Multi-species Occupancy Models

Overview

- What are multi-species occupancy models?
- Why use them? What are their benefits?
- How do you use them?
- What are some applications and extensions?

What are multi-species occupancy models?

Photo By: Mark Chynoweth

What are multi-species occupancy models?

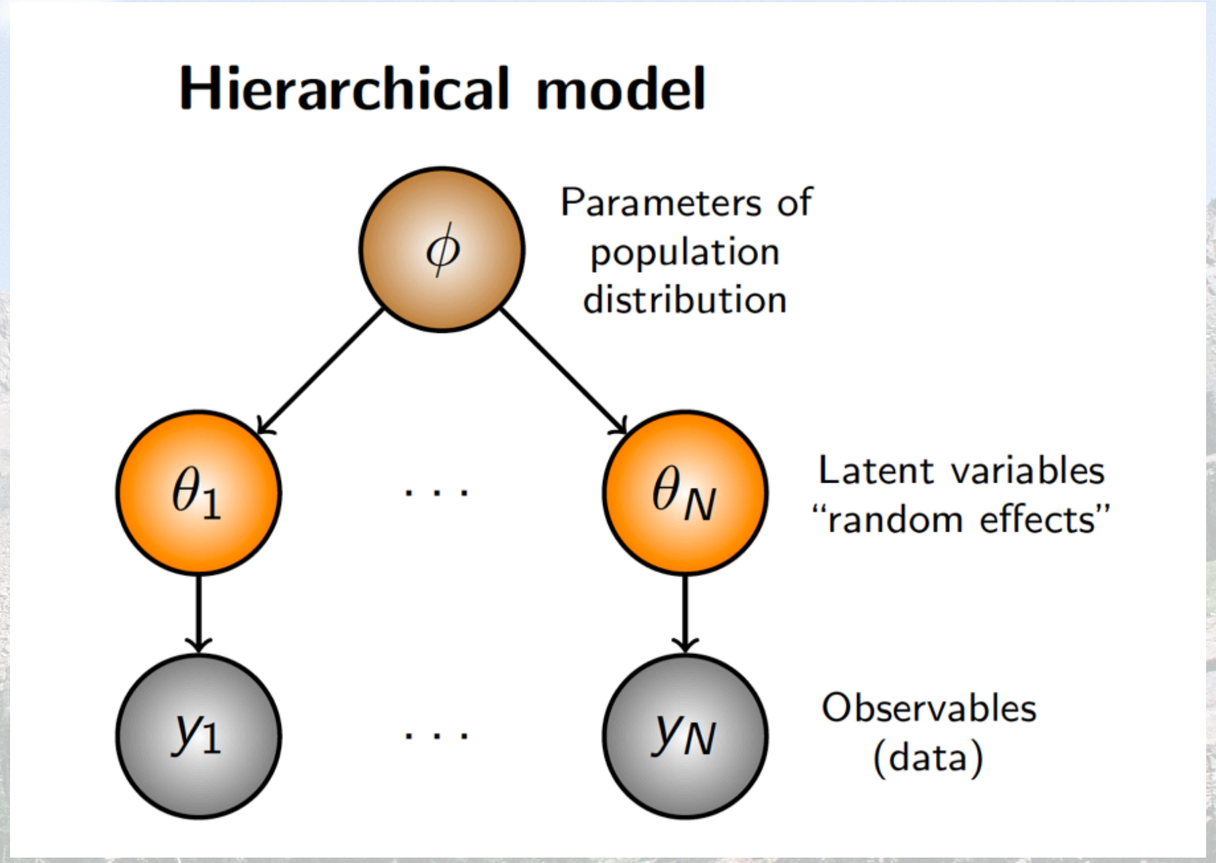
What are multi-species occupancy models?

Kery et al., 2016

What are multi-species occupancy models?

