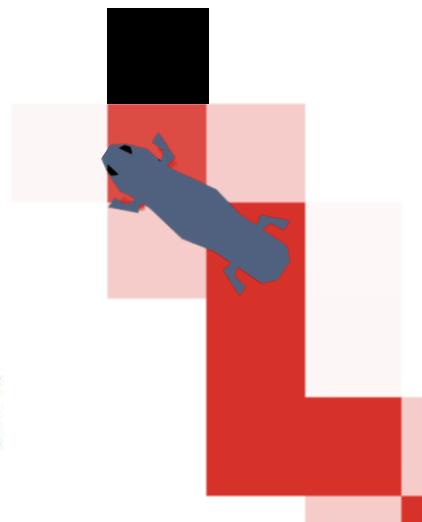
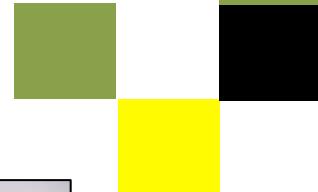


Hot hungry and tired IBMs of animal dispersal using energetics and climates

Matt Malishev



Climate and Metabolic
Ecology Lab (CAMEL)

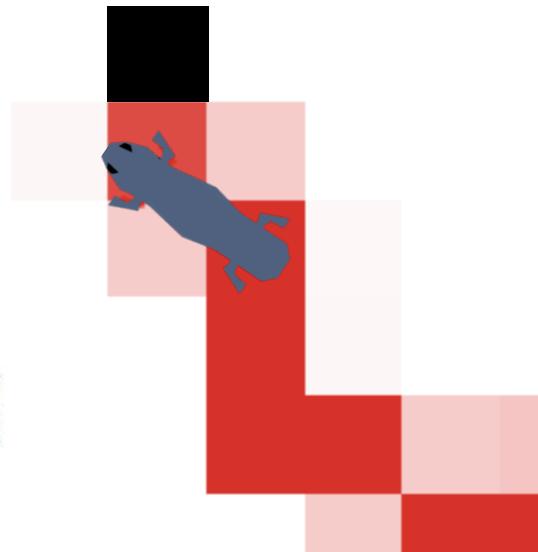
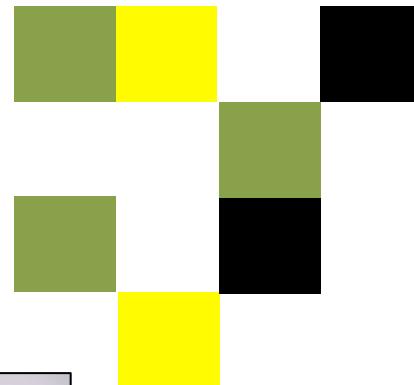


Hot, hungry, and tired: IBMs of animal dispersal using energetics and climates

Matt Malishev

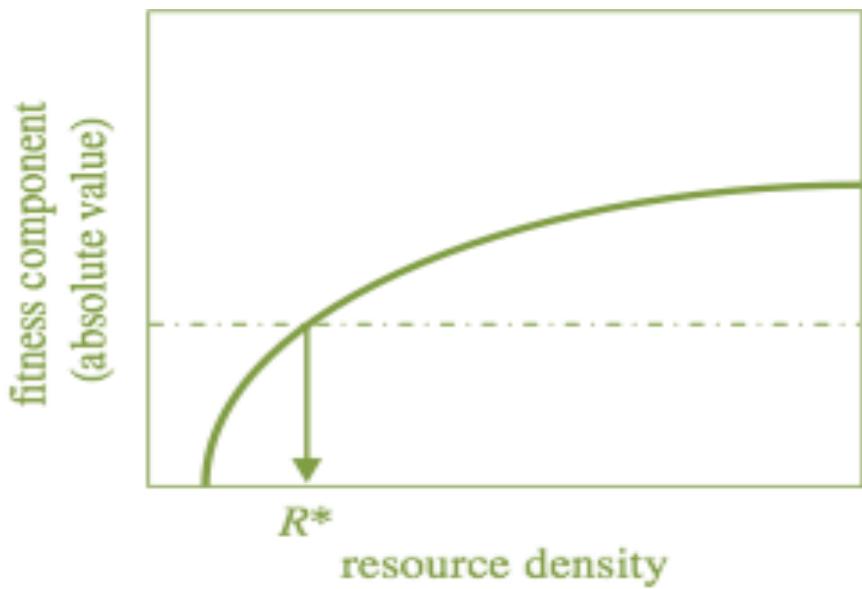


Climate and Metabolic
Ecology Lab (CAMEL)



