Spatially explicit population modelling

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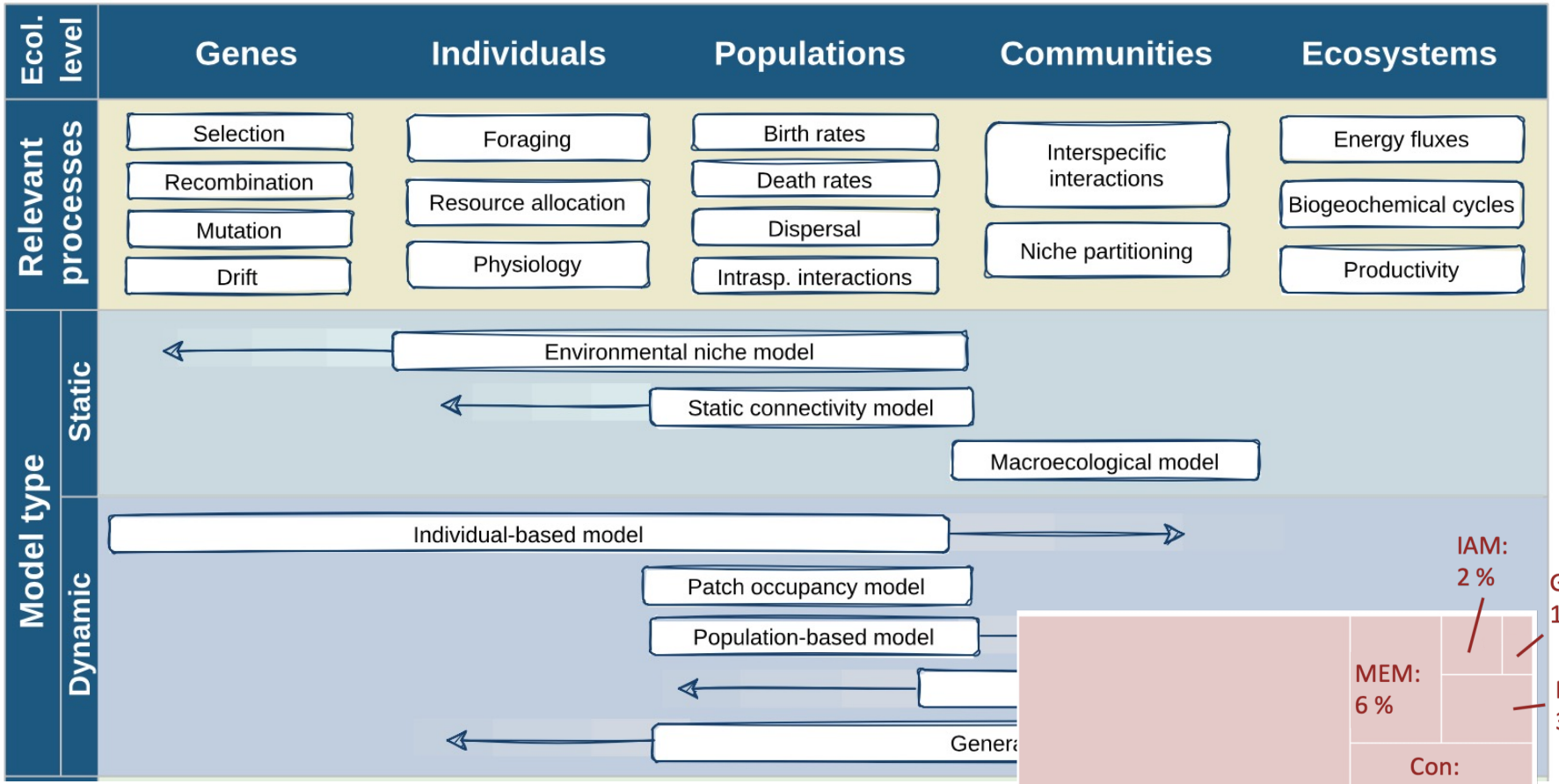
Pictures from www.undekade-biologischevielfalt.de

