10. Measuring Biodiversity: Exam Tutorial

## A quick overview of the lecture series

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Lectures

1. Introduction to measuring diversity

2. Species richness and diversity: Alpha Diversity

3. Species richness and diversity: Beta Diversity

4. Functional and Phylogenetic Diversity

5. The Assembly of Diversity: Local processes

6. The Assembly of Diversity: Regional processes

7. Biodiversity and Ecosystem Function

8. Remote Sensing of Biodiversity

Providing examples from African ecosystems as far as was possible in the time I had... ...but the theory is universal, so think about how examples or case studies introduced by other lecturers may apply here.

1. Why do we need to be able to measure biodiversity?

Figure modified from Chapin et al. 1997, *Science*
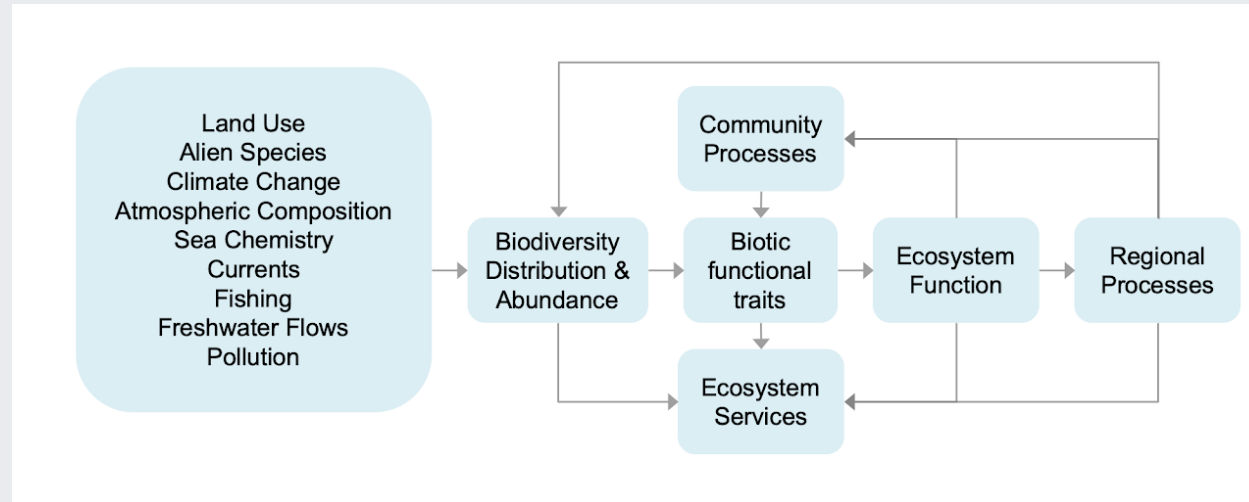
1. What determines the composition and diversity of communities and ecosystems at various scales?

2. What is the role of biodiversity in ecosystem function (and derived societal benefits)?

3. How is biodiversity changing and what are the impacts on ecosystem services?

4. How can we mitigate or adapt to changing biodiversity and ecosystem services?

1-4 (All). What is biodiversity and what is the best way to measure it?