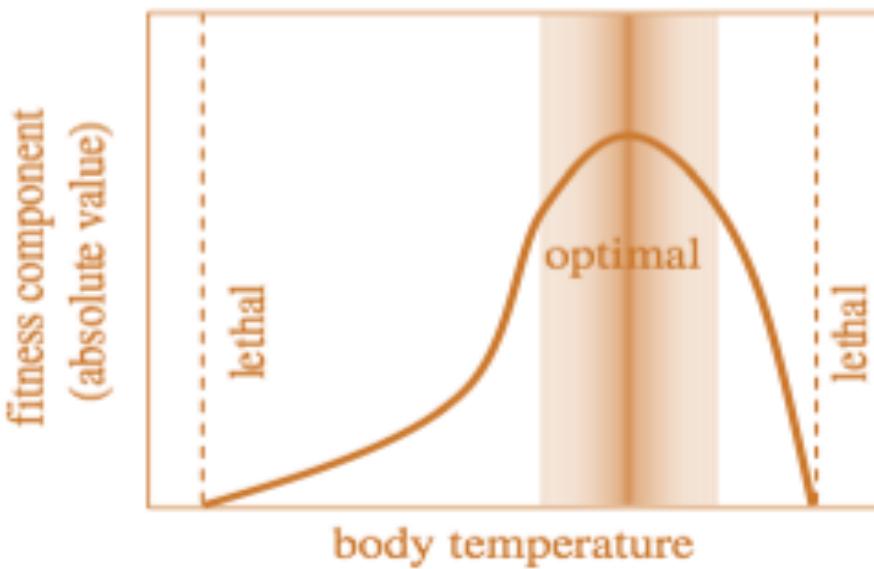
The problem

Resource niche

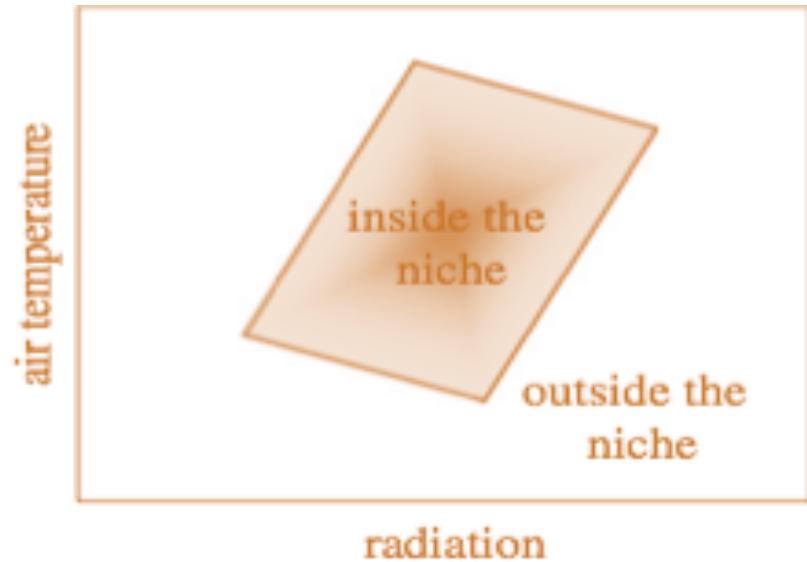


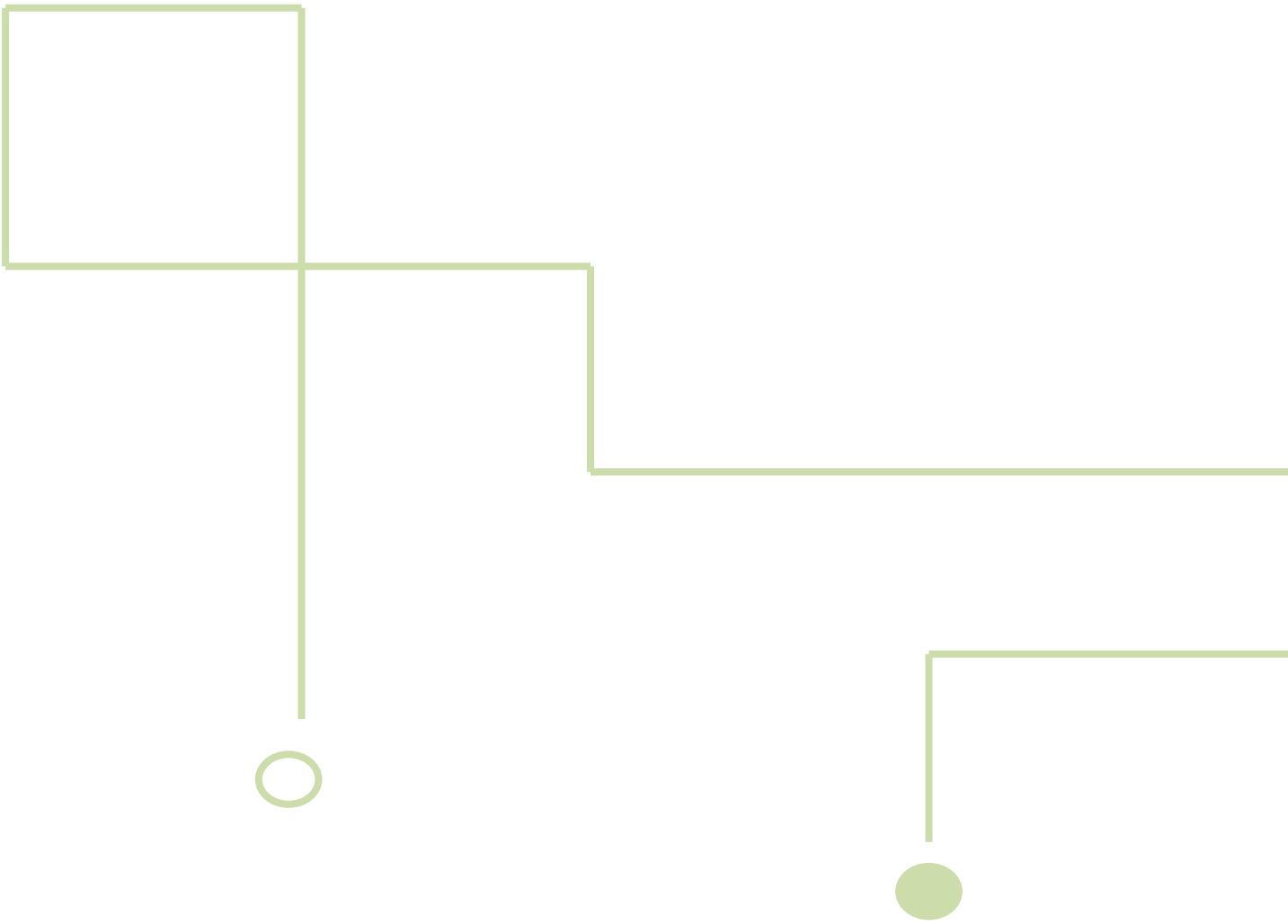
The problem

Resource niche

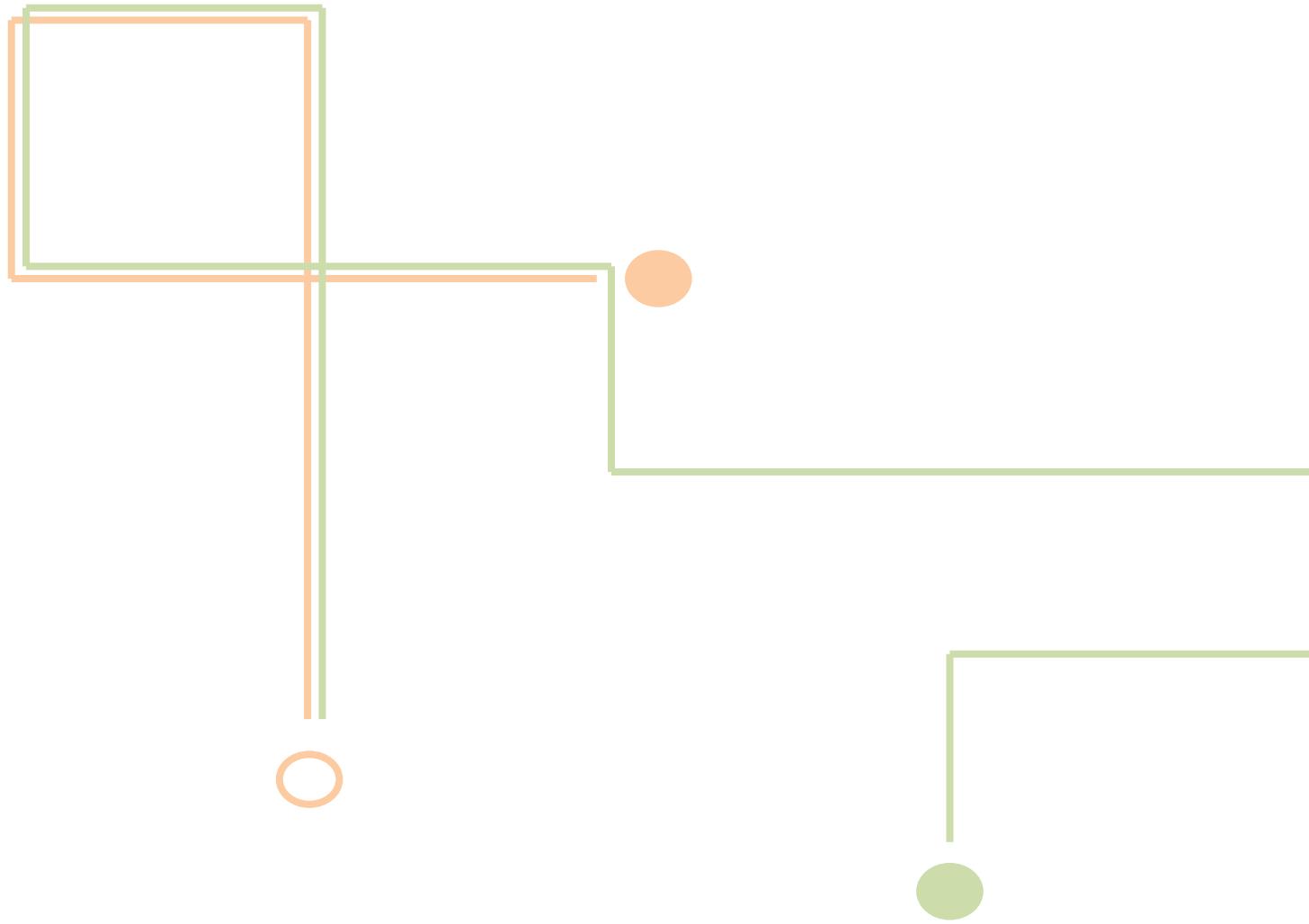


Thermal niche

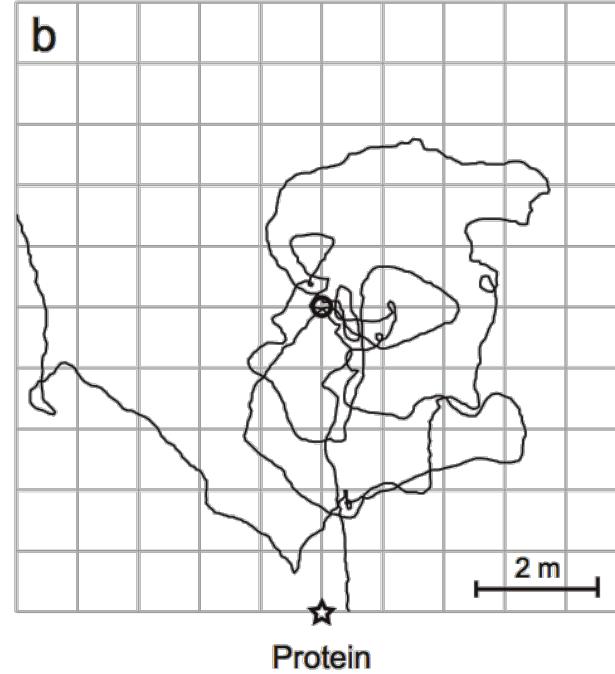
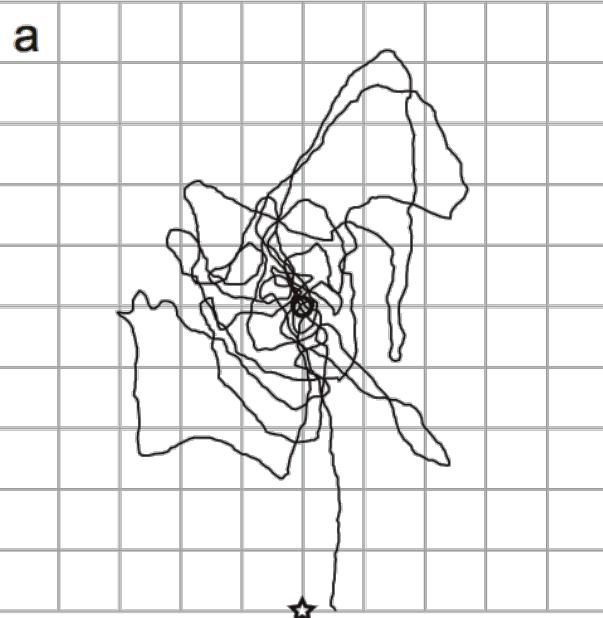


