (1km)

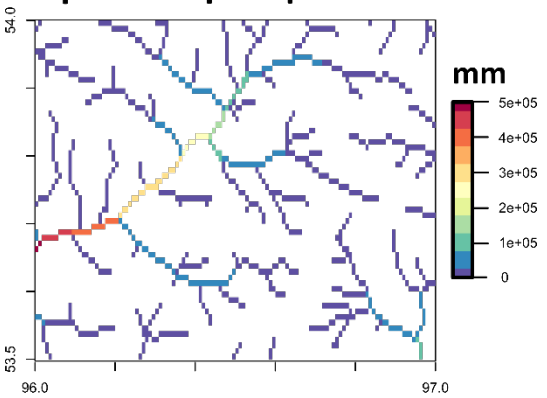
Sum of upstream precipitation in June (log)



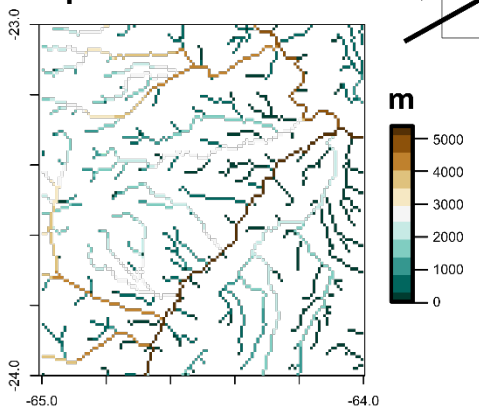
Upstream quarternary surface geology



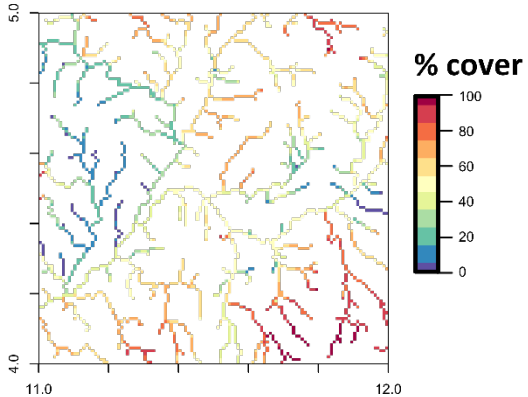
Annual sum of upstream precipitation



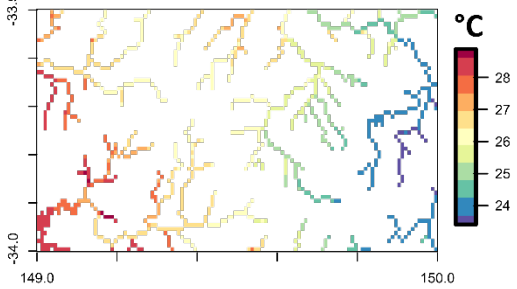
Upstream elevation



Upstream evergreen broadleaf trees



Annual upstream temperature range



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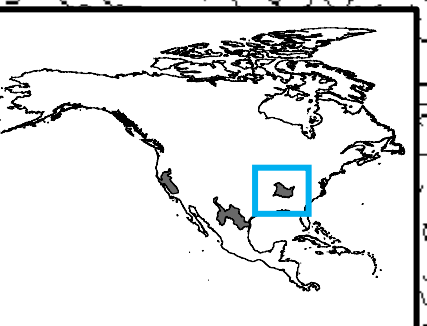
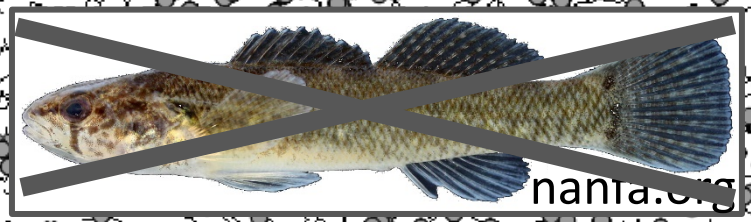
Gringed darter - presences