> "biodiversity is the sum total of all biotic variation from the level of genes to ecosystems" - Purvis & Hector 2000, *Nature*
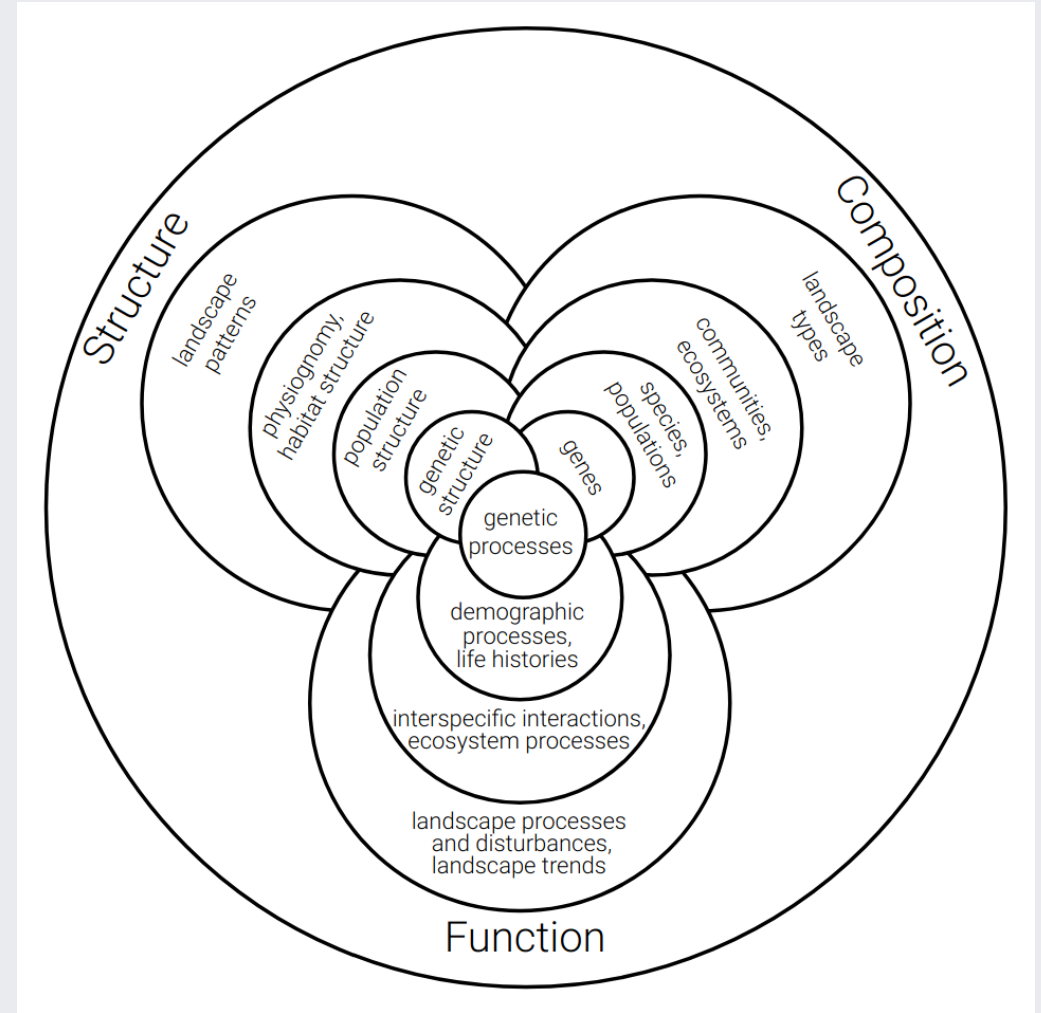

Noss 1990, *Conservation Biology*

2-3. What are the major components of biodiversity and how do we measure them?