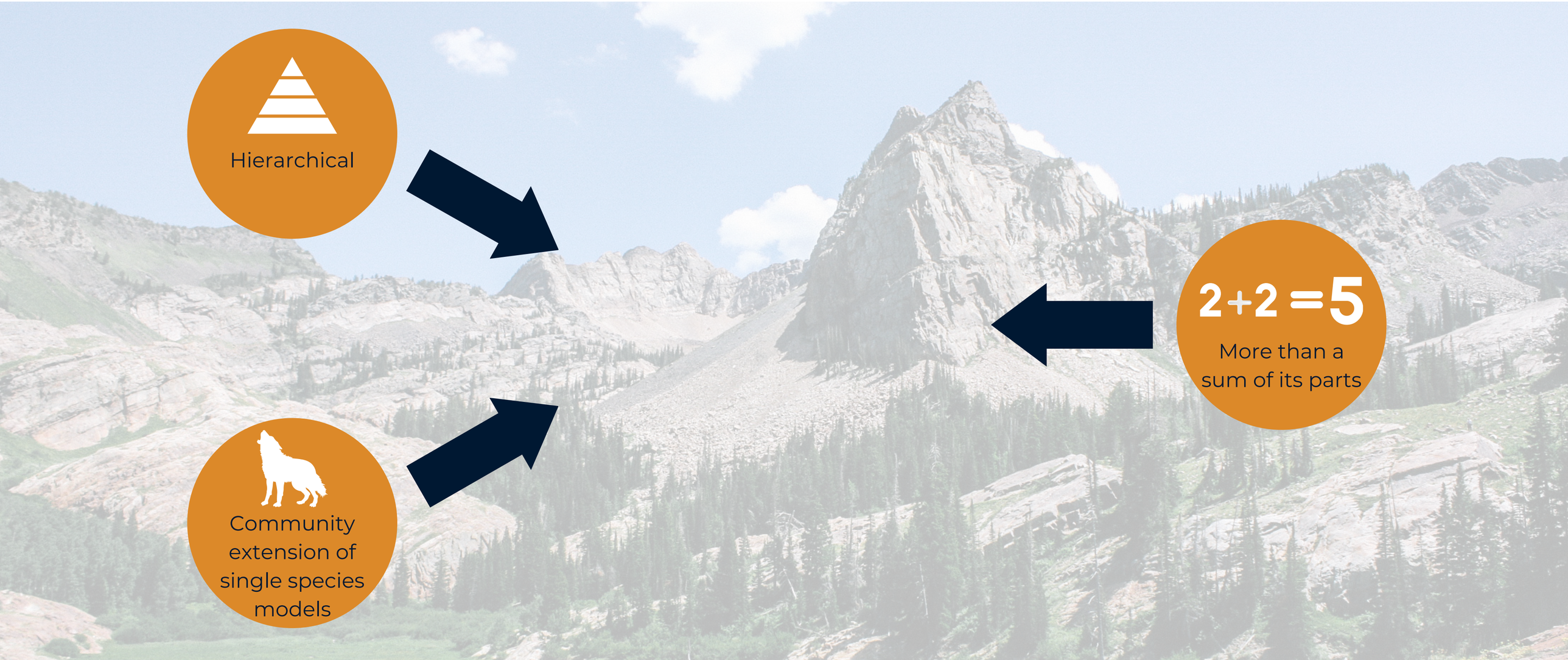
Hierarchical

Community extension of single species models

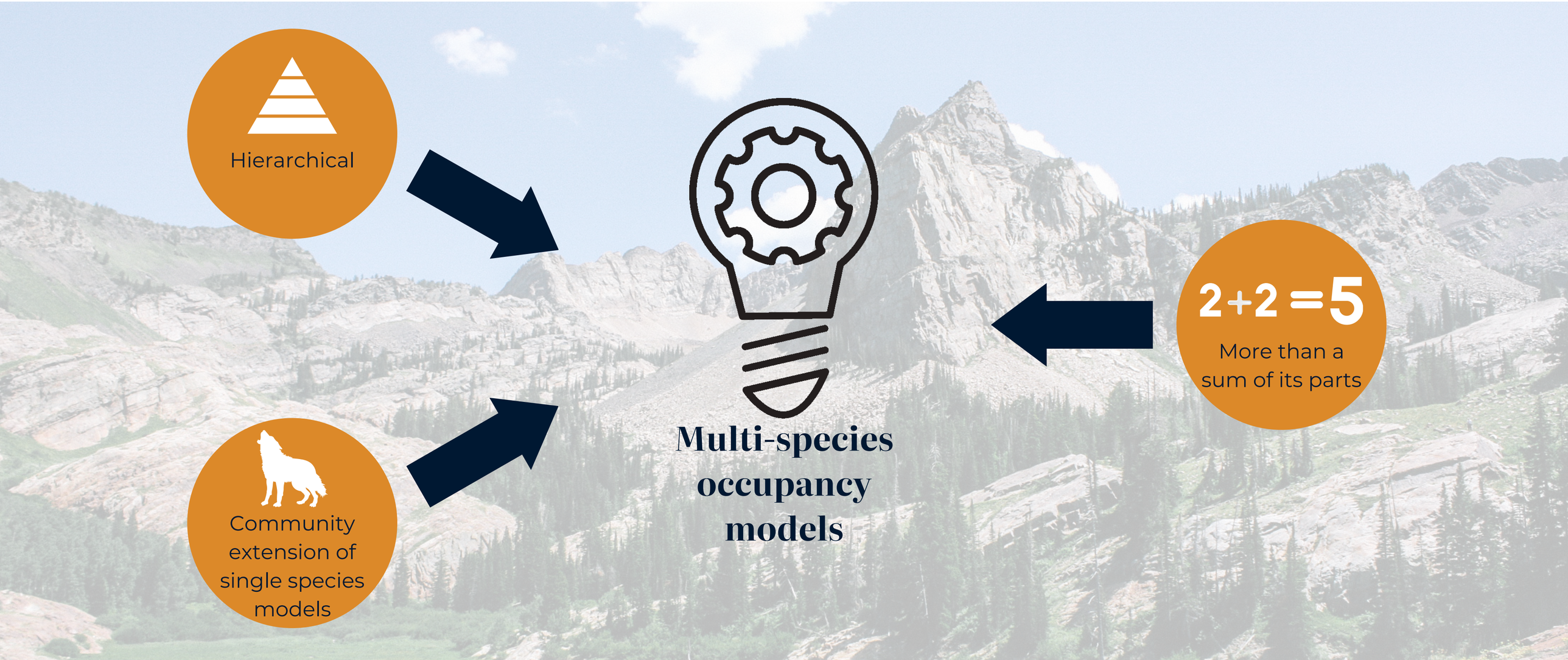


Midway, 2019

What are multi-species occupancy models?