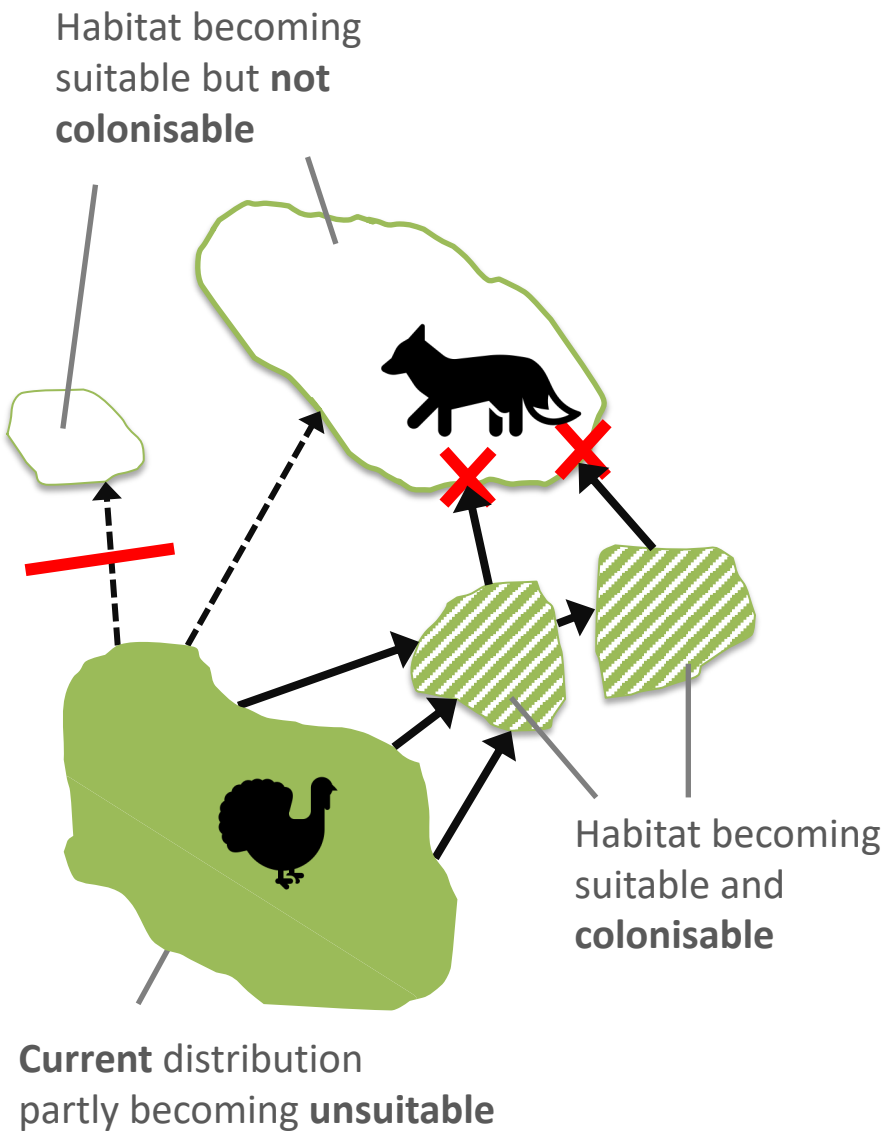
Spatially explicit models in conservation



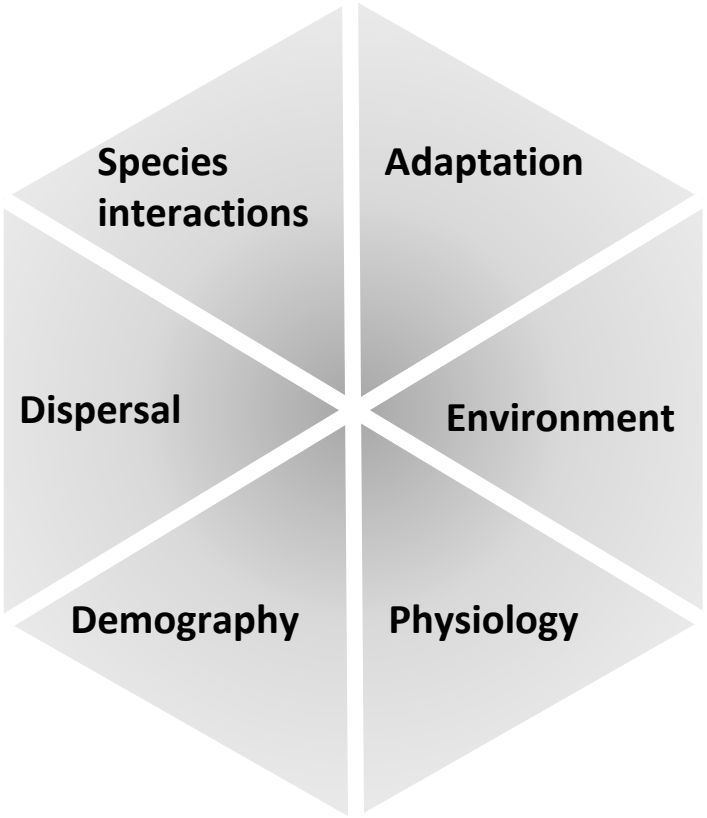
Static and correlative niche models over-represented in literature …

Zurell et al. (2021) Ecography. DOI: 10.1111/ecog.05787.