100 km

Gringed darter - absences

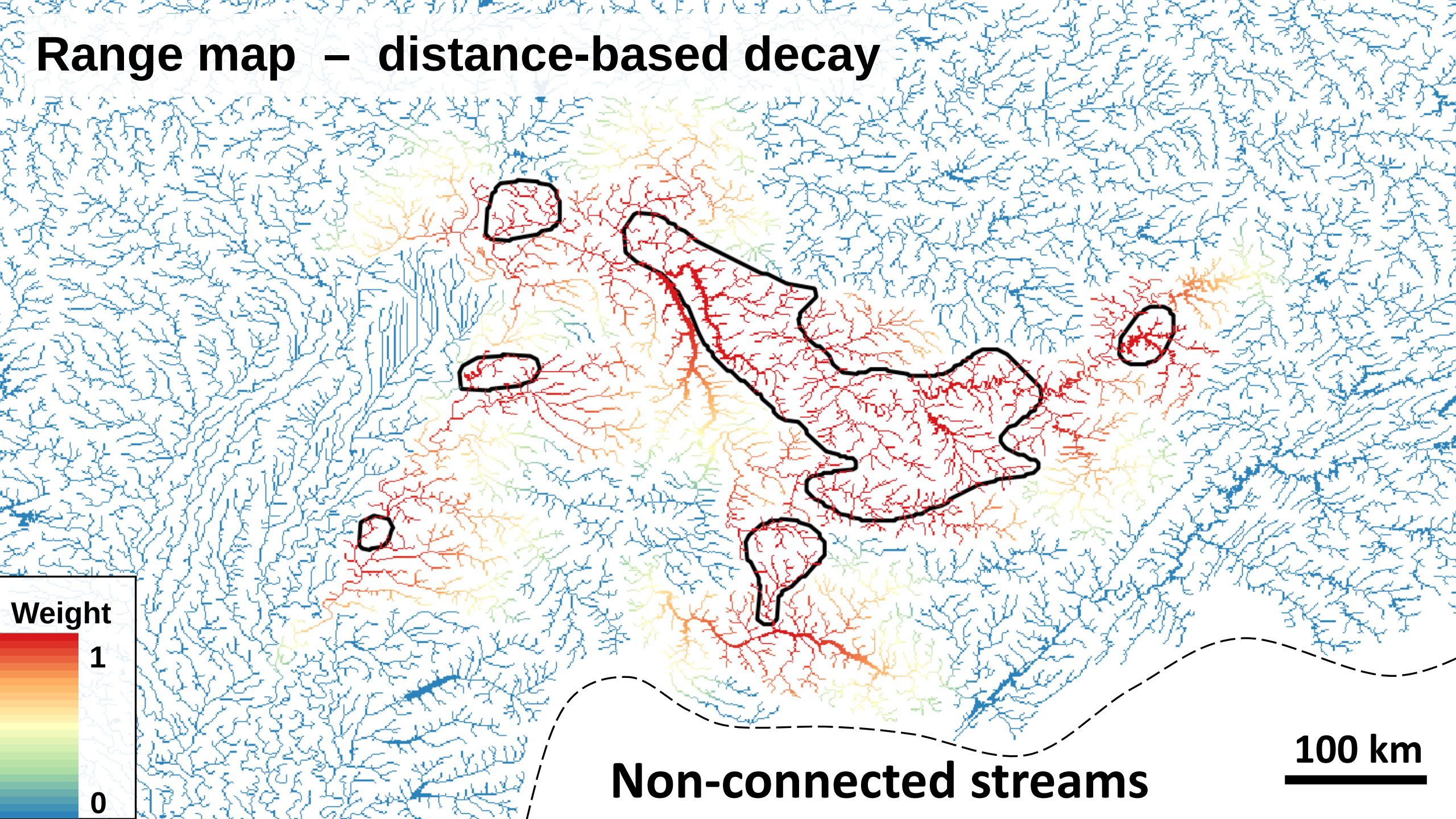


100 km

Gringed darter – expert range information

100 km

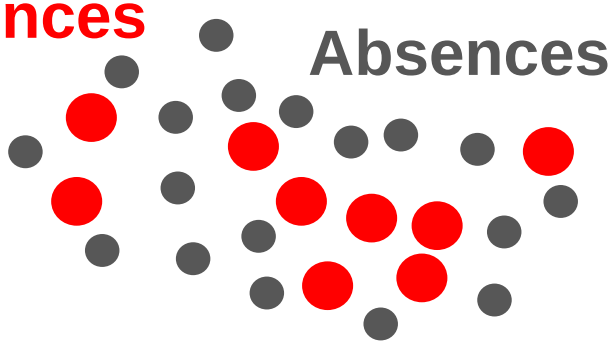
Range map – distance-based decay