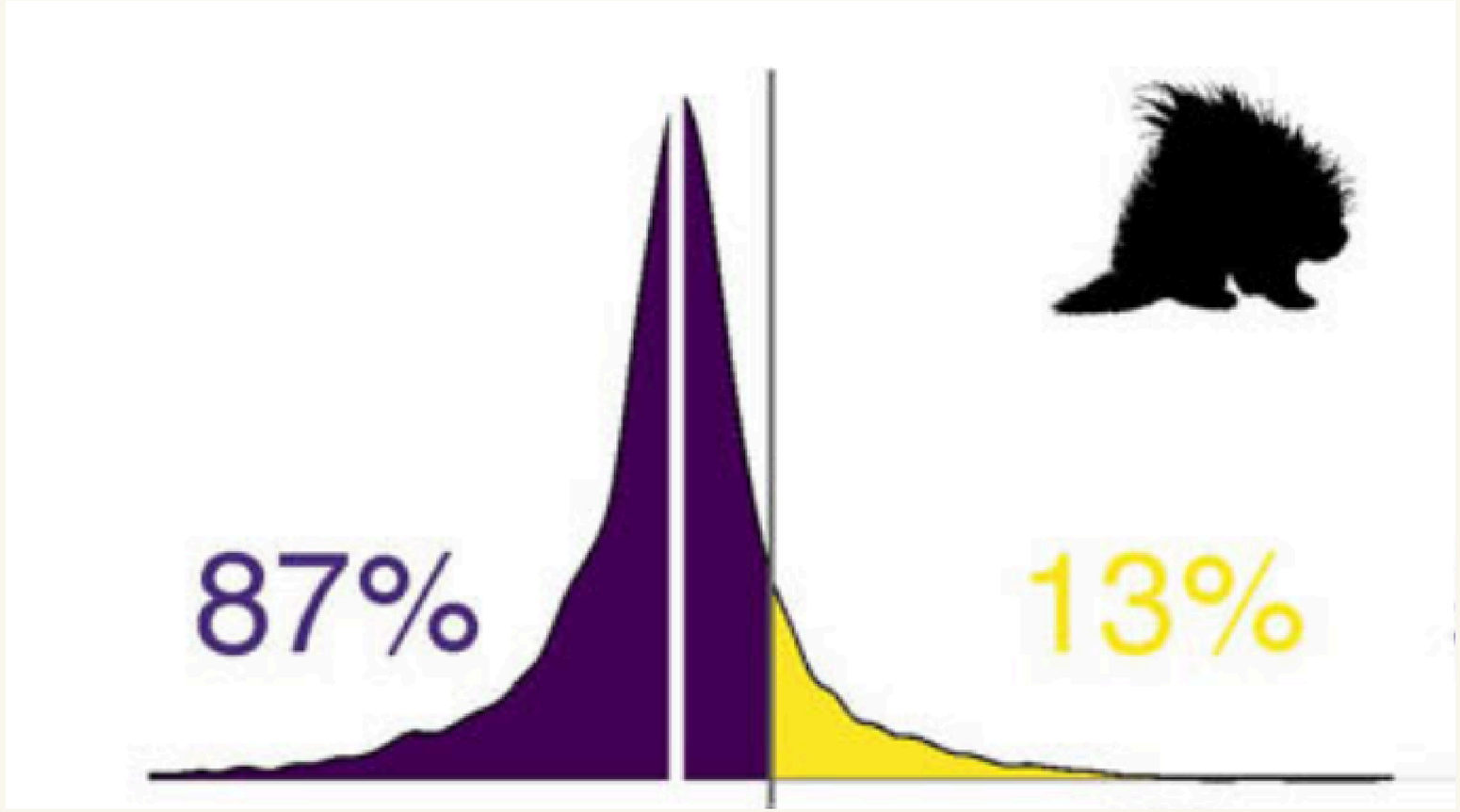


What are multi-species occupancy models?



Why use them and what are their benefits?

Single species models can tell you a lot about a species. . . if they have the data



Multi-species models

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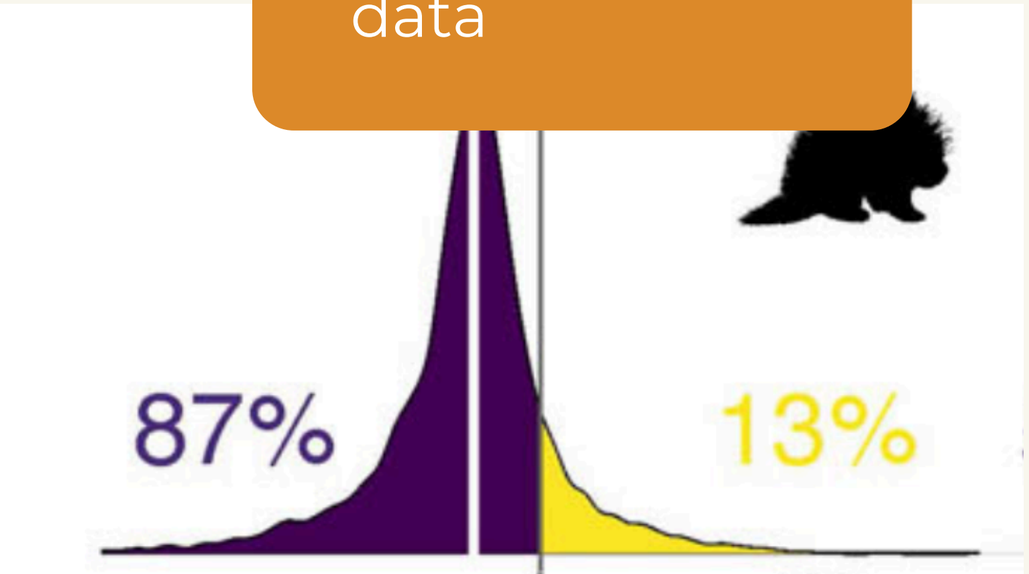
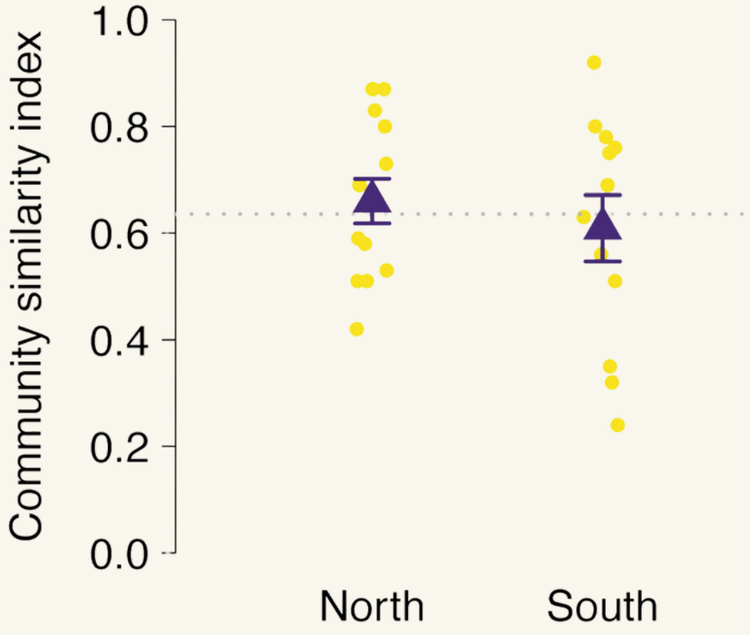
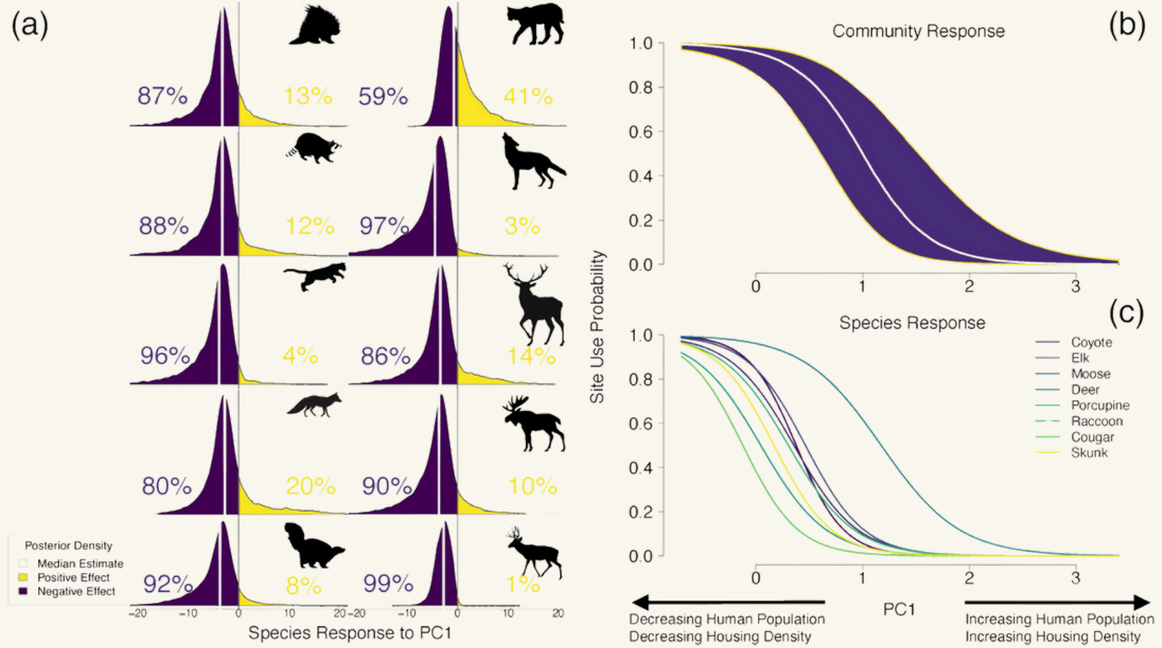