Species respond dynamically to global change



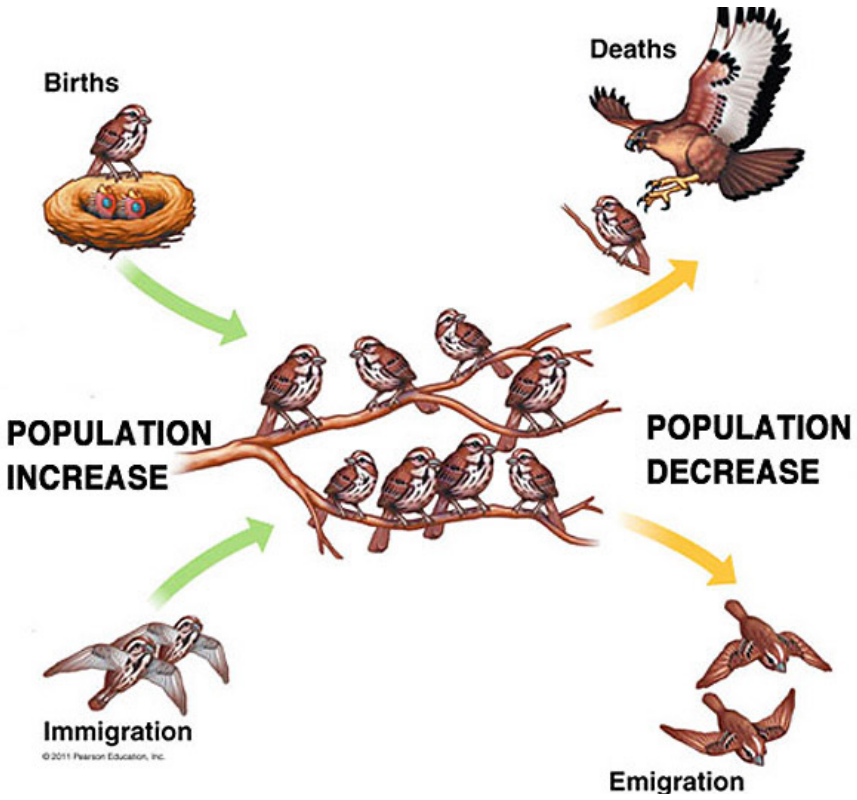
Six key mechanisms for predicting biodiversity response:



Ferrier et al. Eds (2016) IPBES.
Urban et al. (2016) Science 353: aad8466.

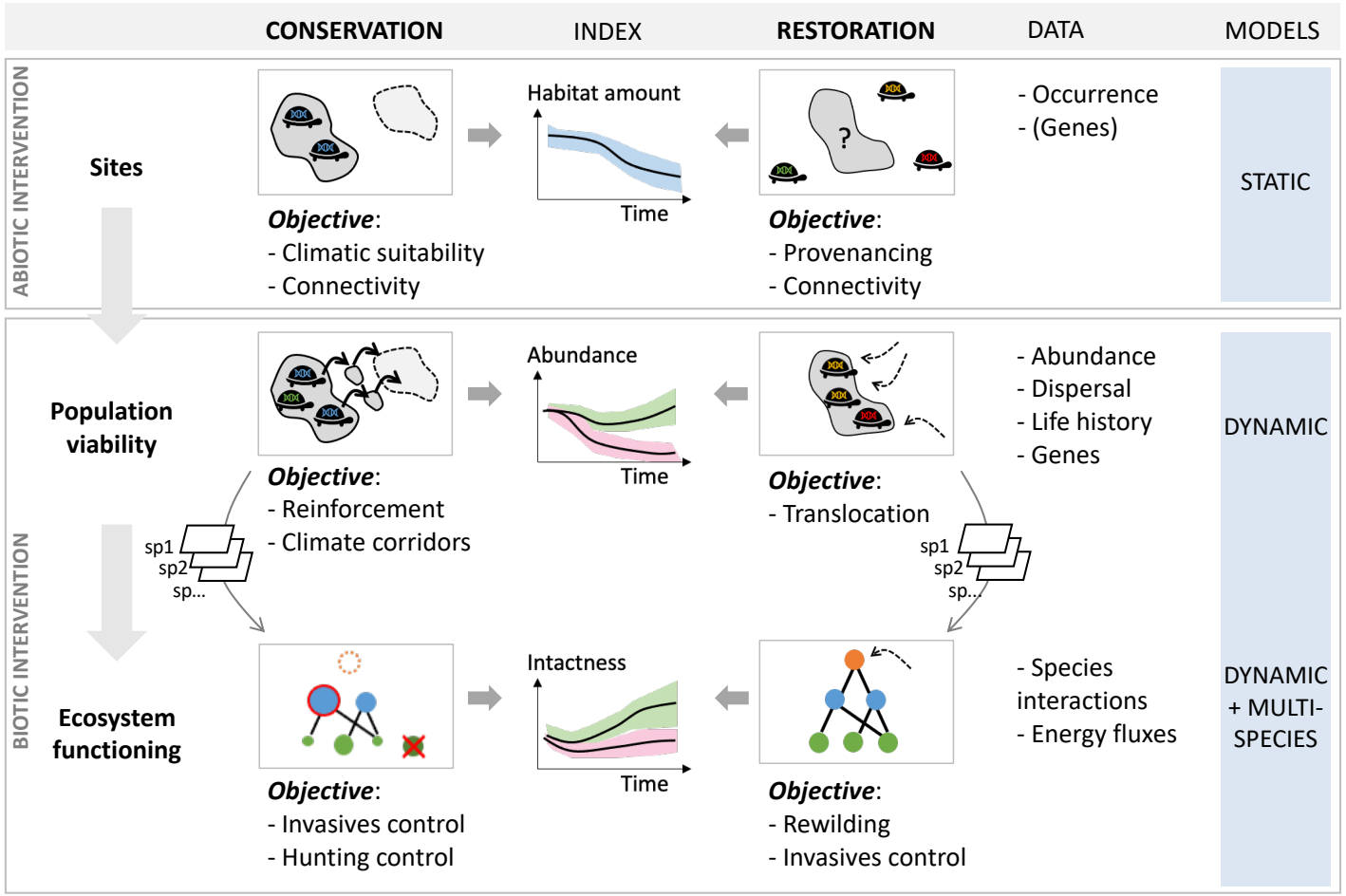
Spatially explicit population models

- Provide a more process-explicit understanding, e.g.:
  - Which factors determine population dynamics and range margins?
  - How will fragmentation affect gene flow between populations?
  - How fast can species recover from population crashes or (re)colonise landscapes?
  - …