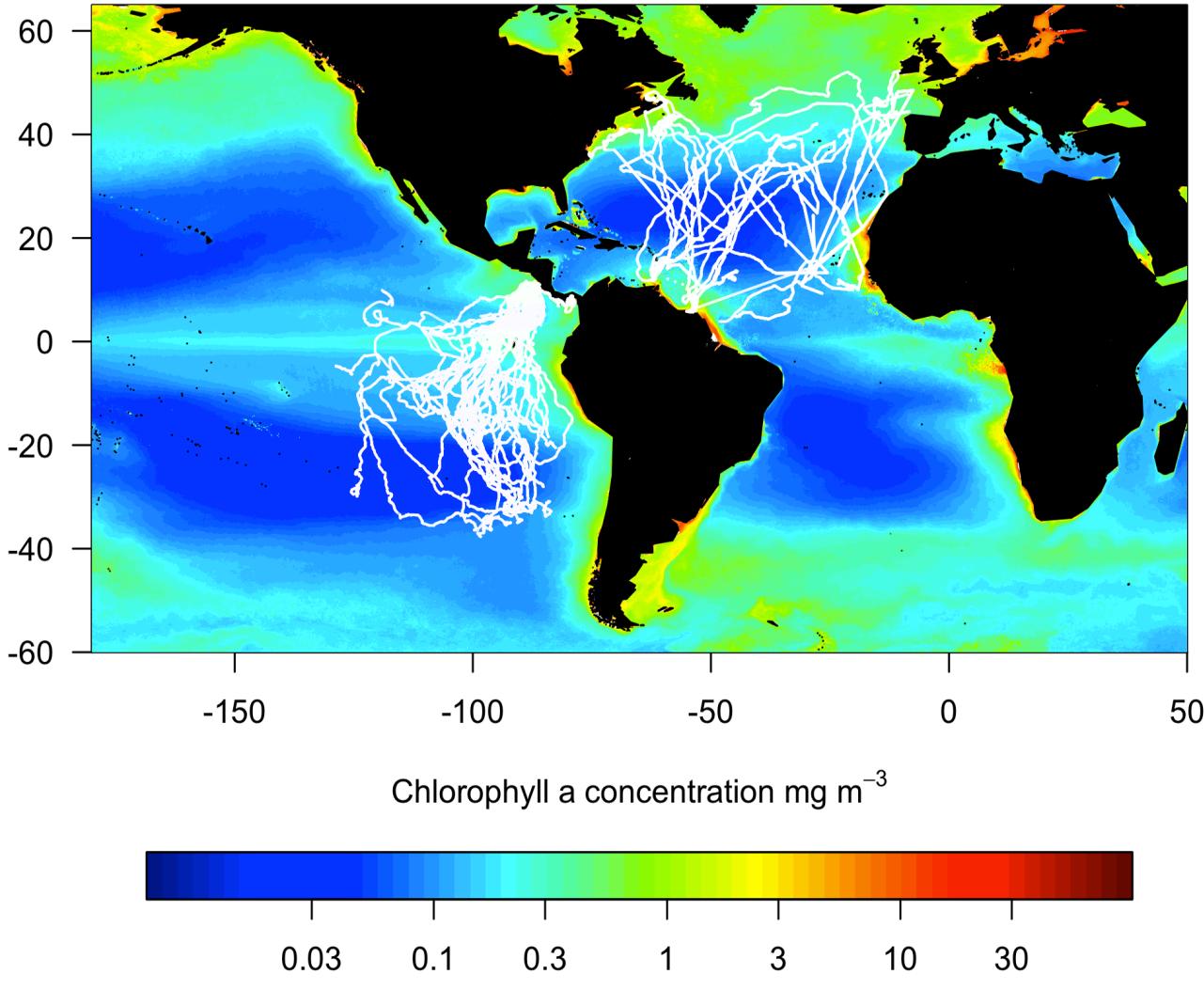


@darwinanddavis



@darwinanddavis





The approach

Mechanistic, *i*-state dynamics

Energetics-driven
energy and mass balance
thermodynamics

Activity budget

Spatially explicit

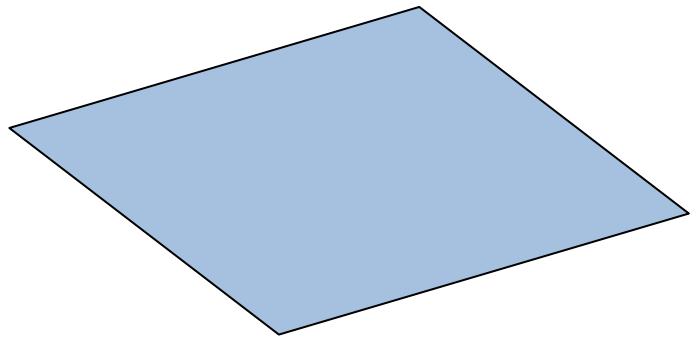
Behaviour-driven



The models

Habitat layer

Food
Shade
Burrows



The models

Climate layers

Solar and IR radiation

Air and soil temp

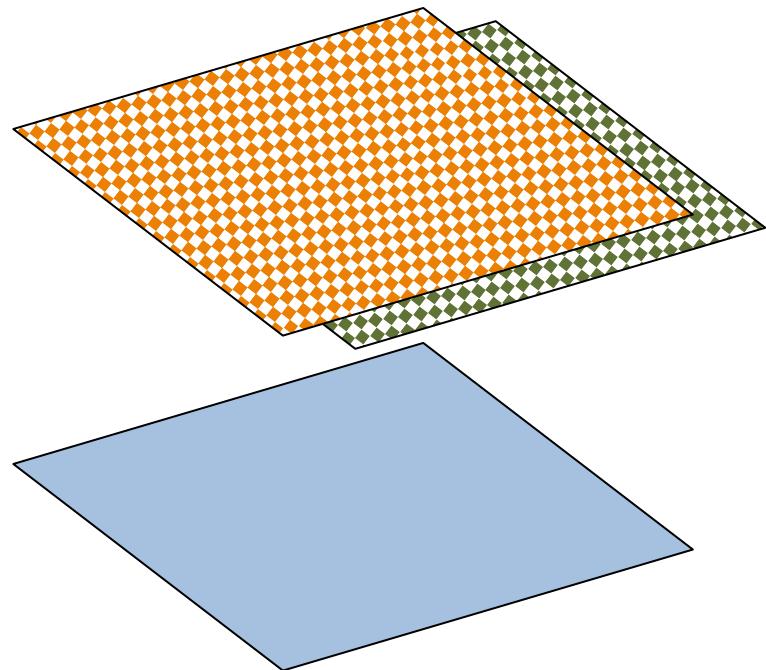
Wind speed

Habitat layer

Food

Shade

Burrows



The models

Animal layers

- Movement decisions
- Energy and mass budget

Transient heat budget