Barnick et al., 2022

Multi-species models

More than just the sum of a number of single-species models





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Multi-species models

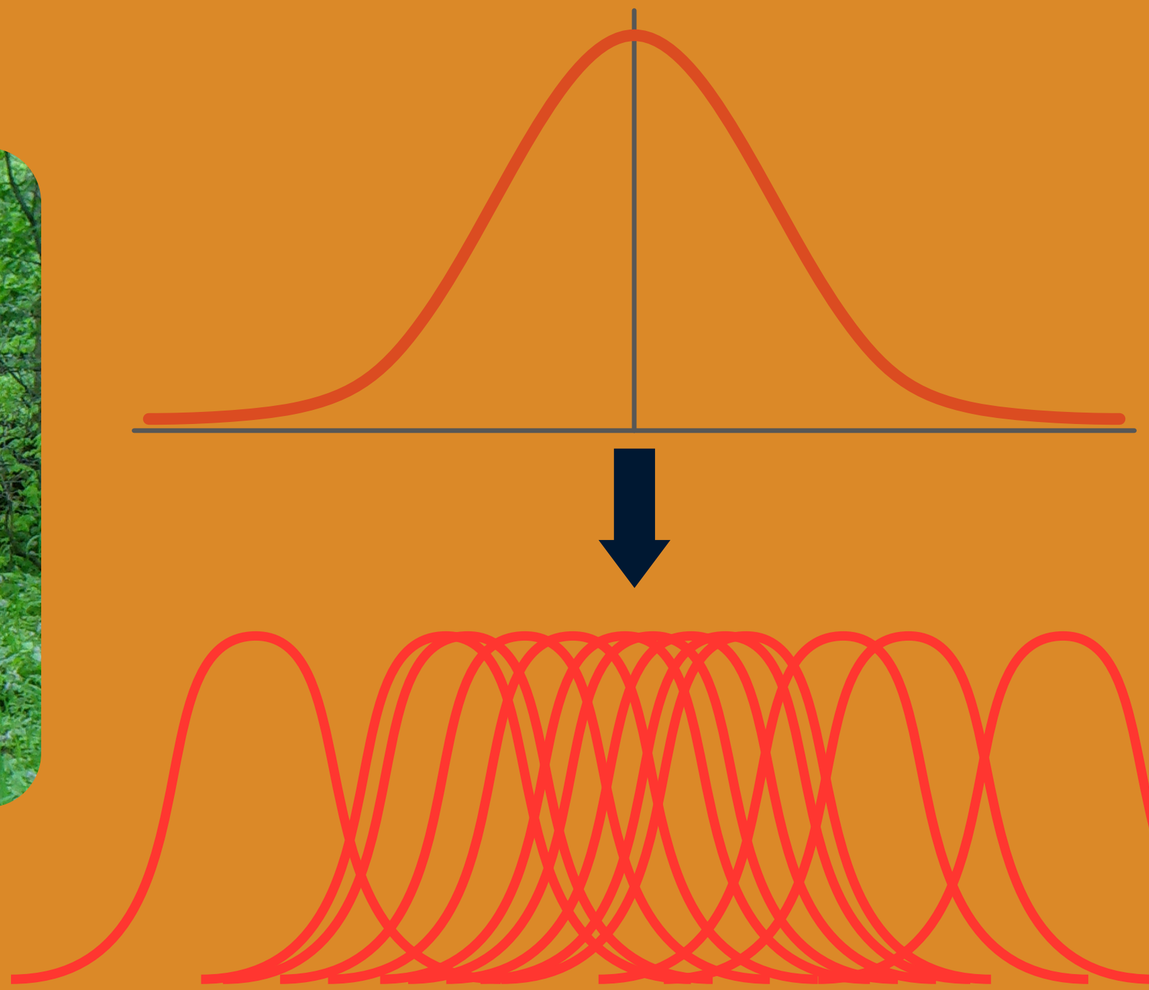
More than just the sum of a number of single-species models

Multi-species modelling through a hierarchical structure can provide a number of benefits that extend single-species models

- Investigate community effects
- Utilize Bayesian ‘borrowing strength’
- Compute community parameters (e.g., species richness, diversity, etc.)