Spatially explicit population models

- Predict viability of populations, communities, and ecosystems
- Define temporally explicit conservation & restoration objectives

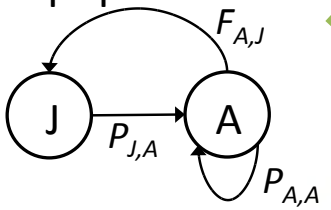


Adapted from Zurell et al. (2021) Ecography. DOI: 10.1111/ecog.05787.

Spatially explicit population models

- Simulating local population dynamics and dispersal

Local population dynamics described by population model, e.g. logistic growth or matrix population model



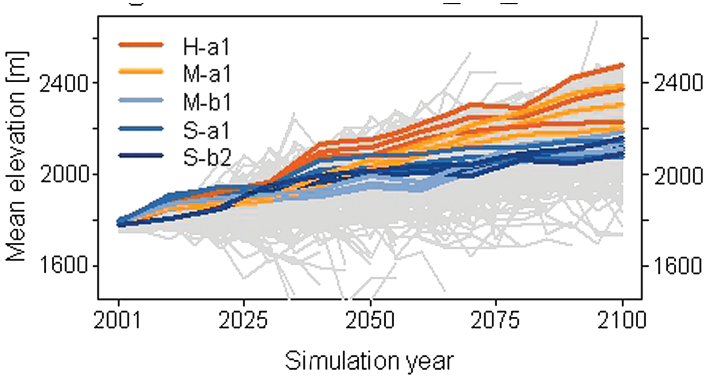
Dispersal described by dispersal kernel or movement simulator

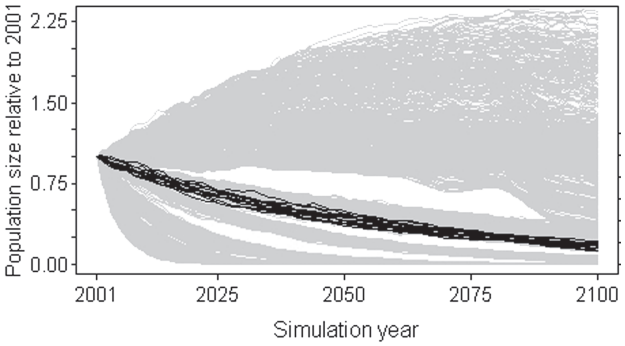
Landscape can be described as patch-matrix landscapes, patch types of different quality, of grid cells of different quality

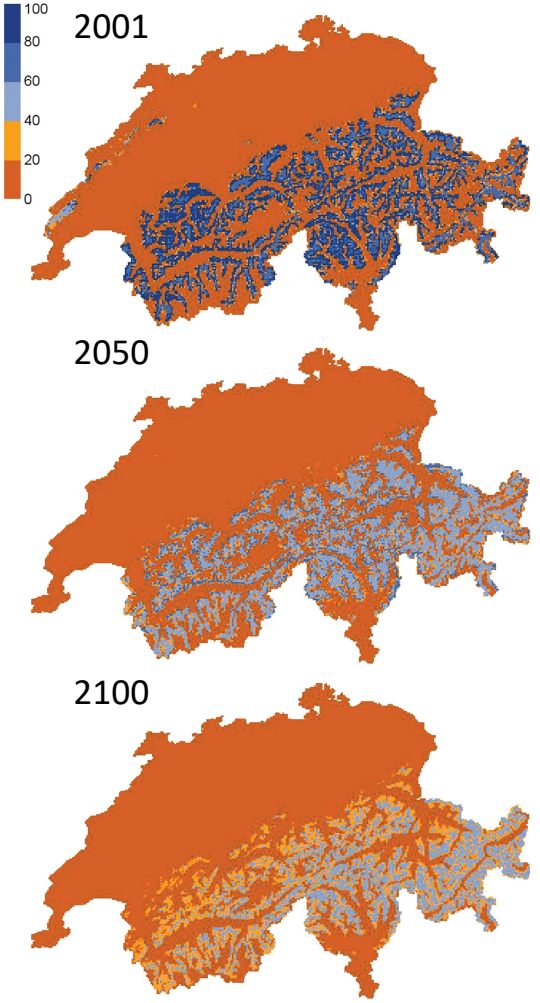
Spatially explicit population models

Example: black grouse in Switzerland

- Stage-structured model, individual-based movement decisions





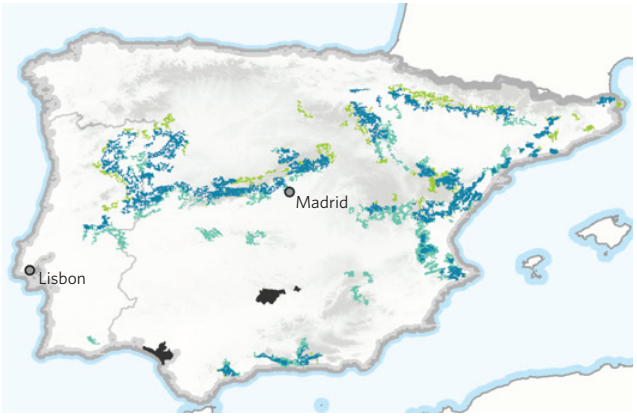


Zurell et al. (2012) Ecography 35: 590-603.