Climate layers

Solar and IR radiation

Air and soil temp

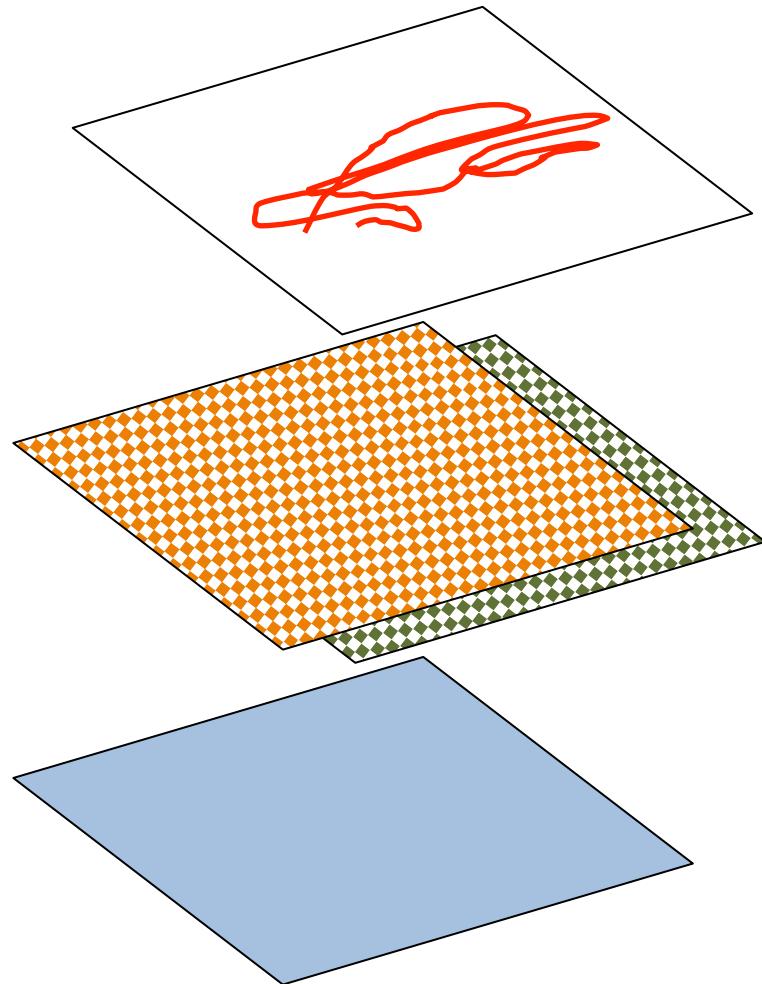
Wind speed

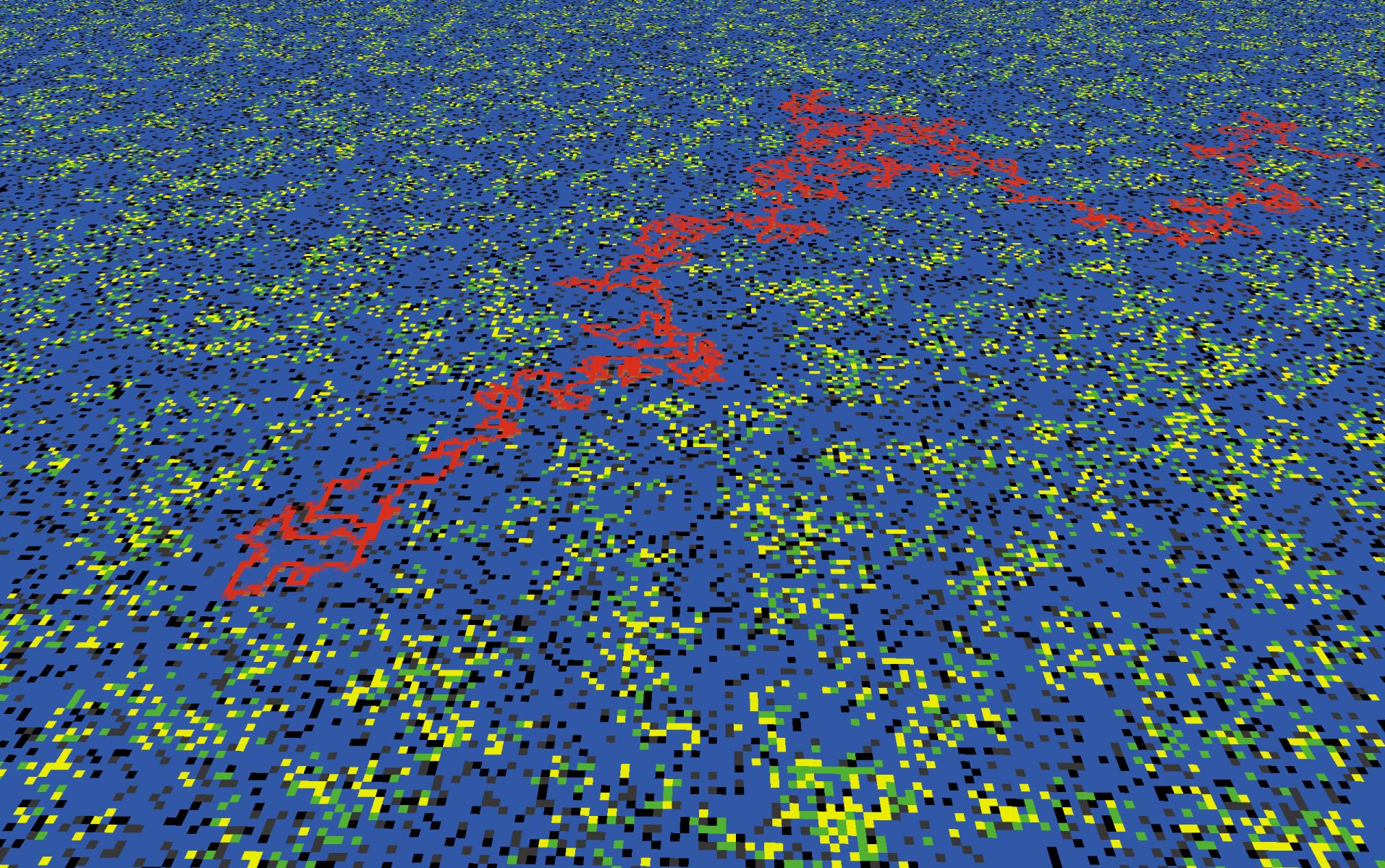
Habitat layer

Food

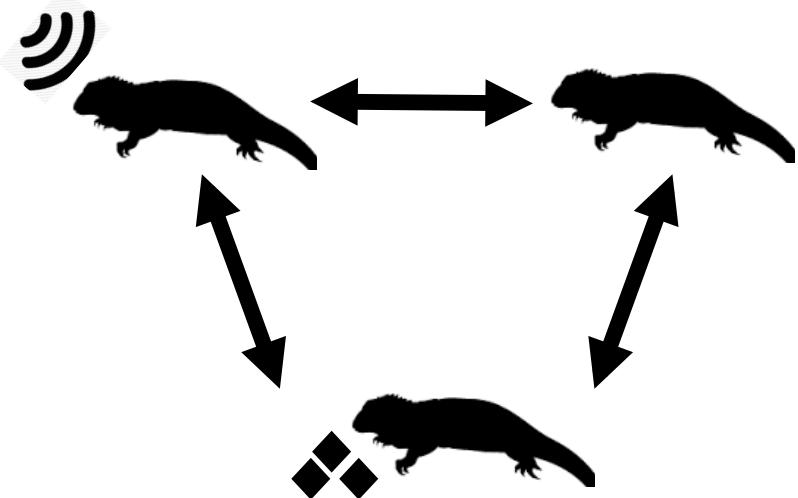
Shade

Burrows

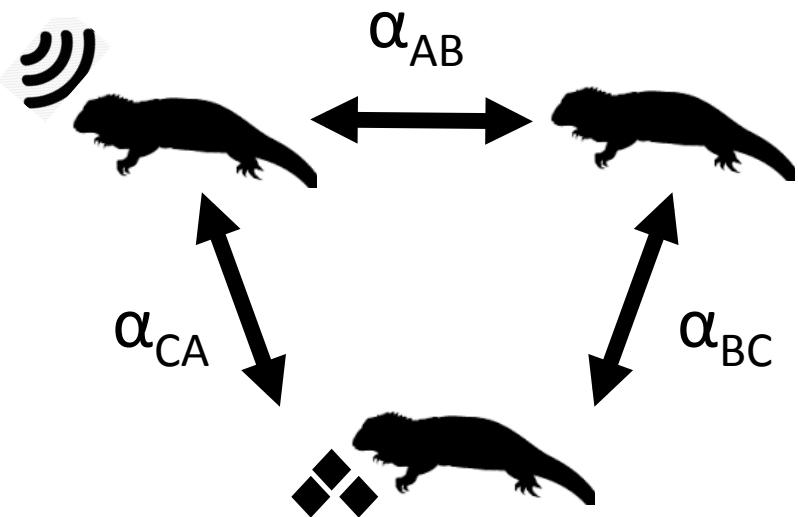




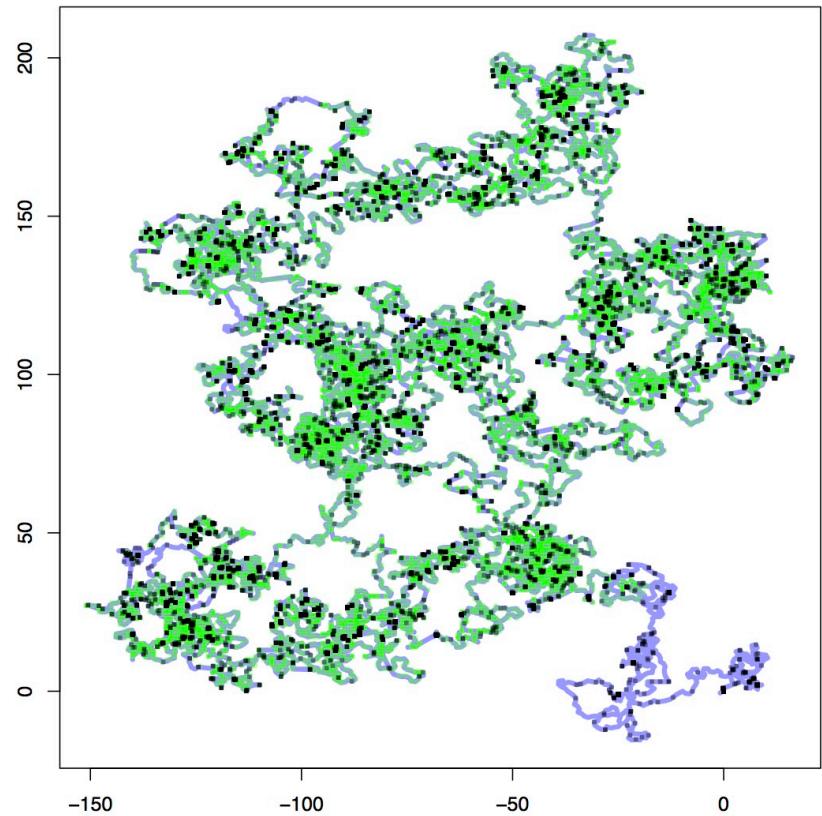
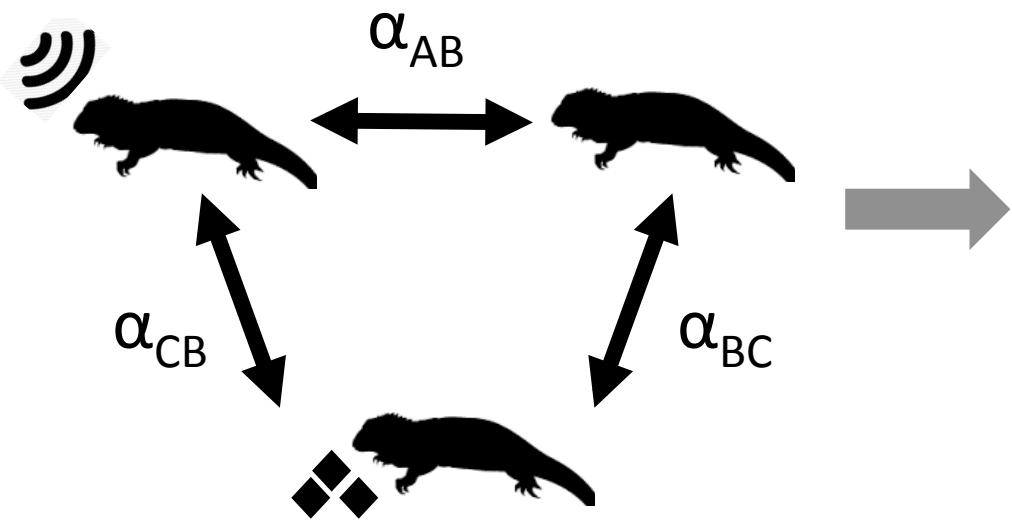
Time and space

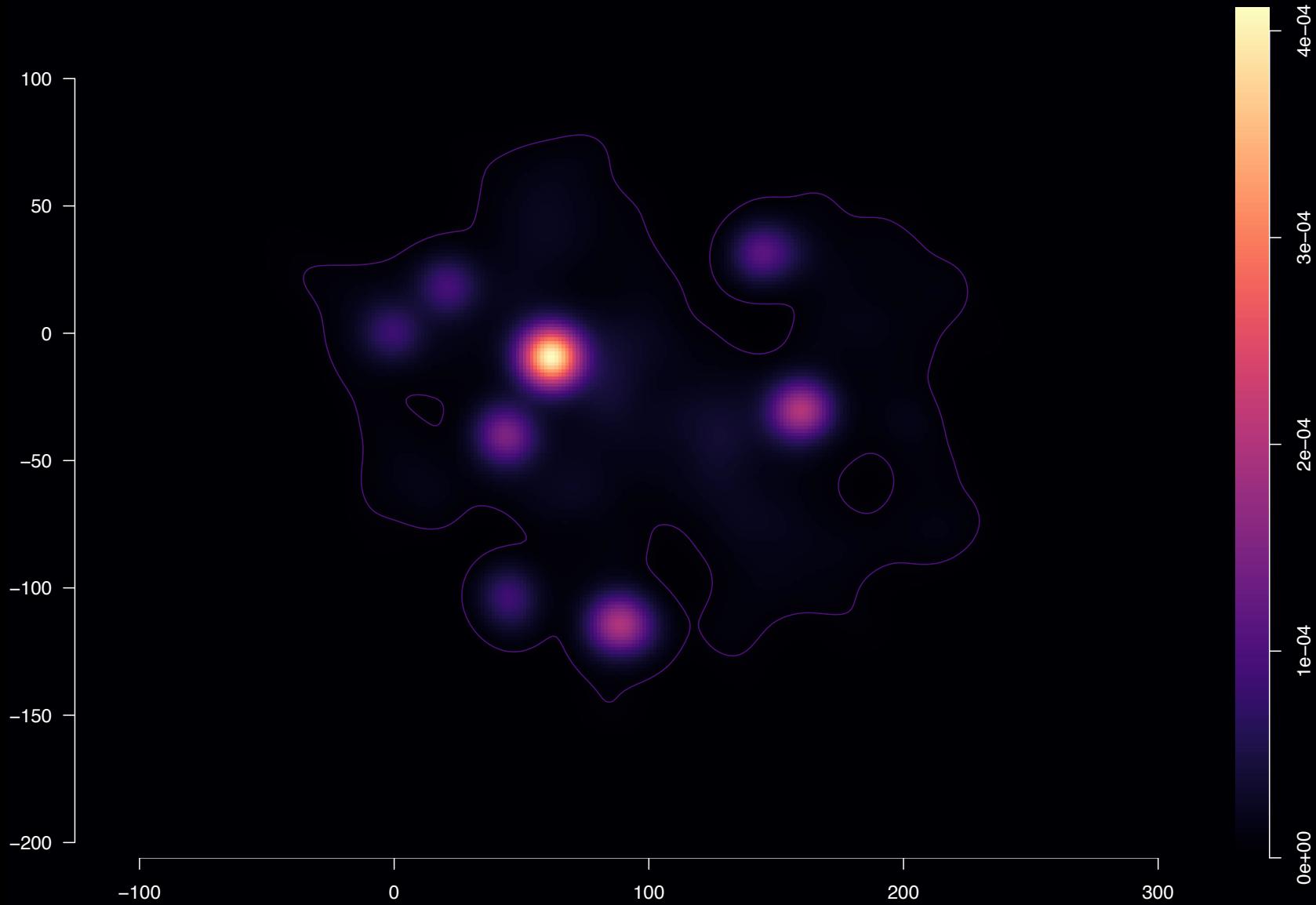


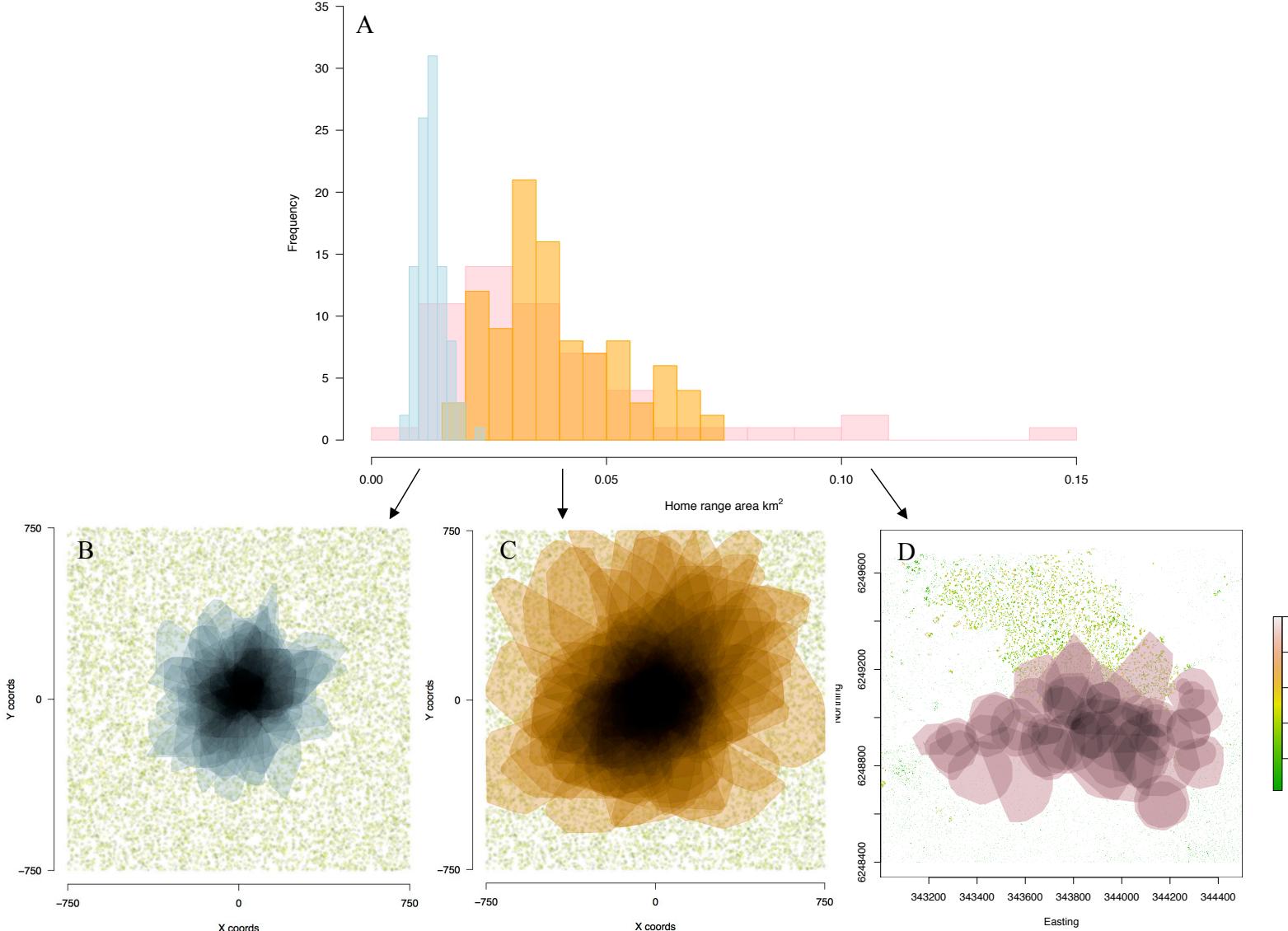
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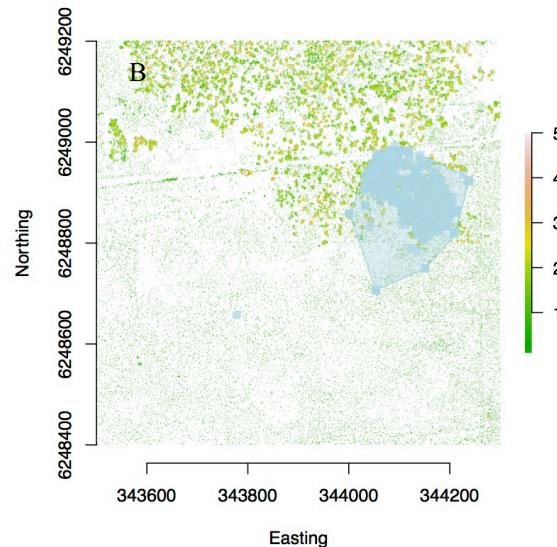
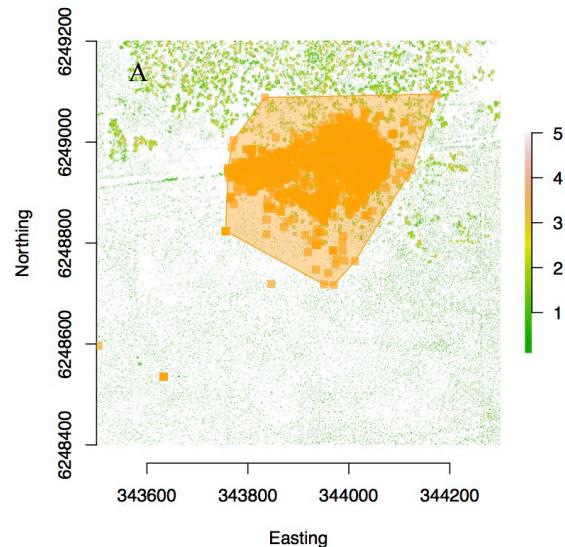