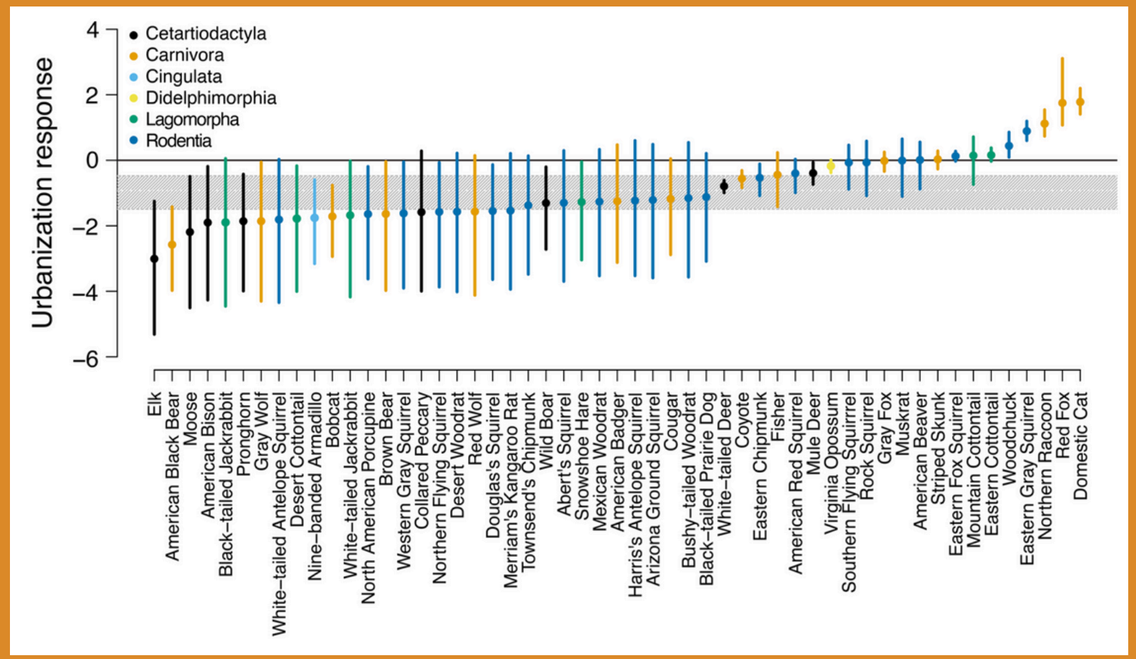
Community Effects

Based on hyper-parameters

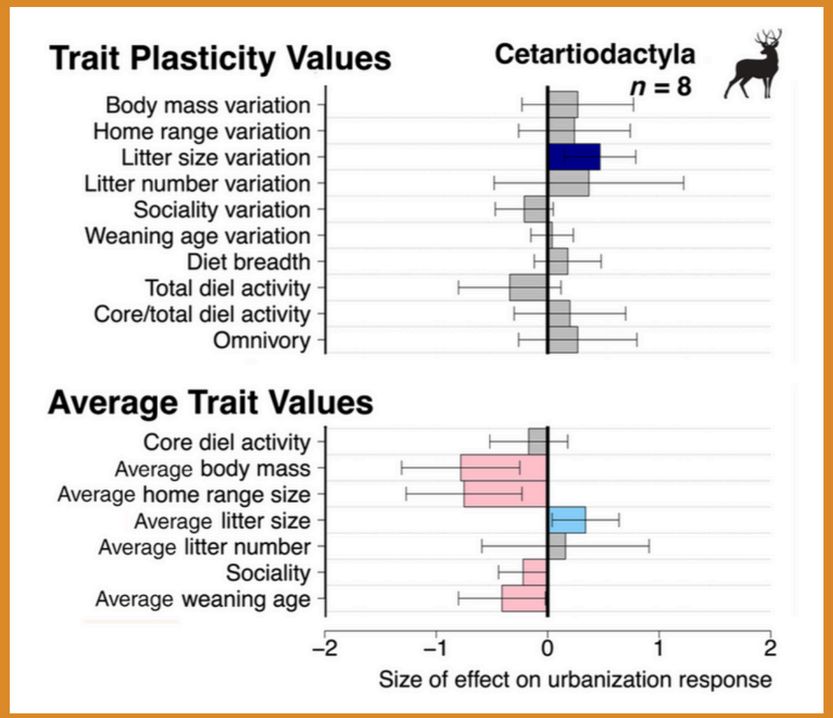


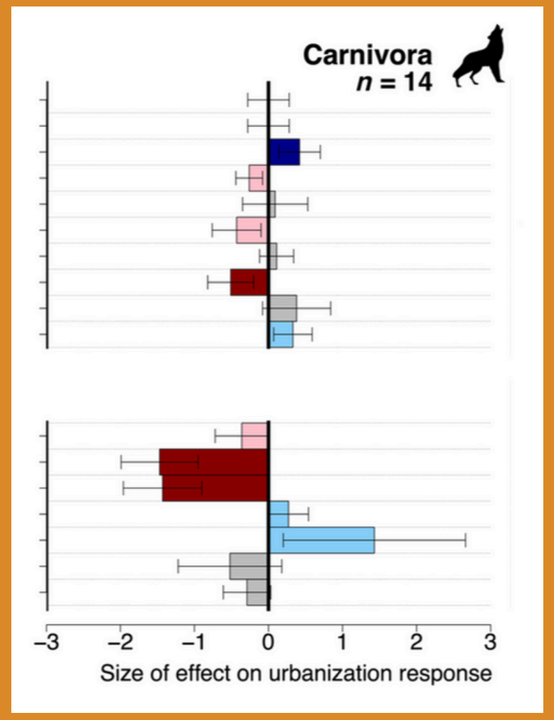
Community Effects

- Based on hyper-parameters
- Allows for inclusion of species with few detections