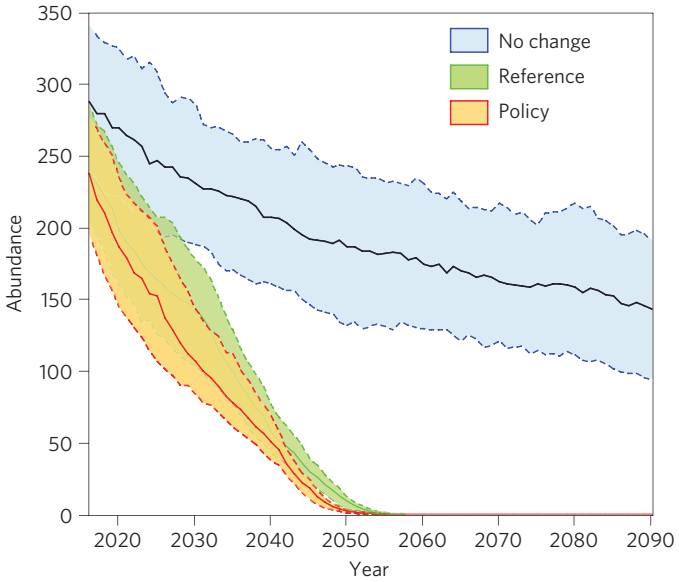
Spatially explicit population models

Example: Iberian lynx

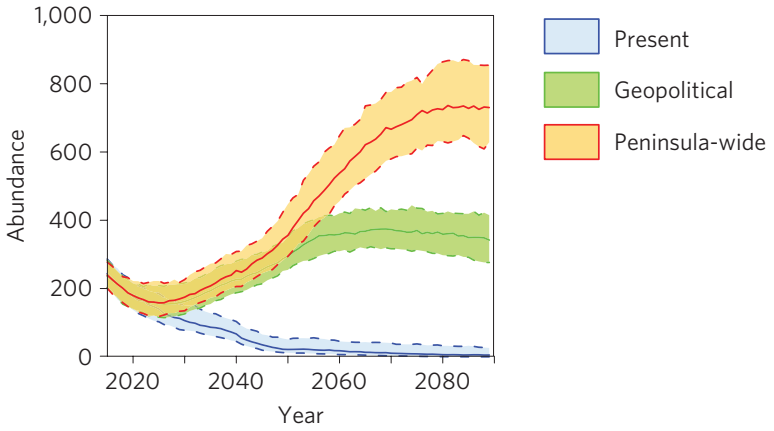
- Stage-structured model, dispersal kernel



Climate change:



Management intervention:

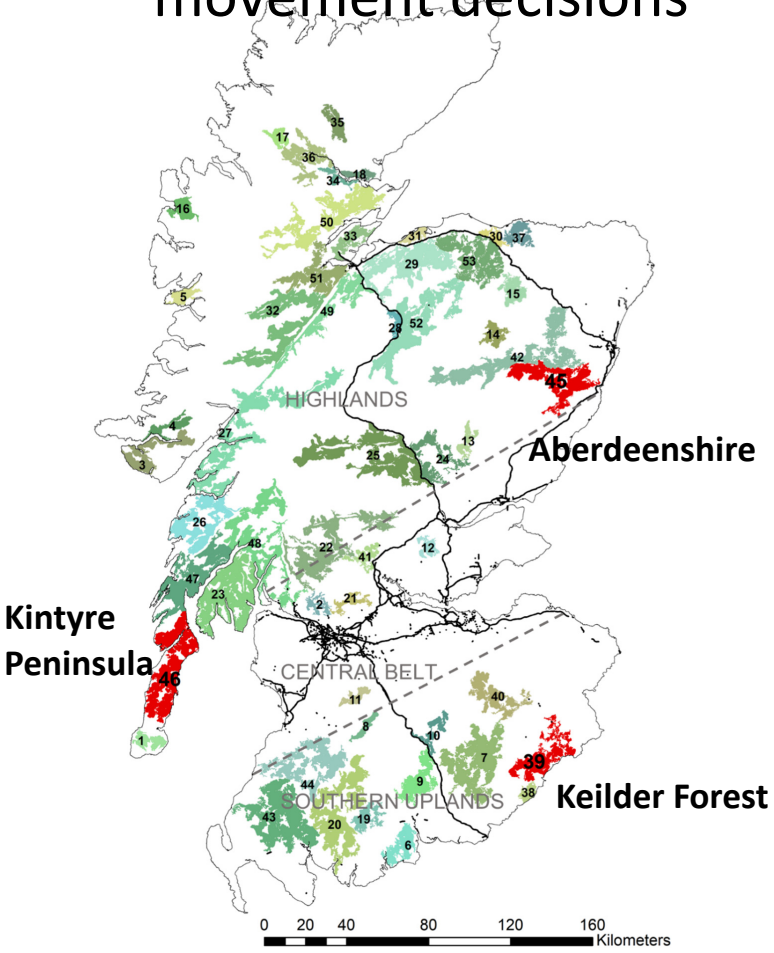


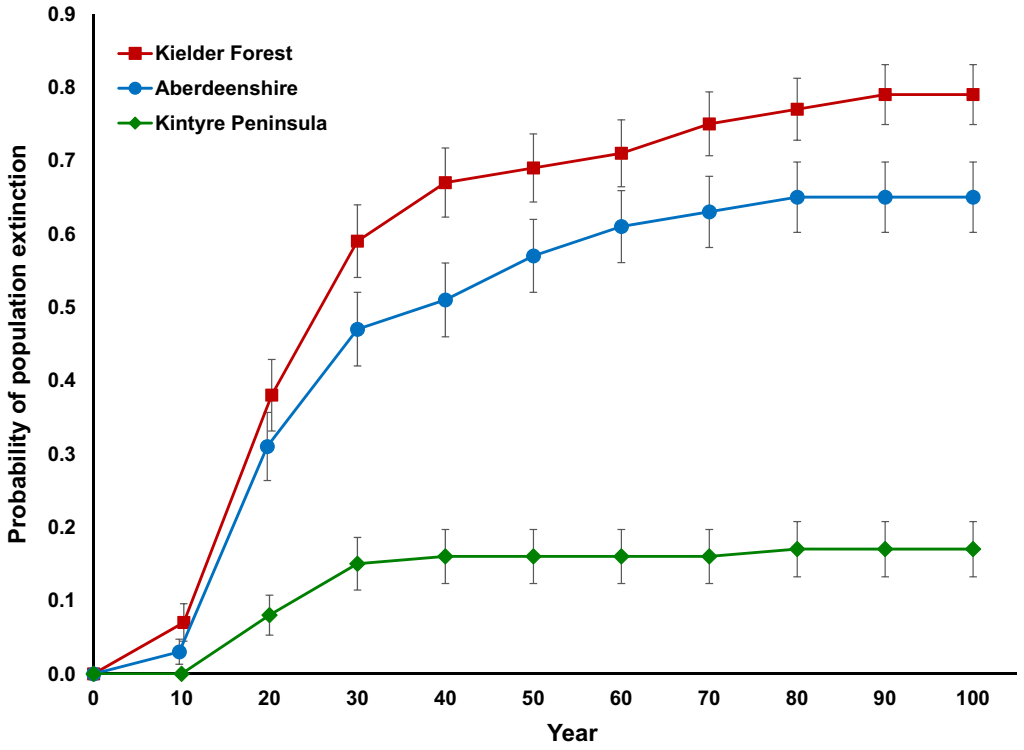
Fordham et al. (2013) Nature Clim Ch 3: 899-903.