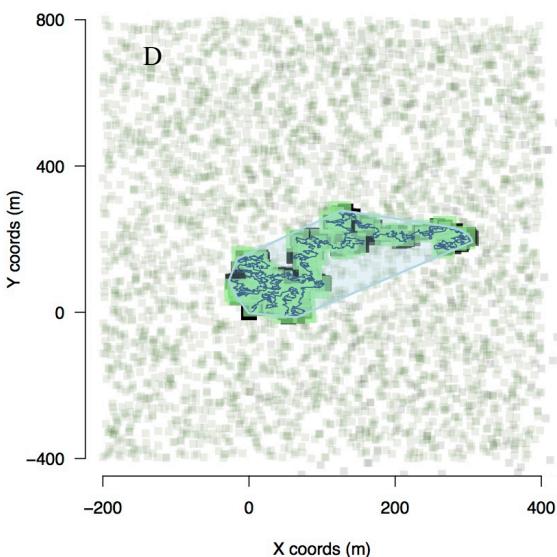
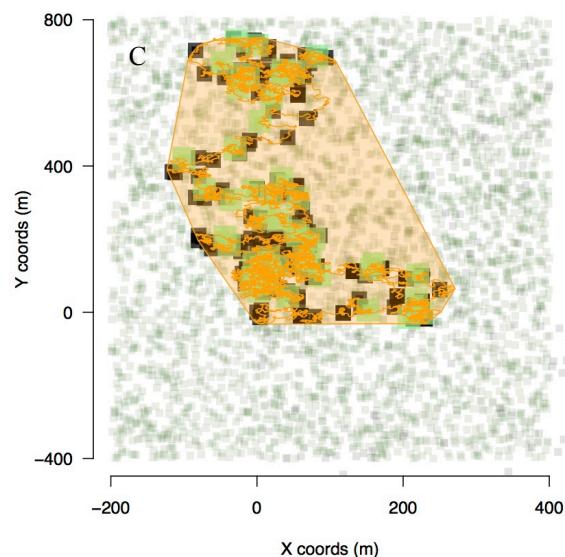
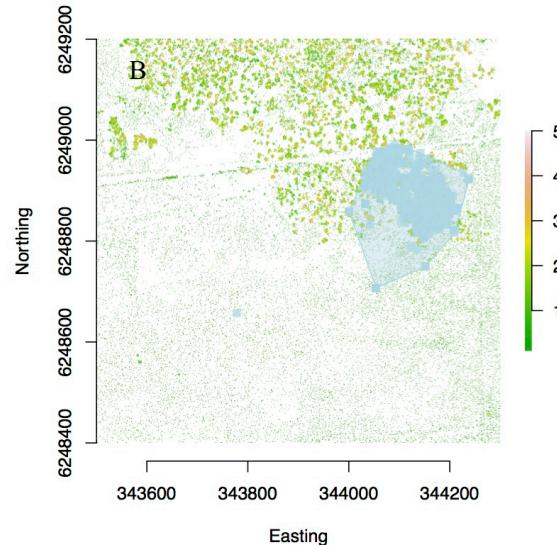
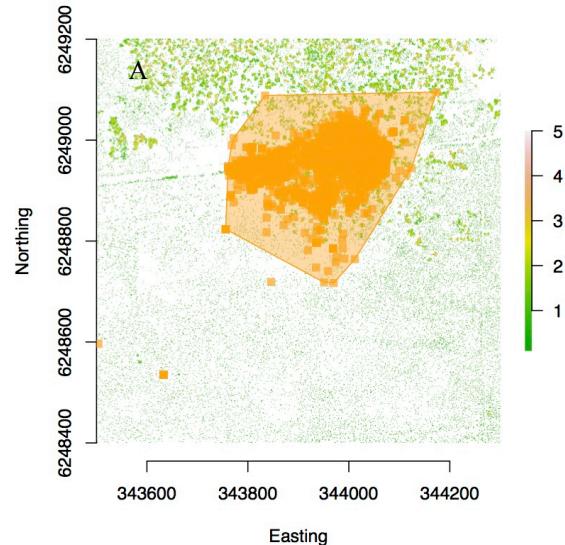
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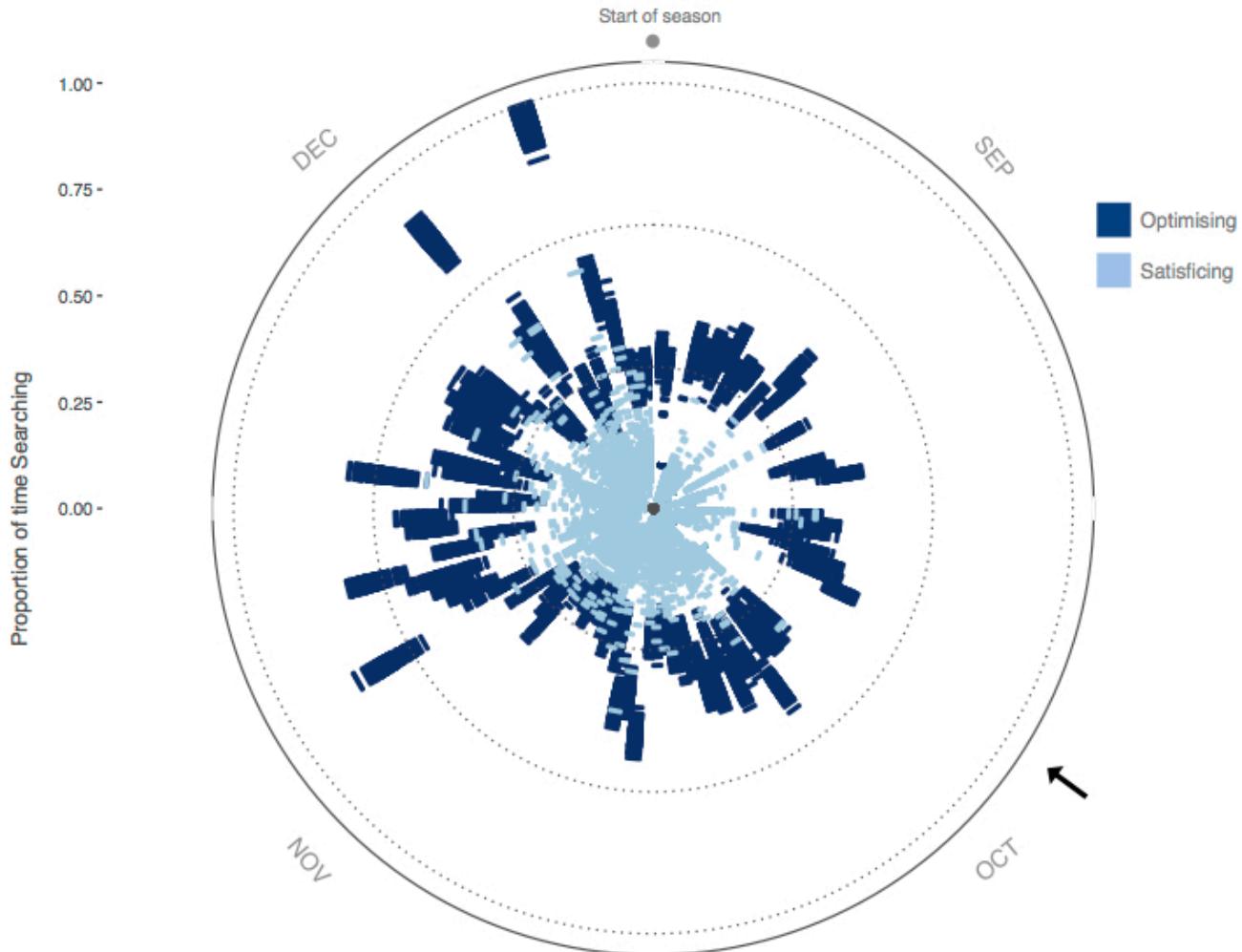
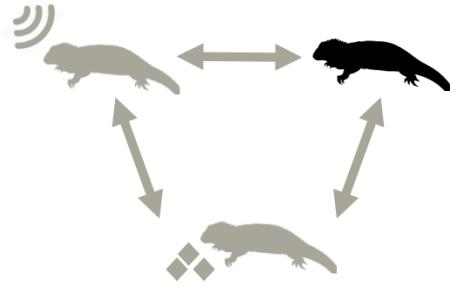