Community Effects

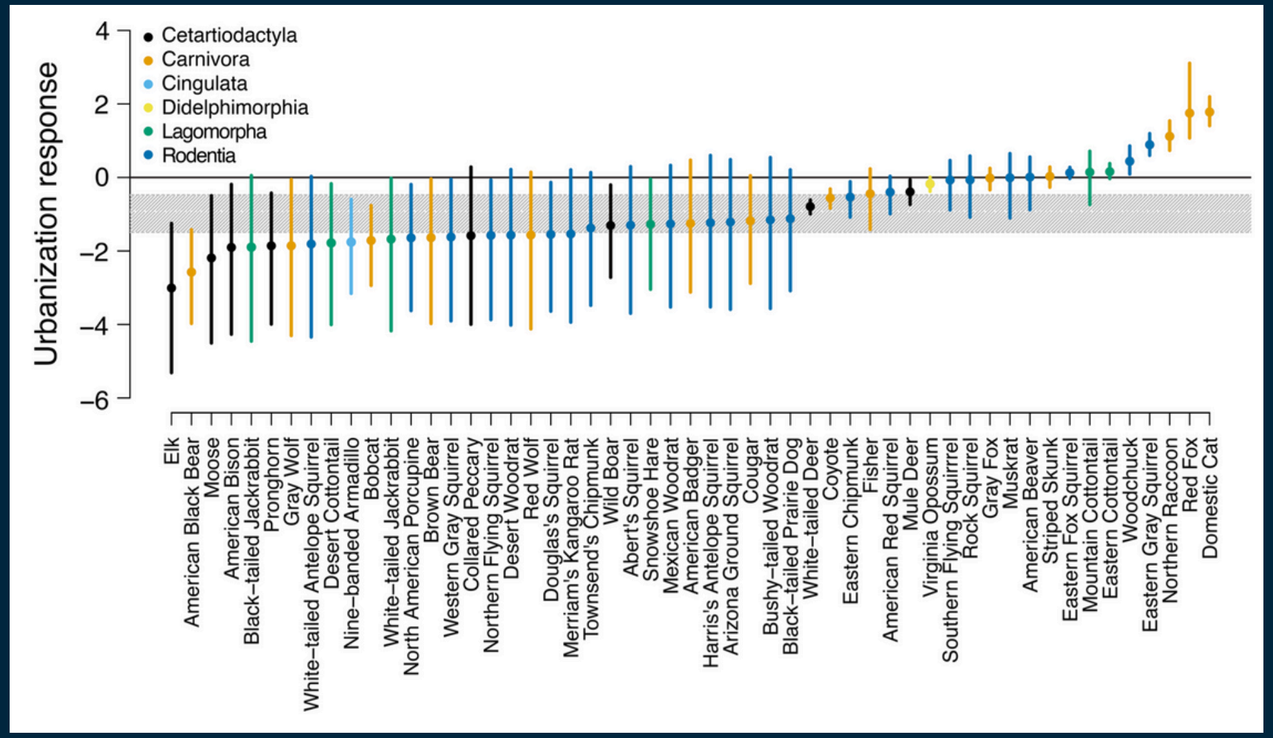


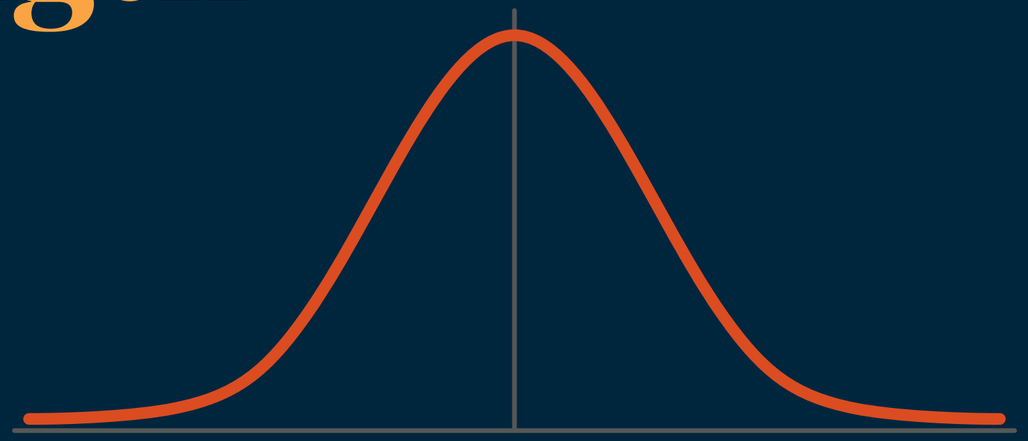


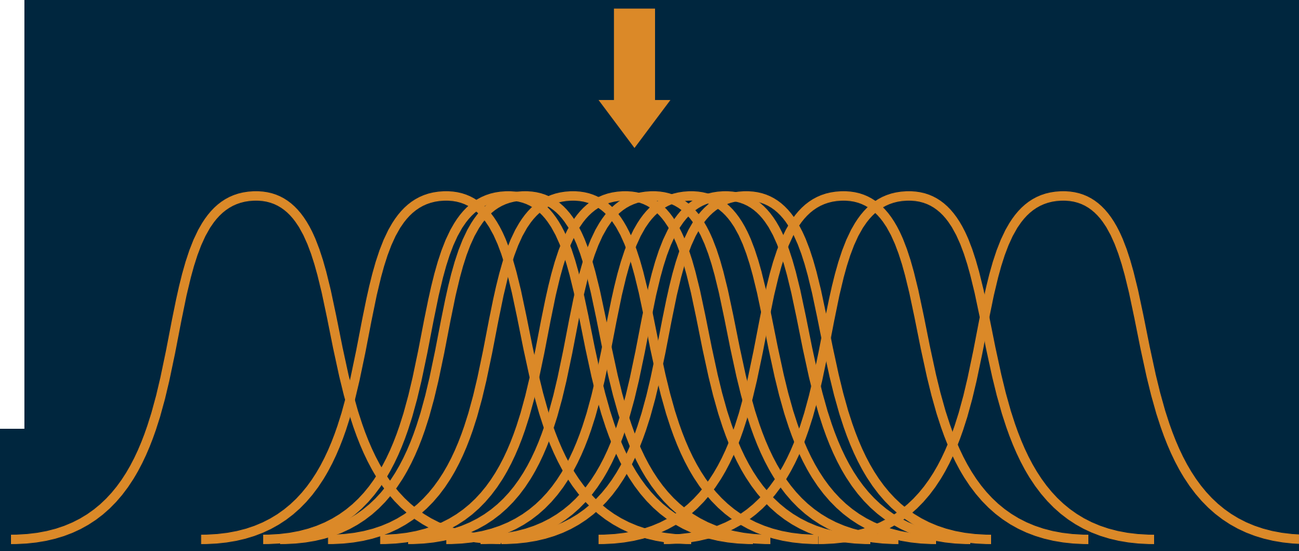
- Based on hyper-parameters
- Allows for inclusion of species with few detections
- Can compare across guilds, taxonomic diversity, etc.