Spatially explicit population models

Example: Eurasian lynx, reintroduction Scotland

- Stage-structured model, individual-based movement decisions



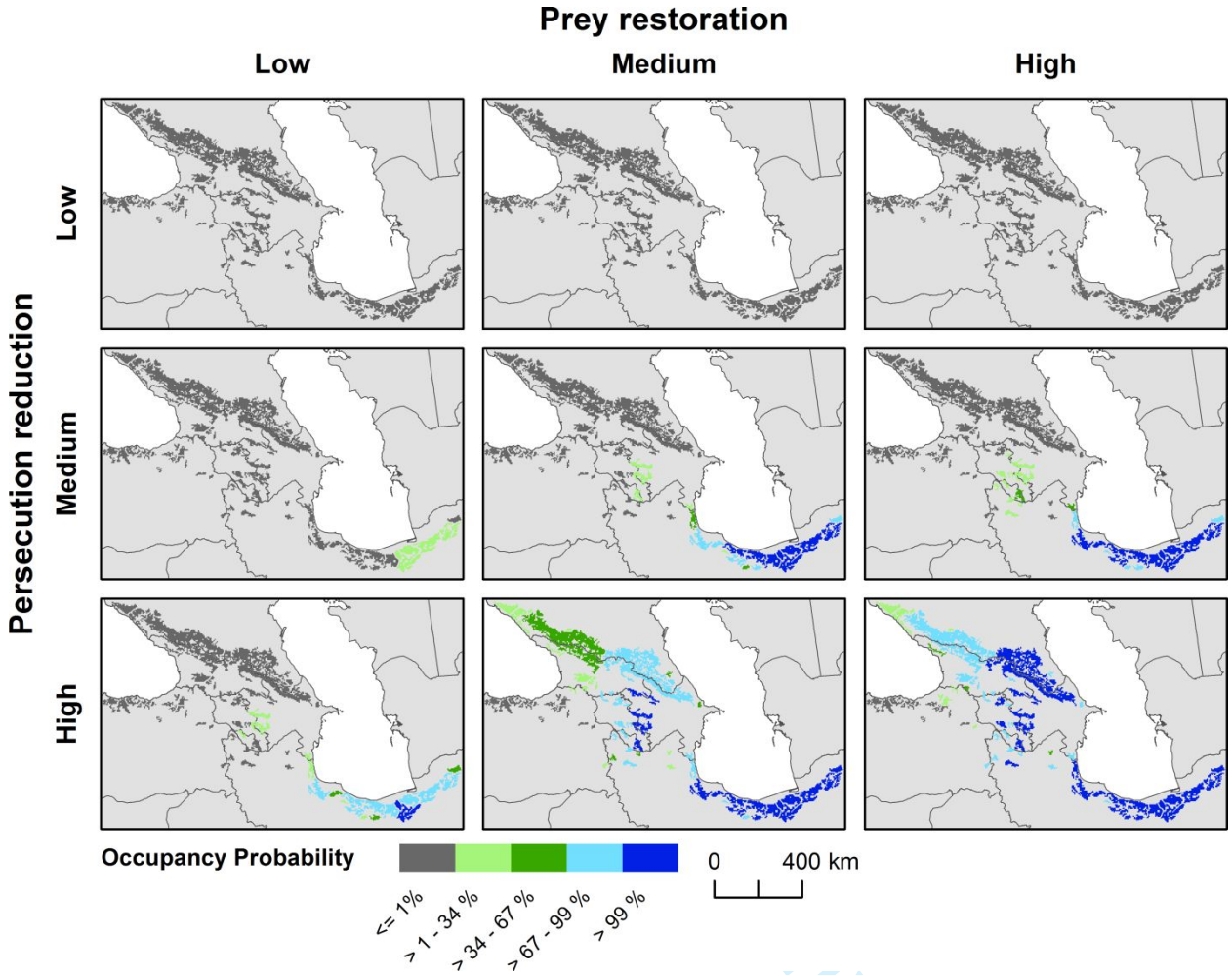


Ovenden et al. (2019) Biol Cons 234: 140-153.