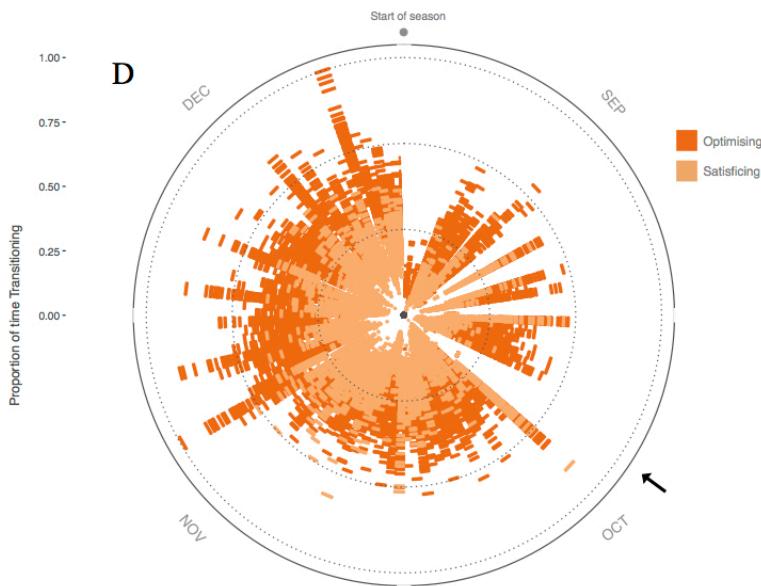
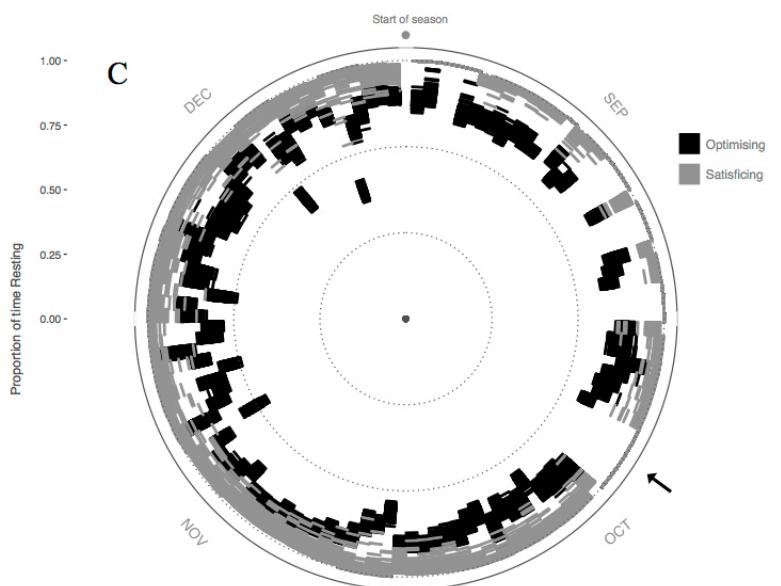
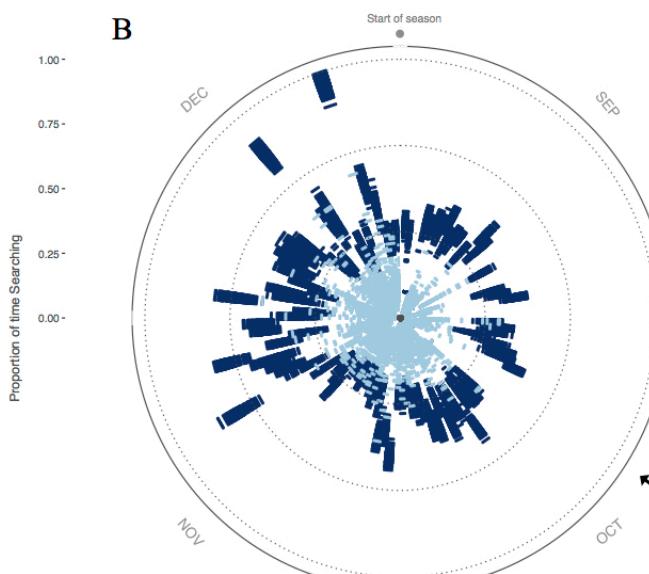
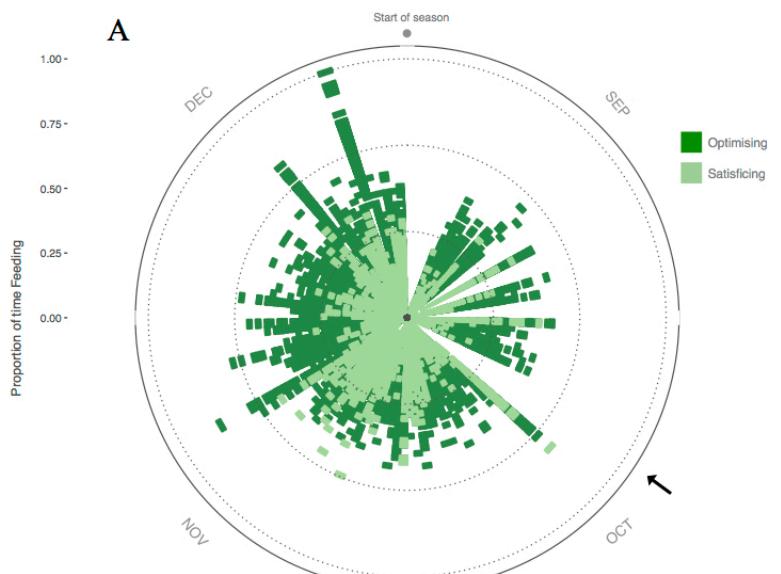