Weiss et al., 2023

Bayesian "Borrowing Strength"







Bayesian “Borrowing Strength”

Note:

The size of the ball illustrates the precision of the estimate.

Link

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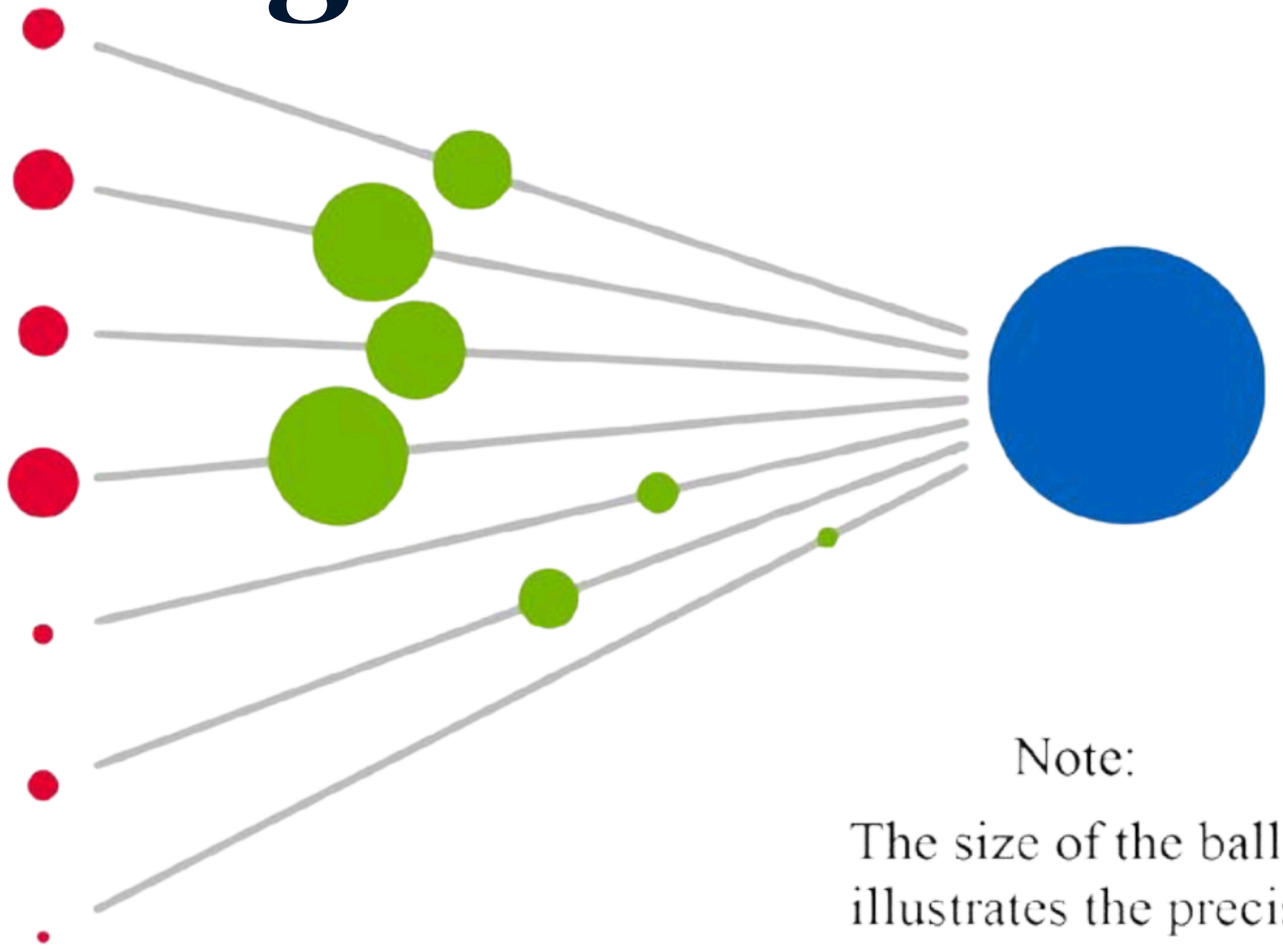
Bayesian “Borrowing Strength”