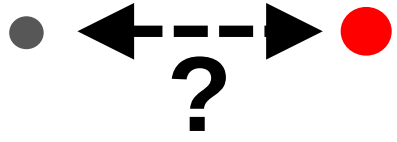
Point data

Presences

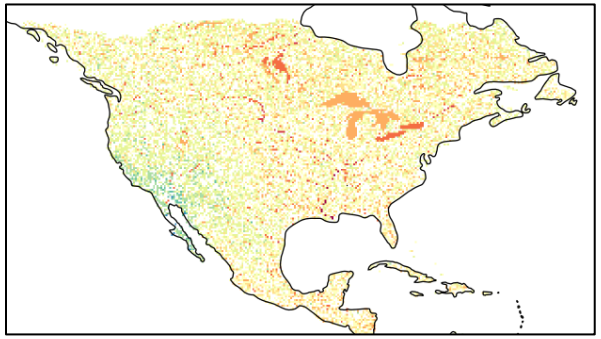
Absences



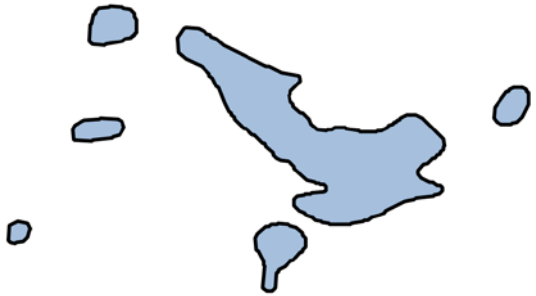
Imperfect detections (repeat visits)



