Modelling the evolution of movement strategies in fluctuating landscapes

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What are we modelling and why?

1. Animal movement is often consistent across time, even though such movement types may be non-optimal in some situations;
2. The evolution of movement is challenging to study in real-world systems: spatially explicit agent-based models (ABM) are a solution;
3. Mechanistic models of intermediate complexity allow many agents in fluctuating landscapes to choose their movement at each timestep;
4. Replication over ecological 'seasons' enables the study of the evolution of movement types in different regimes of spatio-temporal change.

Fluctuating landscapes

Spatial heterogeneity

Infinite, continuous space landscape with varying range of ***spatial autocorrelation*** implemented as static Perlin noise

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Fig. 1. 4-panel figure of 2 Perlin noise regimes and respective spatial autocorrelation plots

Temporal heterogeneity

Temporal change implemented as dynamic Perlin noise

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Fig. 2. 4-panel figure of 2 Perlin noise regimes with respective temporal autocorrelation plots

Moving agents

Agents use an Artificial Neural Network to process the value of ***local resources*** and choose their next ***step-size*** and ***movement angle***

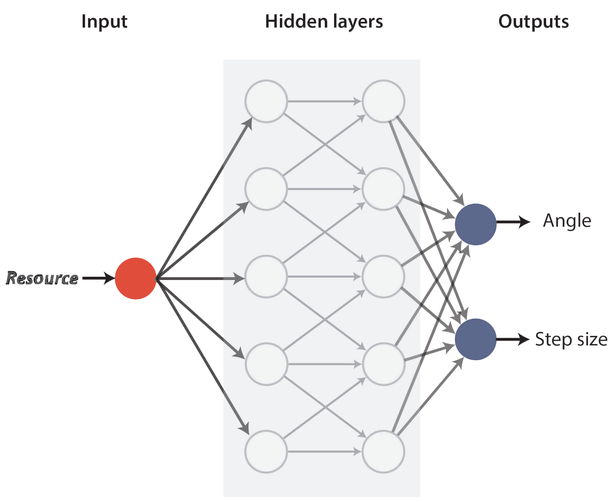

Fig. 3. Structure of the artificial neural network used to process input

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Fig. 4. Figure of scheduling schematic

Fig. 5. Waders such as red knots can only sample buried resources at their own position on intertidal mudflats, and inspire our model.

Expected outcomes

Movement types

Movement types *should* evolve when spatial predictability is low, but environmental change occurs relatively slowly

Fig. 6. Figure from Botero et al. (2015) showing axes of spatial predictability and timescale of change and region of expected consistency

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