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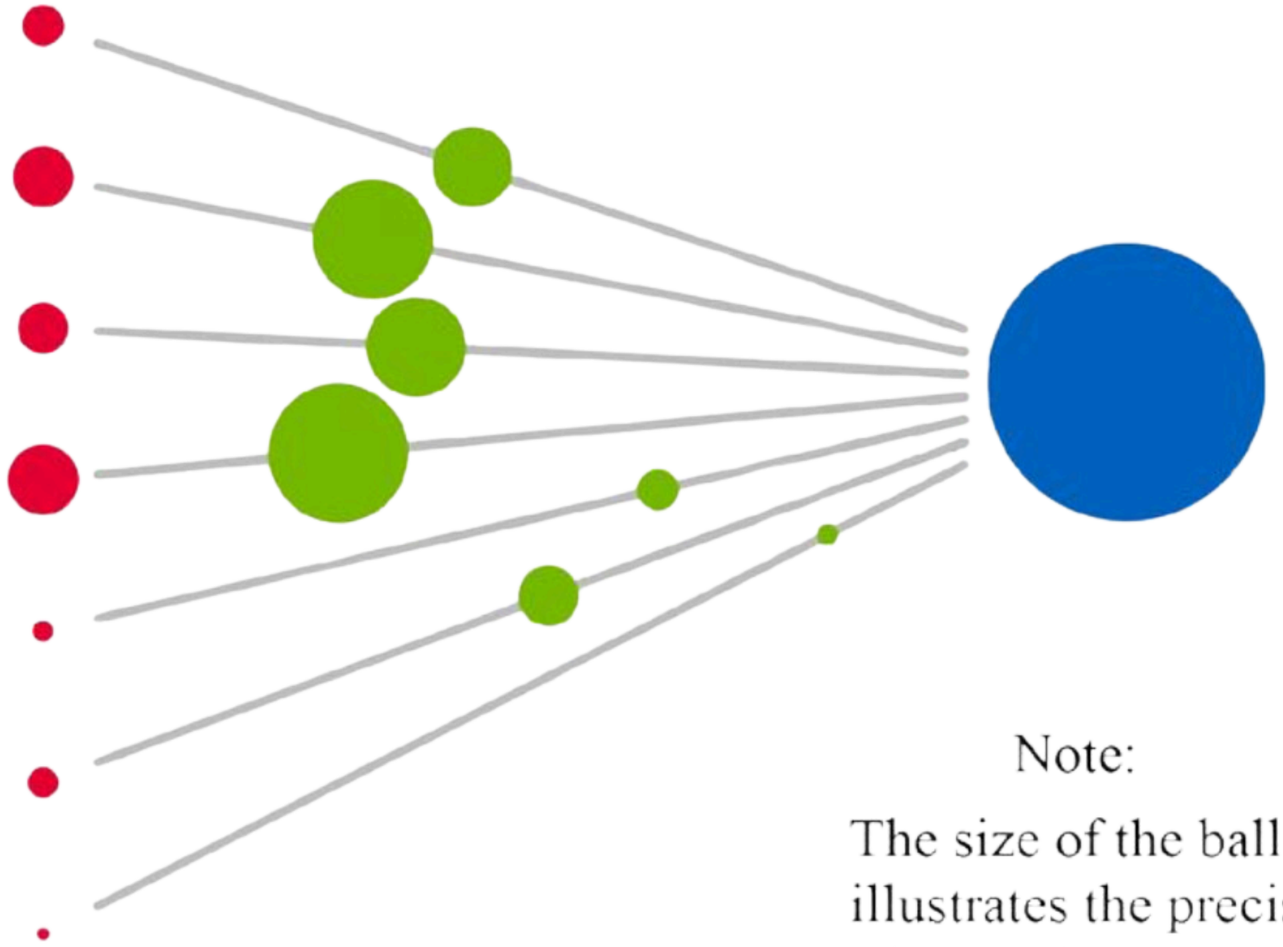
Bayesian "Shrinkage"



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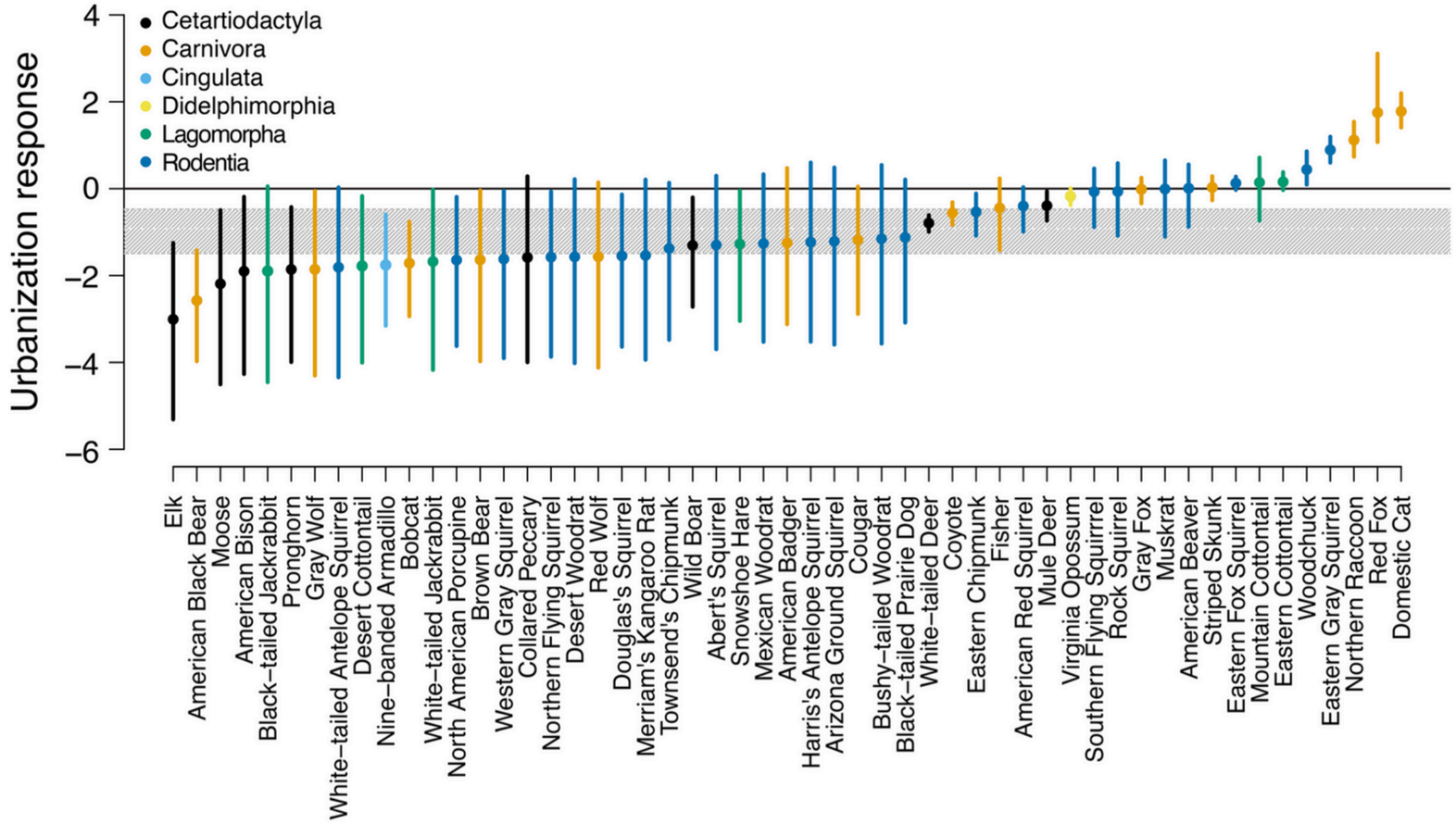

Community Effects

Include:

- Species richness
- Derivation of functional and phylogenetic diversity
- Community similarity indices
- Multi-species interactions
- Differences in alpha, beta, and gamma diversity
- And more!