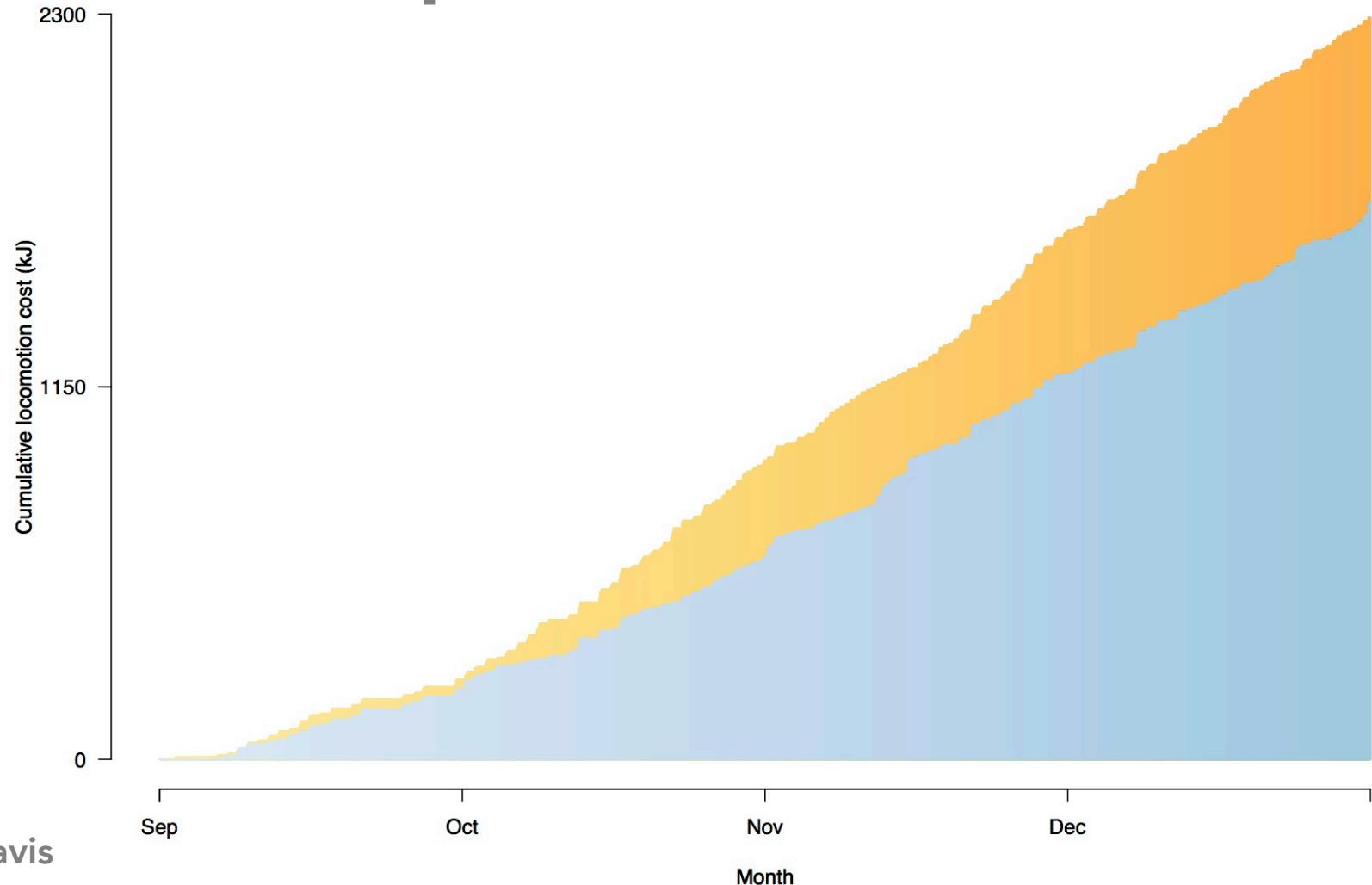




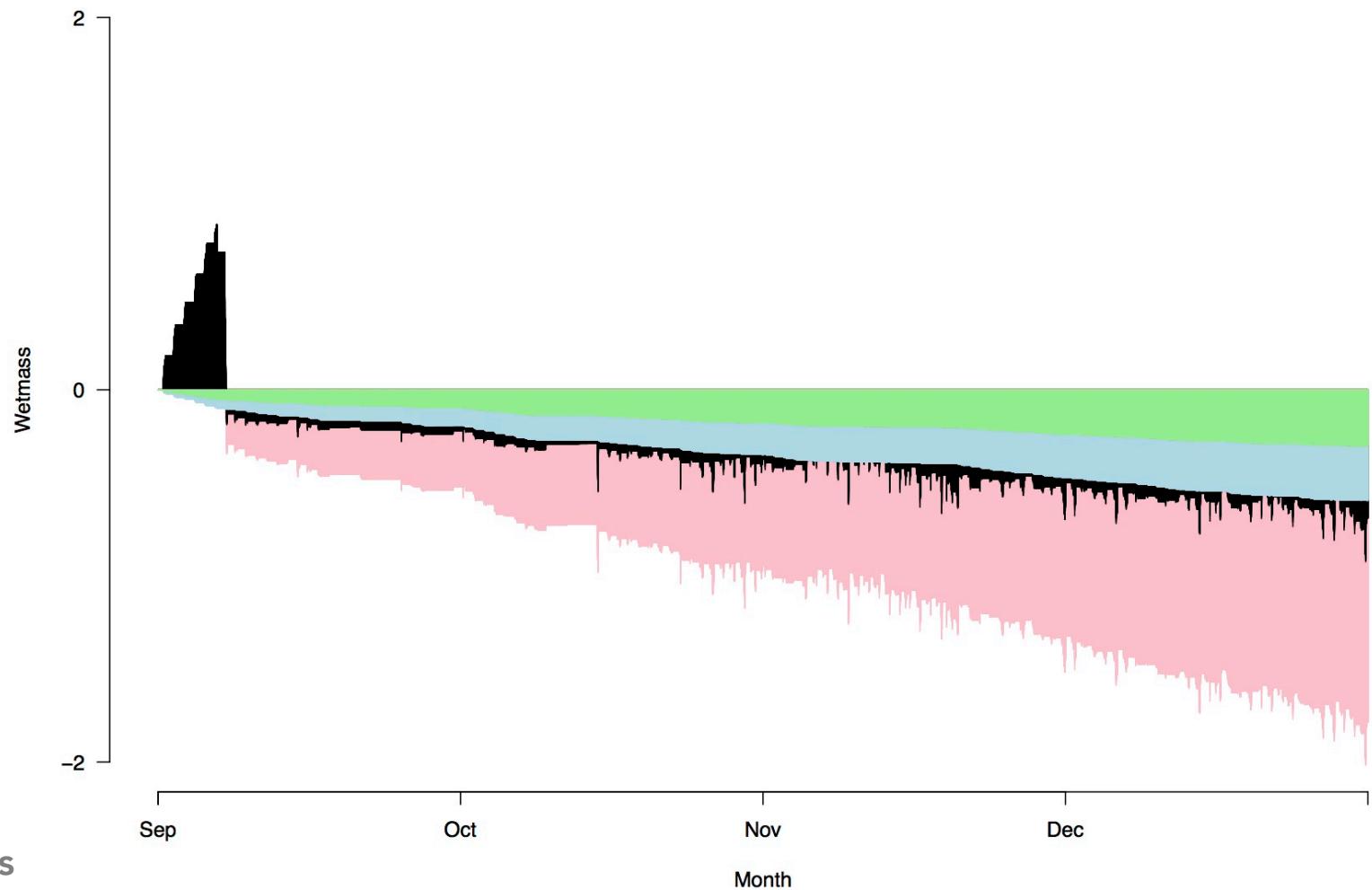




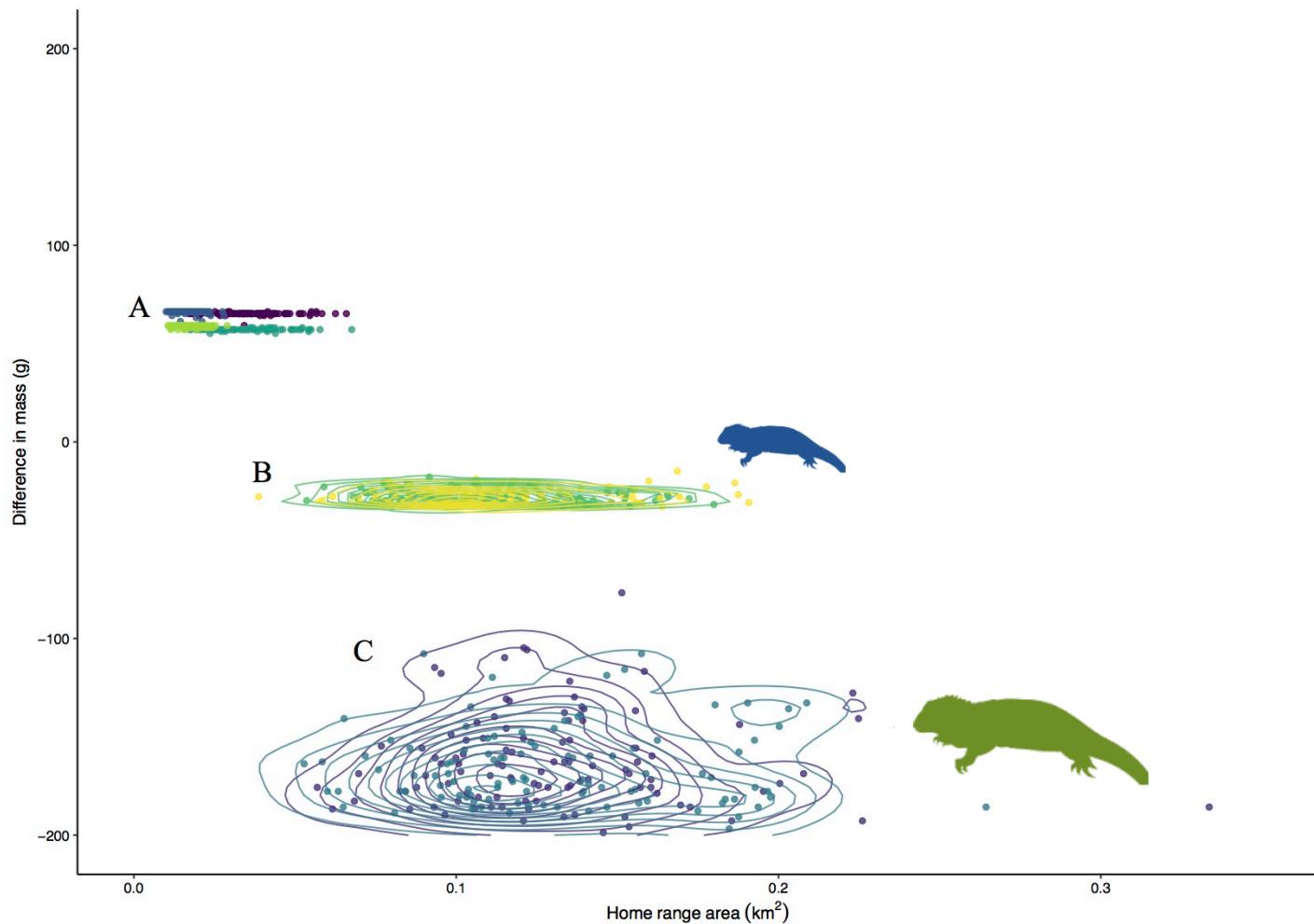
Metabolic output



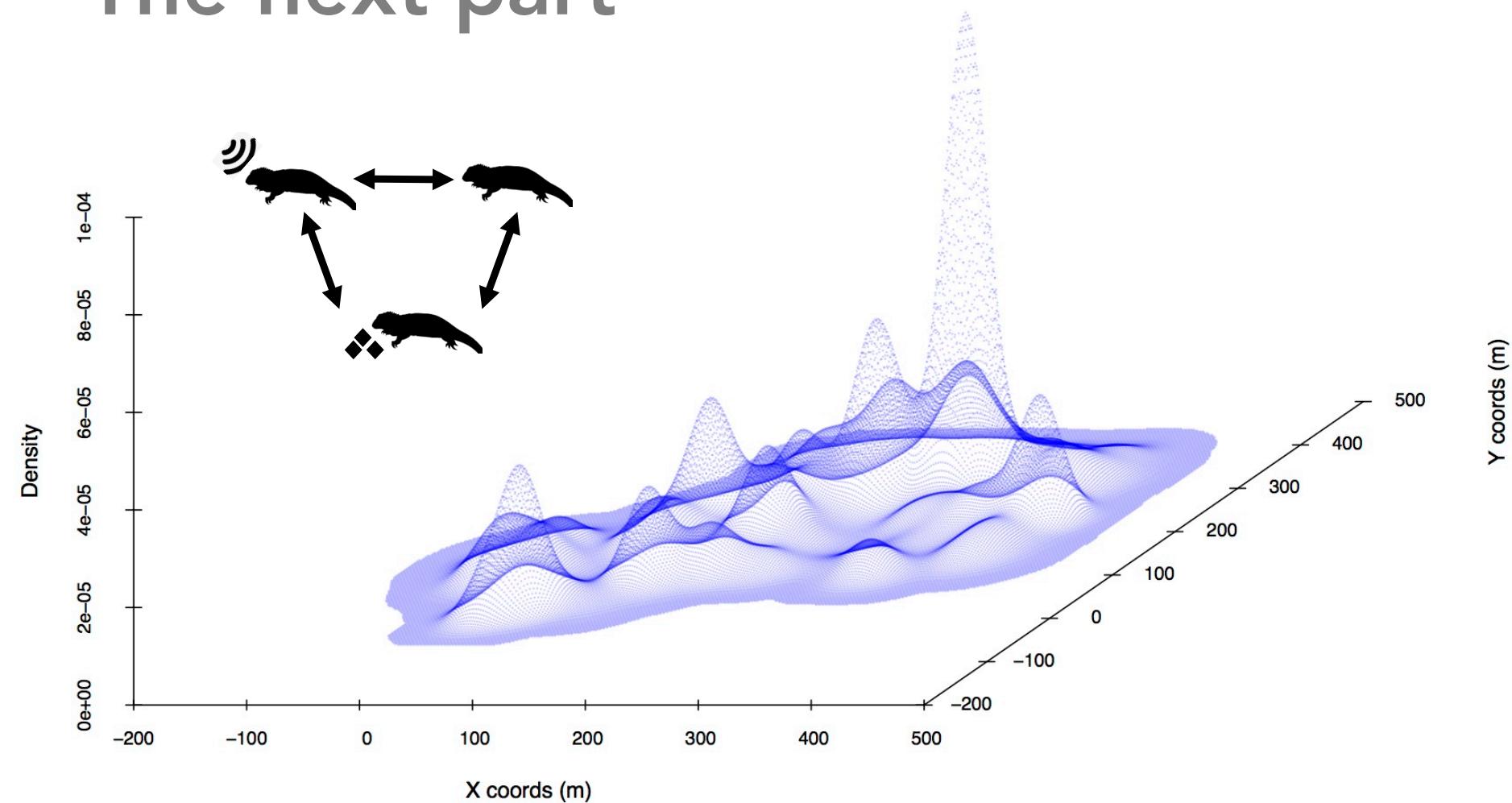
Metabolic output



The next part



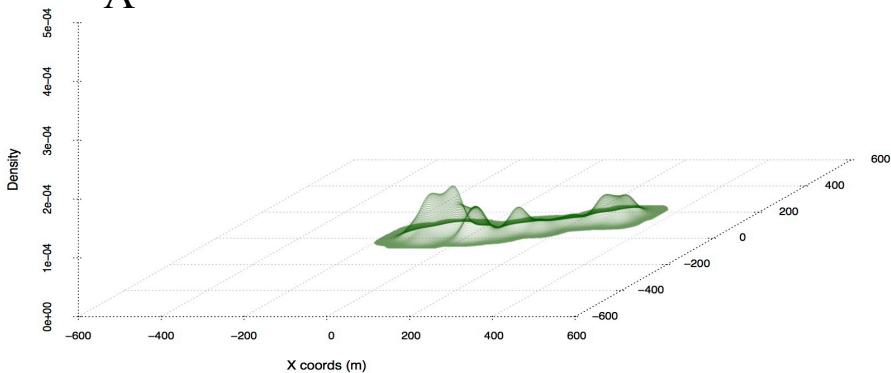
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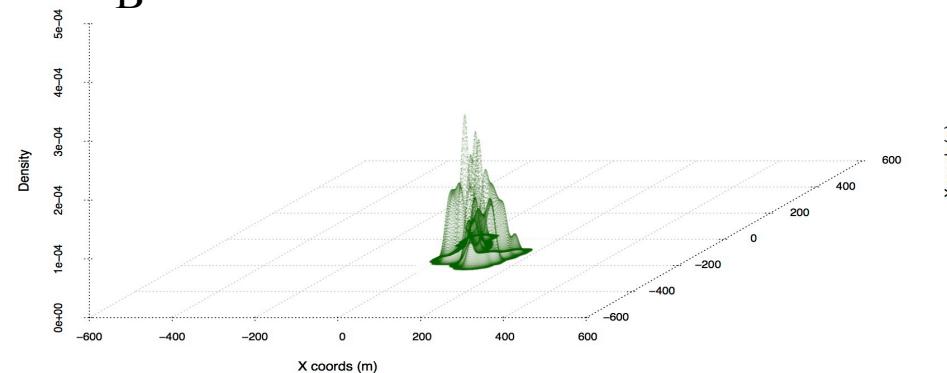
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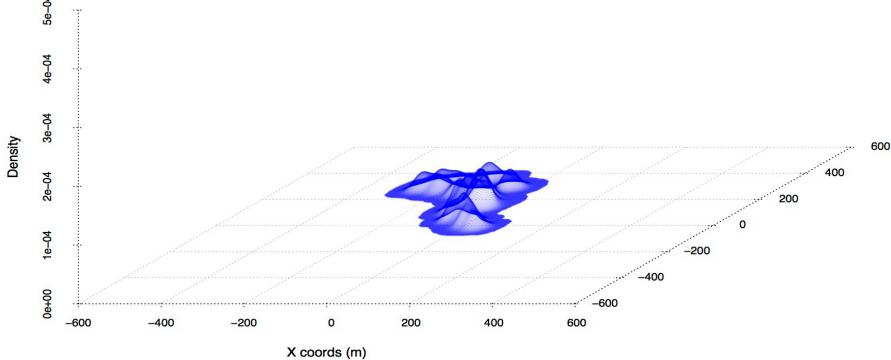
A



