Spatial modelling of freshwater species

Sami Domisch
Department of Ecology and Evolutionary Biology

Yale
Challenges in freshwater distribution modeling

- Spatial configuration and connectivity
  - Nestedness of the environment
  - High spatial autocorrelation
  - Lack of range-wide predictors
Challenges in freshwater distribution modeling

• Spatial configuration and connectivity
  → Nestedness of the environment
  → High spatial autocorrelation
  → Lack of range-wide predictors

• Heterogeneous species data
  → Point data
  → Imperfect detections
  → Expert range information
Developing freshwater predictors

• Watersheds along the 1km HydroSHEDS network
  → Topography
  → Climate
  → Land cover
  → Surface geology
  → Topology / network structure

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

Lehner et al. (2008)

Lehner & Döll (2004)
Evergreen/deciduous needleleaf trees

Tuanmu & Jetz (2014)
Evergreen/deciduous needleleaf trees

Tuanmu & Jetz (2014)
Near-global freshwater environmental predictors (1km)

Domisch et al. (in prep.)
Gringed darter - presences
Gringed darter - absences
Gringed darter – expert range information
Range map – distance-based decay

Non-connected streams
Point data

Presences
Absences

Imperfect detections (repeat visits)

Range-wide predictors

Expert range information

Spatial autocorrelation

Hierarchical Bayesian Model (hSDM in R)
HBM mean suitability

AUC = 0.99
TSS = 0.93

Mean spatial random effects

Lower 2.5%

Upper 97.5%

Domisch et al. (in prep.)
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!

sami.domisch@yale.edu

Walter Jetz
Adam Wilson
Giuseppe Amatulli
Steve Weston

Global Lakes and Wetlands Database

Yale Climate and Energy Institute - YCEI