Alpha (α) = mean species diversity/richness within local-scale sites, habitats or communities (often termed "point diversity")
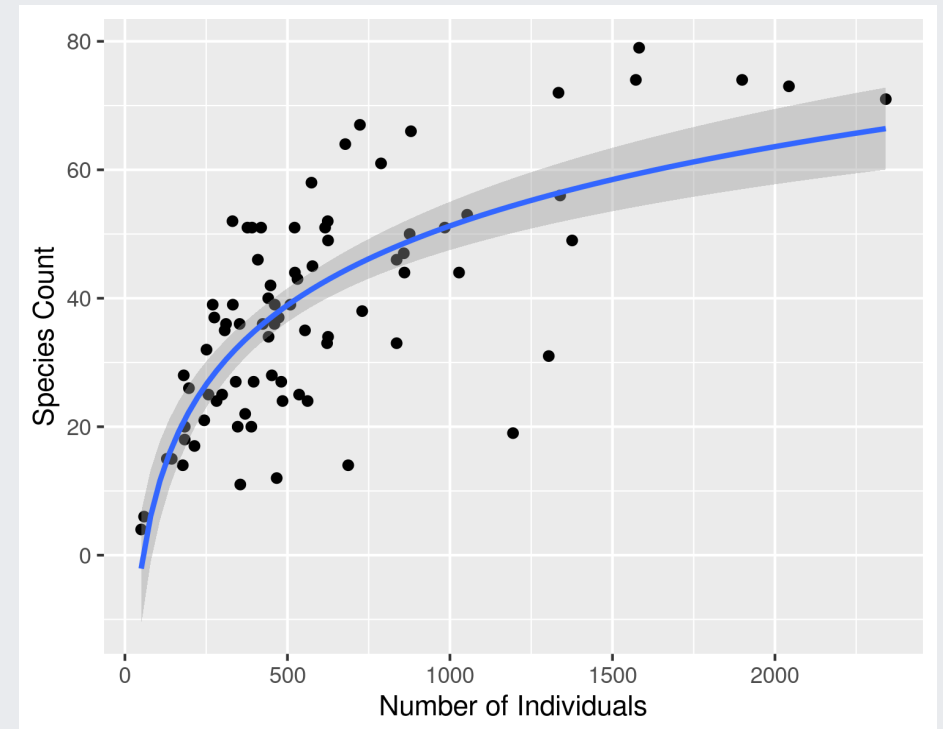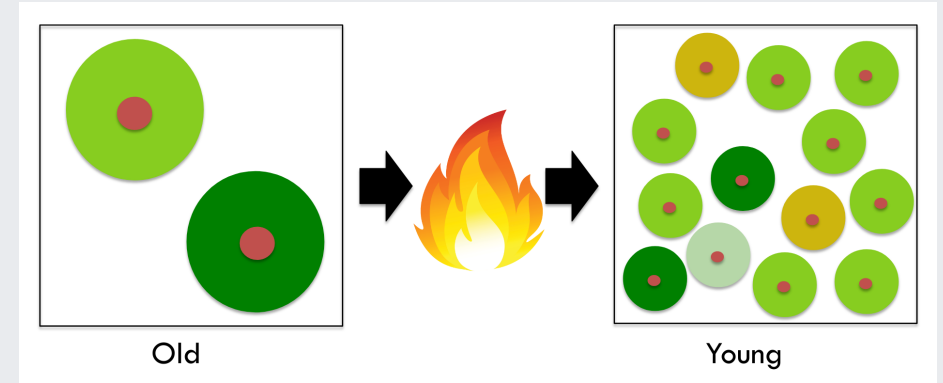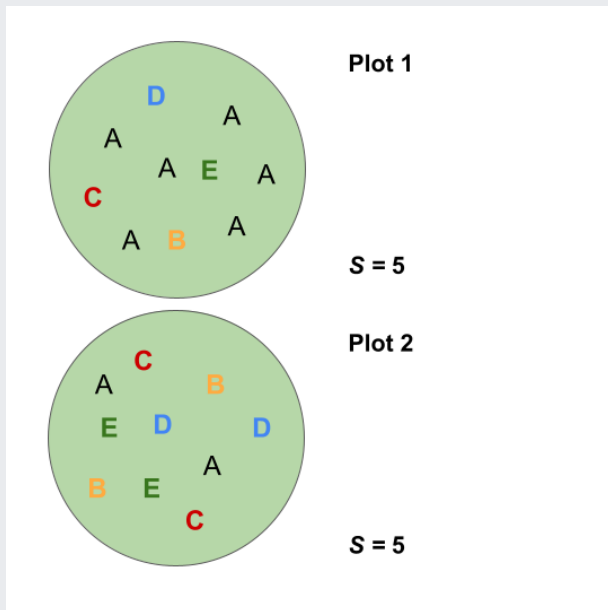
Beta (β) = diversity/richness differences between sites or habitats (attributable to species "turnover" or "nestedness")