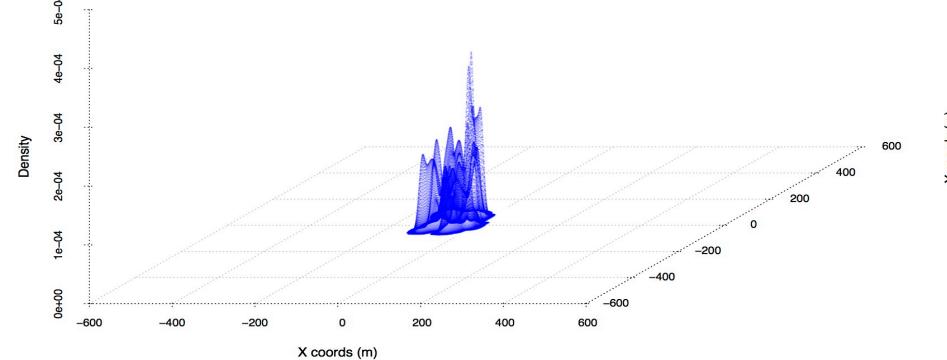
B



C



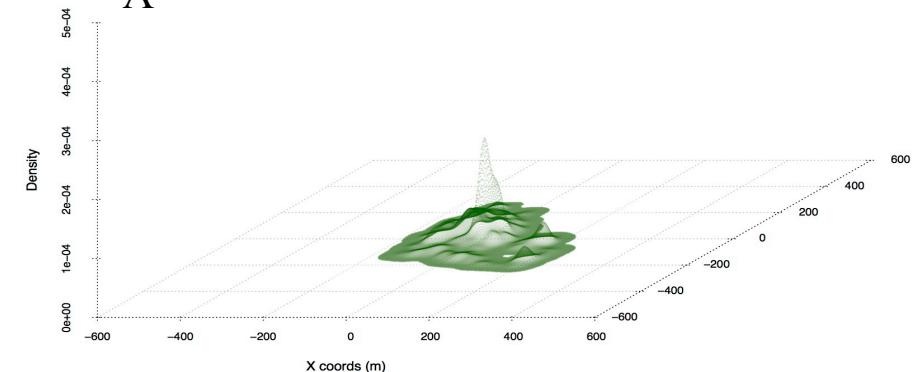
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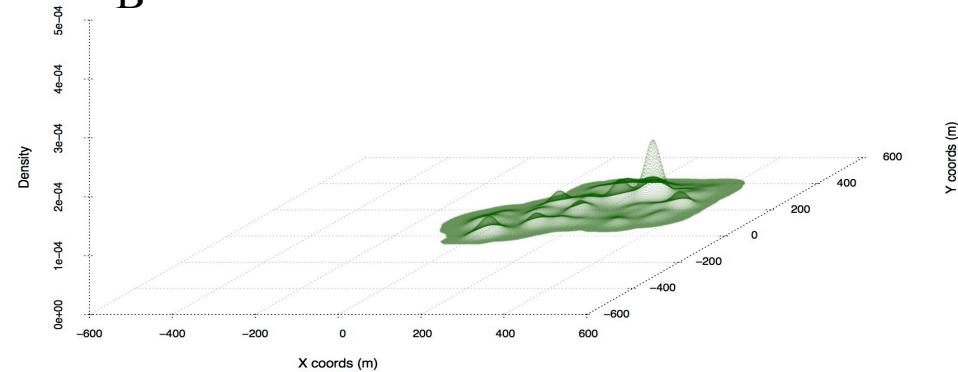
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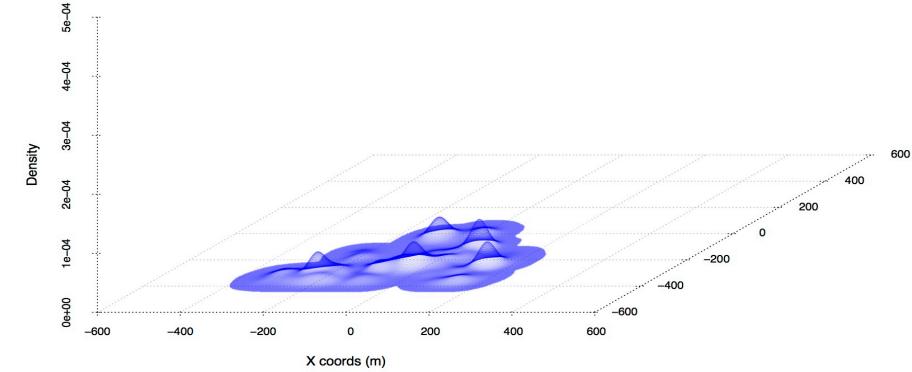
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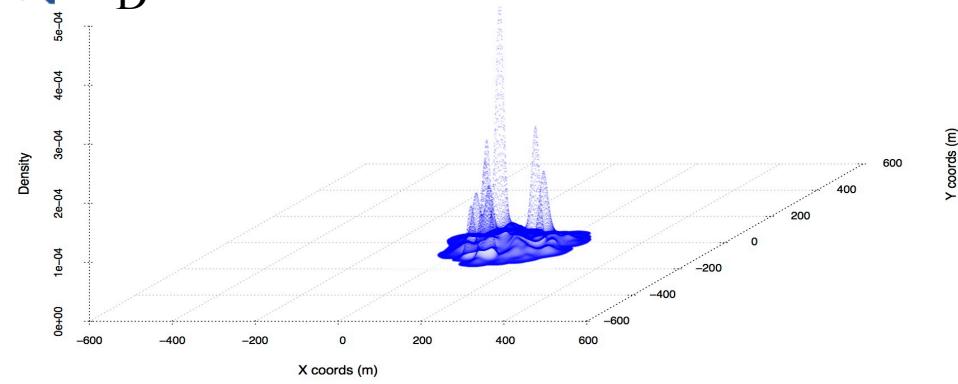
B



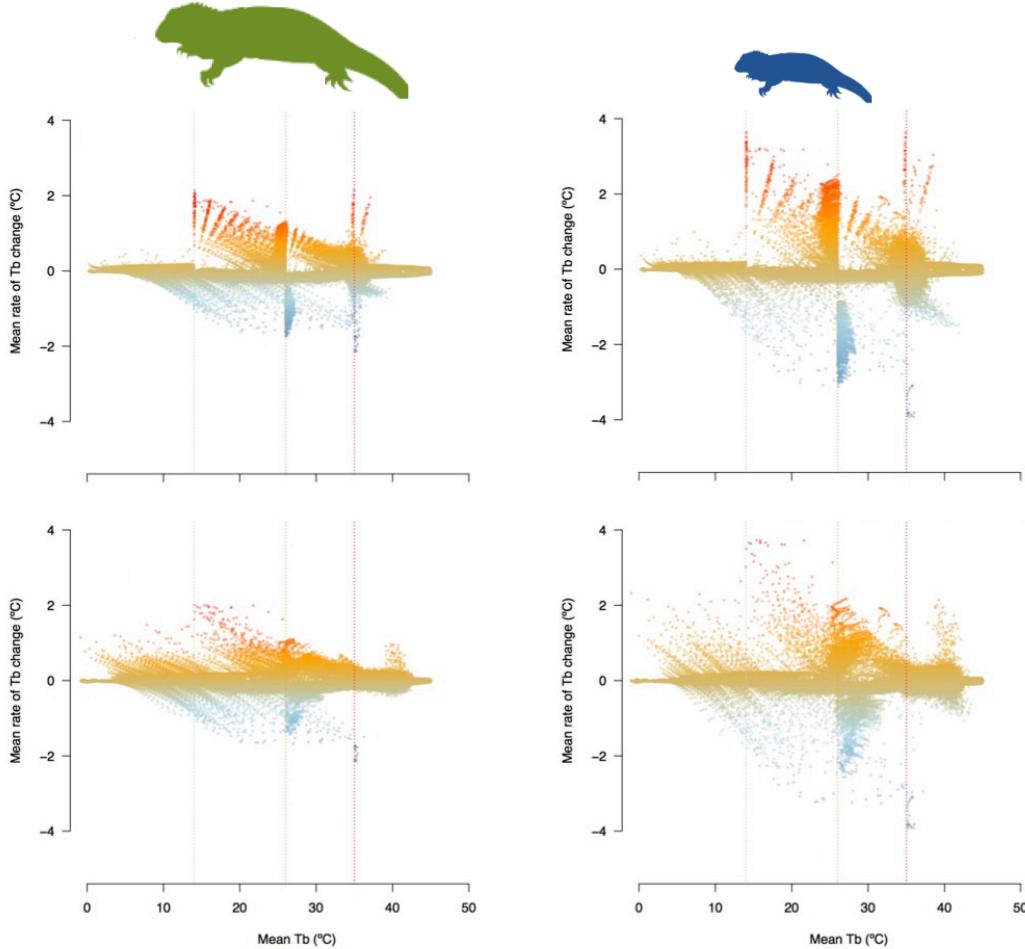
C



D



The next part



The summary

Individual-level constraints

Metabolic investment of movement

Activity budget and physiology

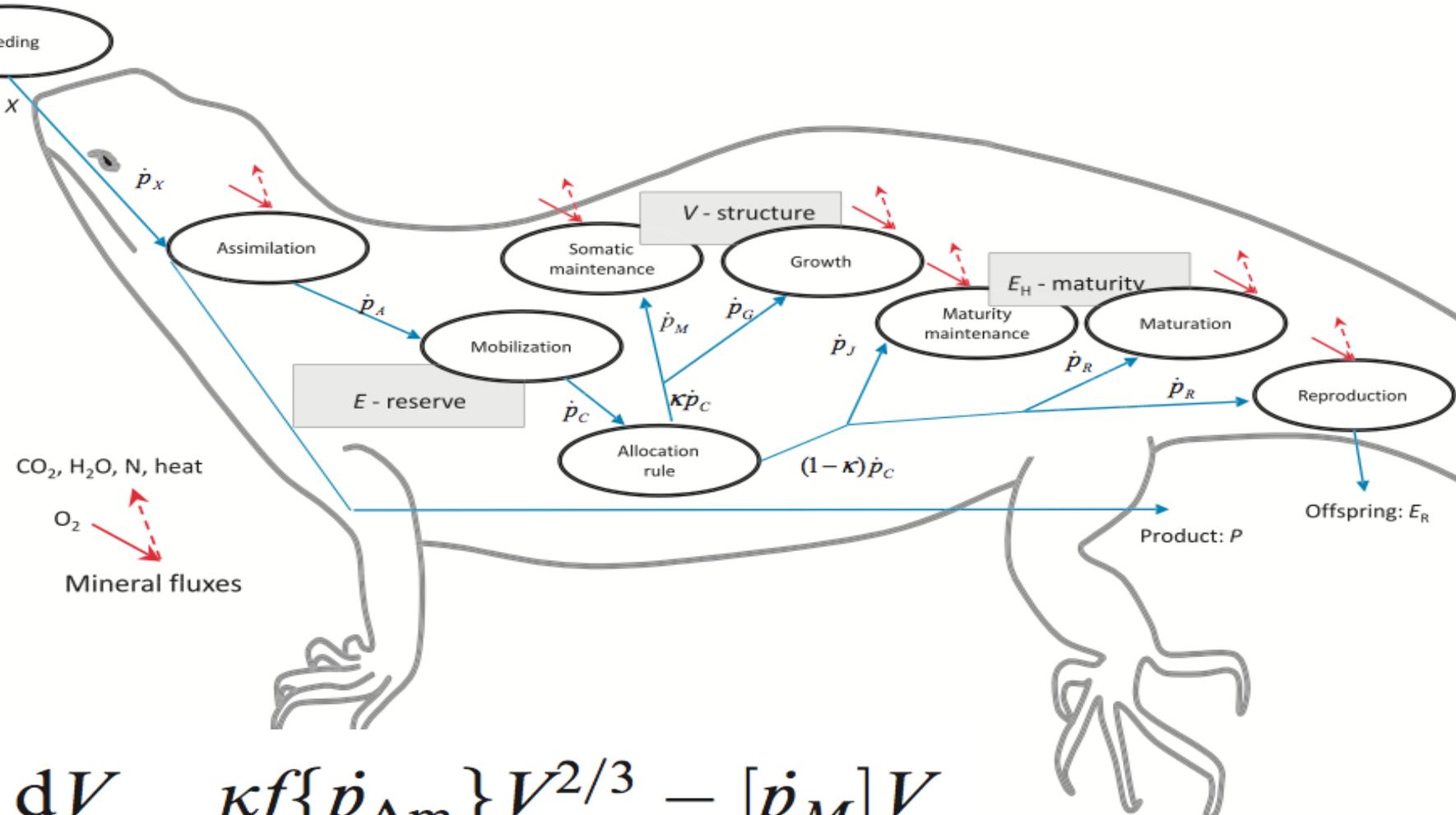
Individuals are scalable

The thanks



Climate and Metabolic
Ecology Lab (CAMEL)





$$\frac{dV}{dt} = \frac{\kappa f\{\dot{p}_{Am}\} V^{2/3} - [\dot{p}_M] V}{\kappa f[E_m] + [E_G]}$$

The applications

Infer physiological limits to survival

→ individual-level is scalable

Conservationists should focus on different layers of the model
(habitat, climate, or individual)

→ some traits more limiting than others

What does the current habitat look like under future environmental change?