Spatially explicit population models

Example: Caucasian leopard

- Stage-structured model, individual-based movement decisions

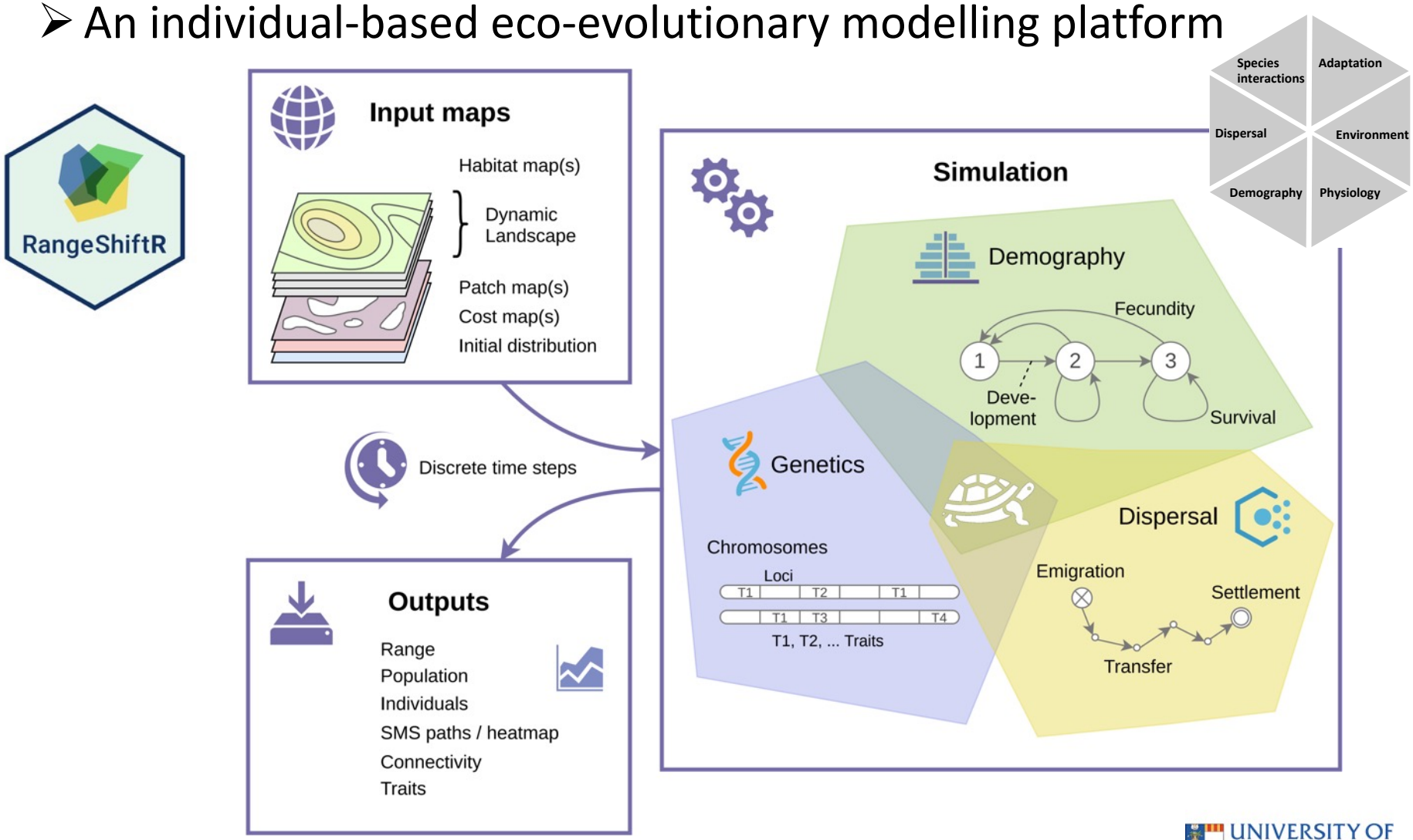


Bleyhl et al. (2021) Ecol Appl.

RangeShiftR

Spatially explicit population models

➢ An individual-based eco-evolutionary modelling platform



Malchow et al. (2021) Ecography. DOI: 10.1111/ecog.05689 .
Building on Bocedi et al. (2014) Methods Ecol Evol 5: 388-396. & Bocedi et al. (2021) Ecography. DOI: 10.1111/ecog.05687.

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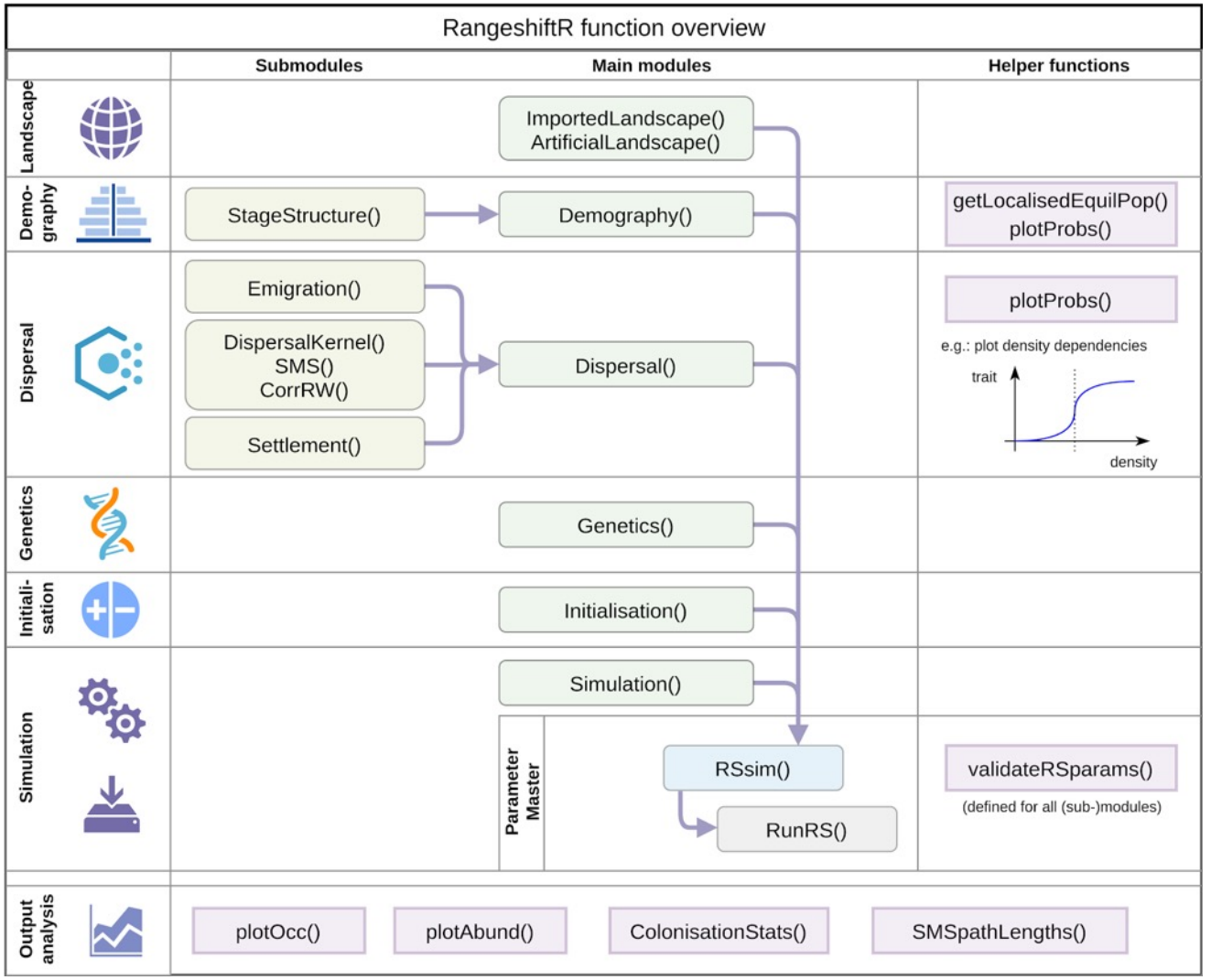

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Thank you for your interest

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