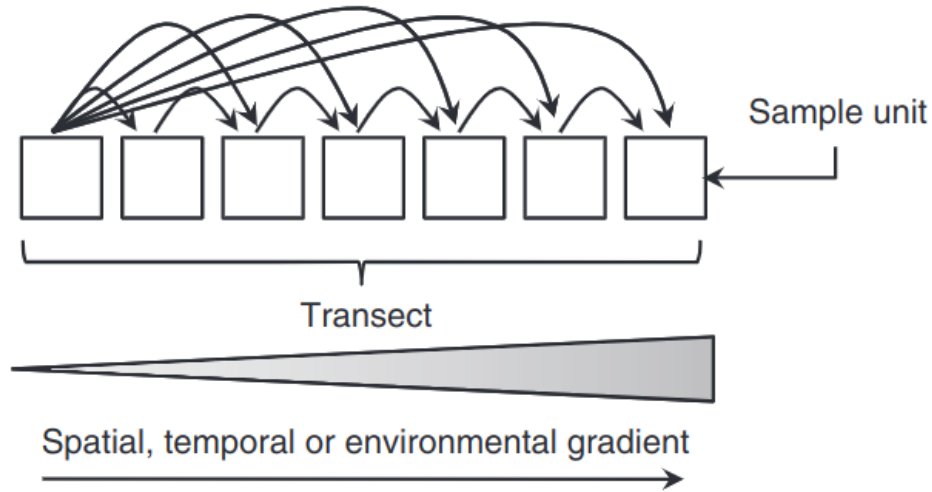Gamma (γ) = total landscape species diversity/richness
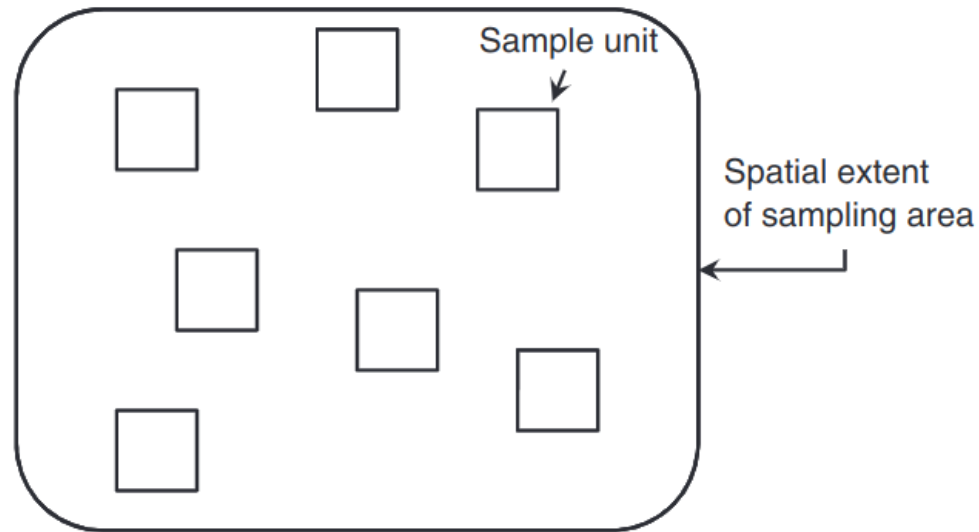