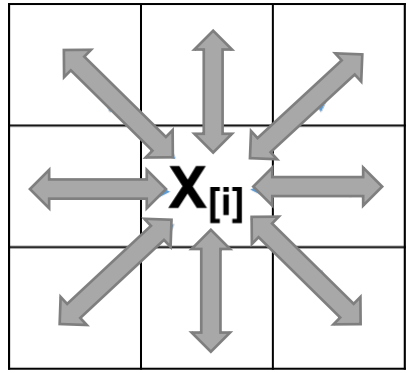
Range-wide predictors



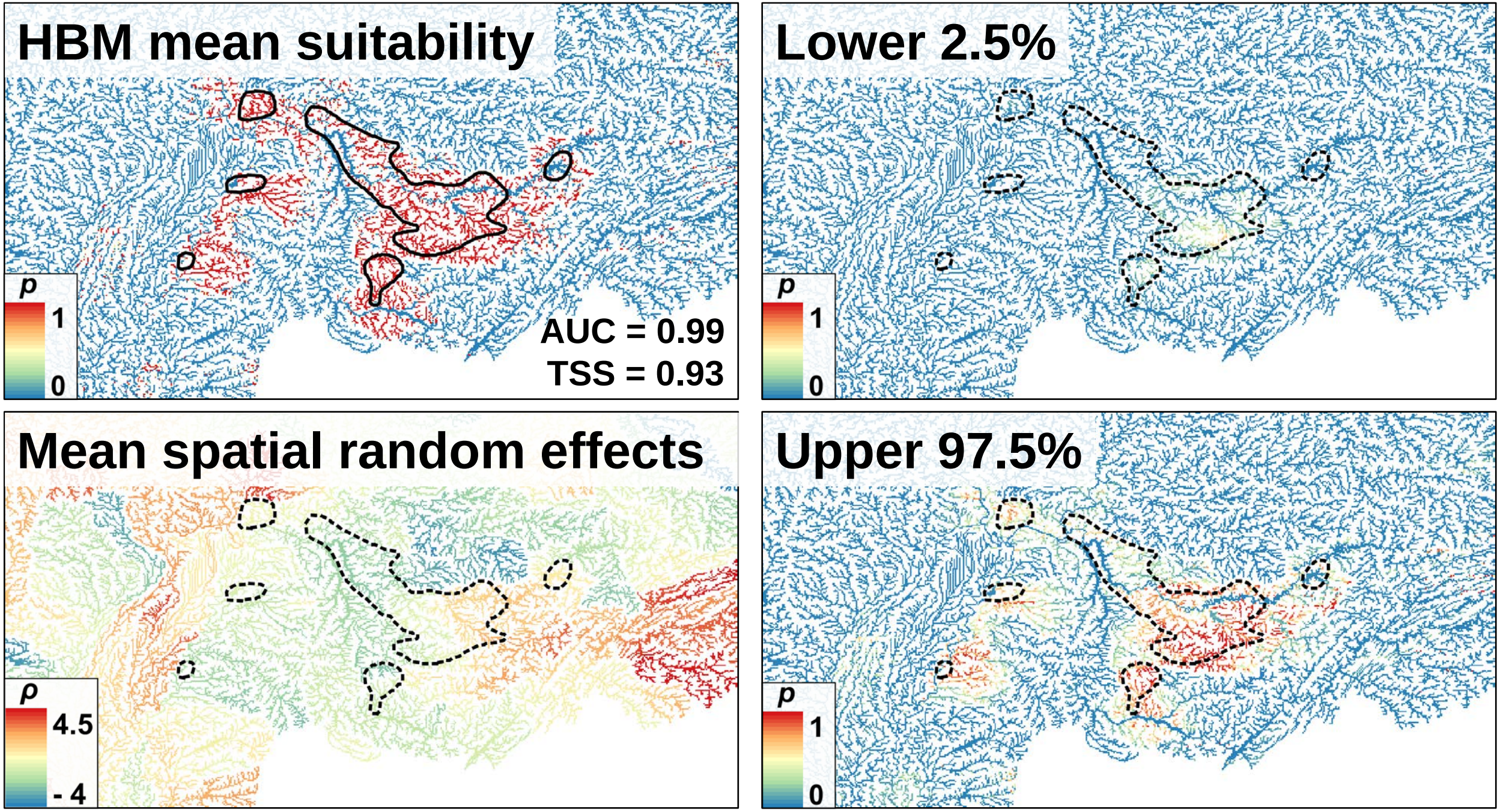
Expert range information



Spatial autocorrelation



Hierarchical Bayesian Model (hSDM in R)



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Outlook

- Large scale but fine-grain predictions
- Integration of disparate data
- Account for connectivity

Work in progress:

- Future IPCC climate projections
- River chemistry (N, P, ..)

Further challenges:

- Dispersal, dams/waterfalls…

Thank you!

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HydroSHEDS

Global Lakes and Wetlands Database

FishNet 2

StreamNet
FISH DATA FOR THE NORTHWEST

NATIONAL FISH HABITAT PARTNERSHIP

GBIF

MOL MAP OF LIFE

USGS BioData

DFG