Whittaker (1972)
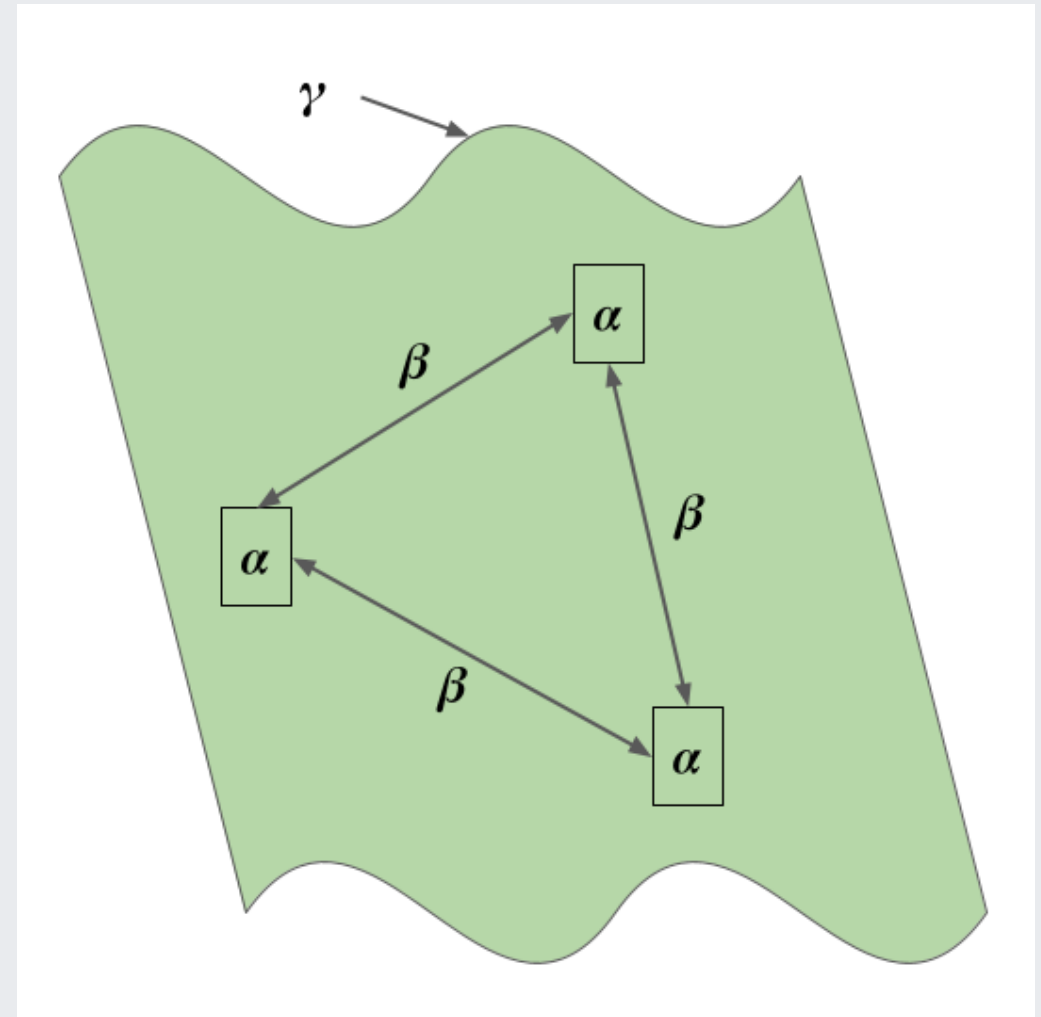
2. What are the issues when quantifying α-diversity and how can we handle them?

(a) Directional turnover in community structure — Sample unit — Transect — Spatial, temporal or environmental gradient

(b) Variation in community structure (non-directional) — Sample unit — Spatial extent of sampling area

3. Why do we measure β diversity and what questions can it be used to address?

The application β diversity can be largely split into

- directional analyses, that explore *turnover* along spatial, temporal or environmental gradients, and

- non-directional analyses, that explore *variation* within or among groups.

figure from Anderson et al. 2011

4. There's a lot of diversity in the functional form and evolutionary history of species...
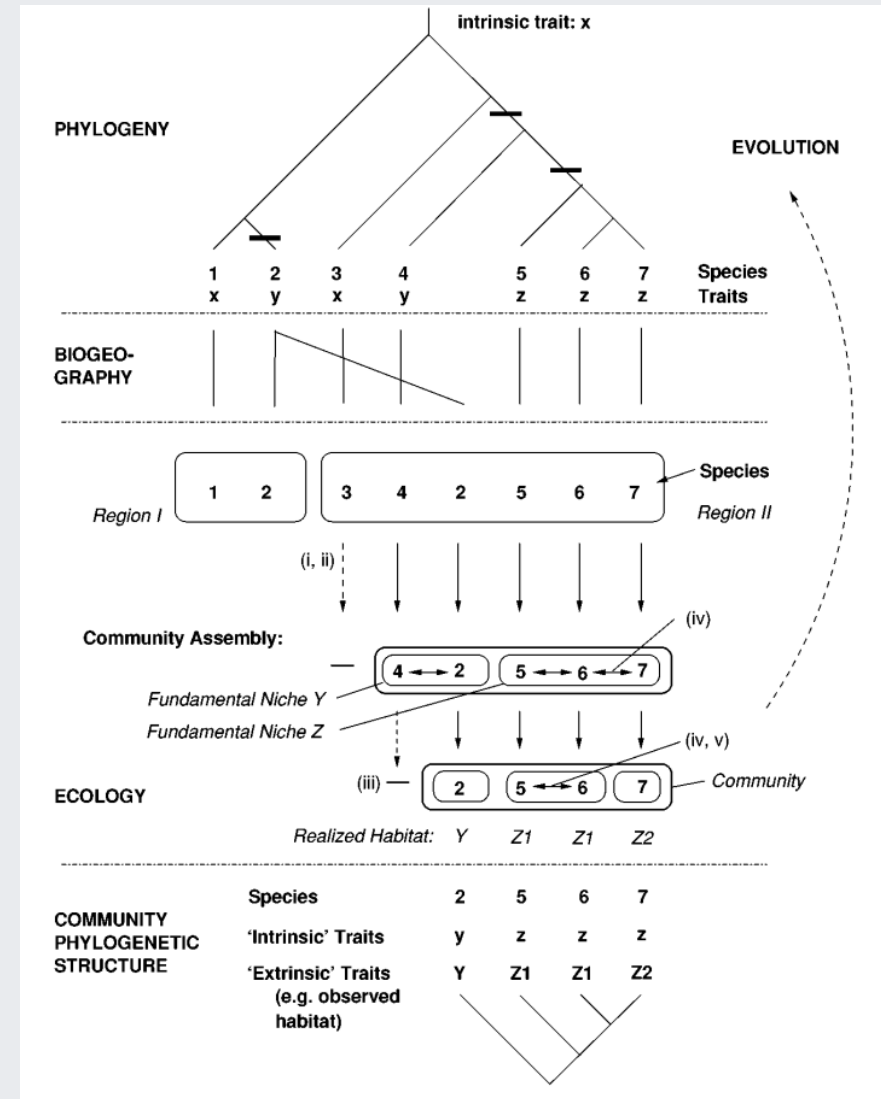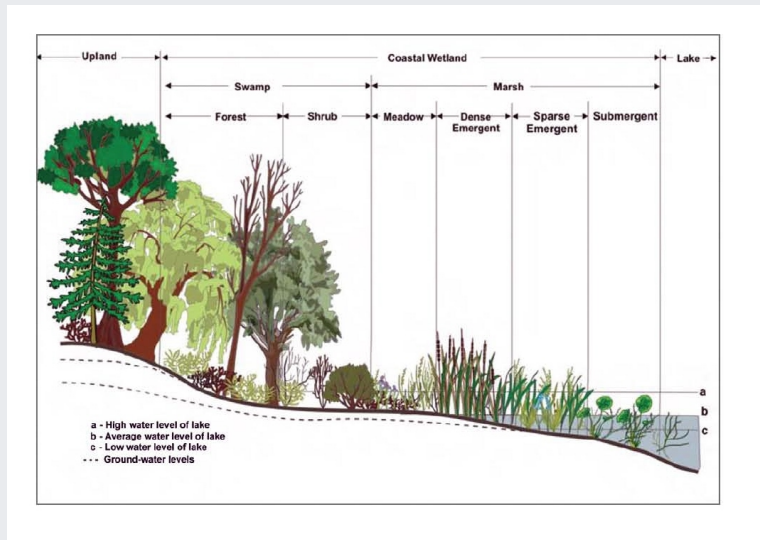

How can these be measured and how can they help us to address ecological and evolutionary questions?

5-6. What determines the assembly of species pools?

How do the processes vary with spatial and temporal scale? How can we use measures of biodiversity to infer their contribution to observed pattern?
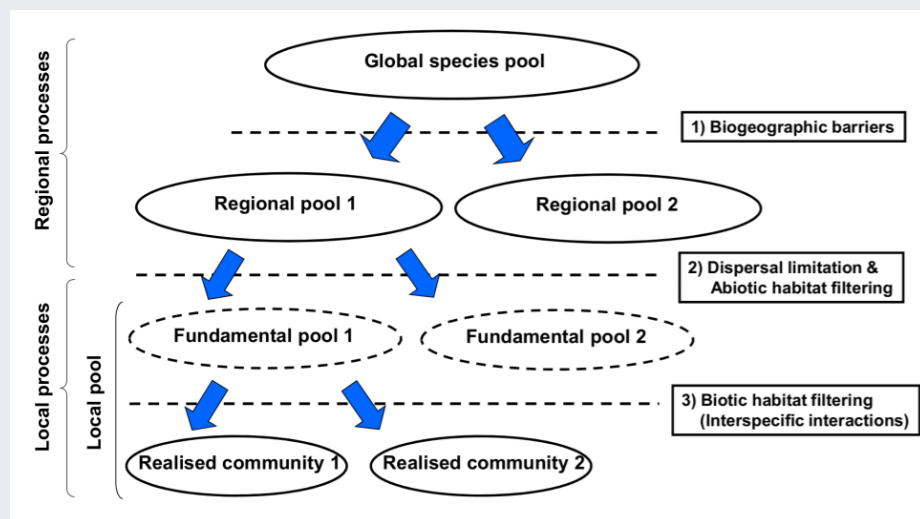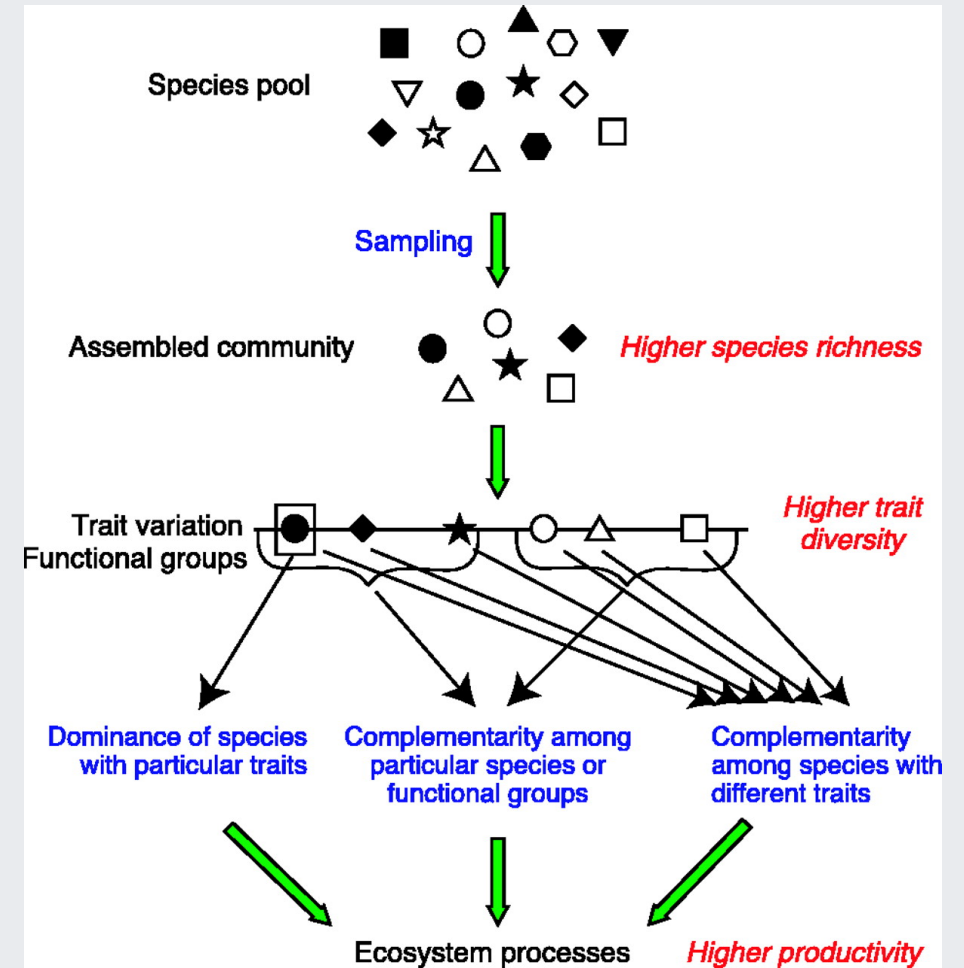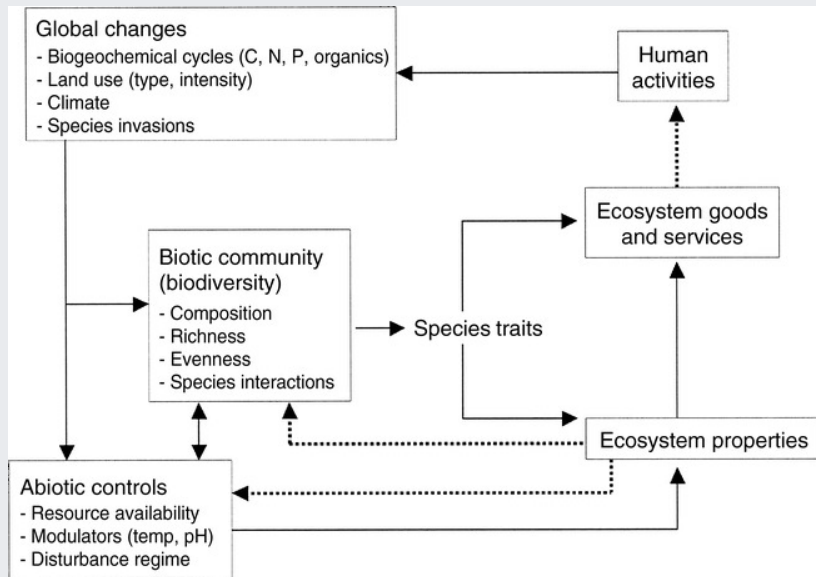

Community assembly can be thought of as the successive filtering of species pools descending in spatial (and temporal) scale from global to local
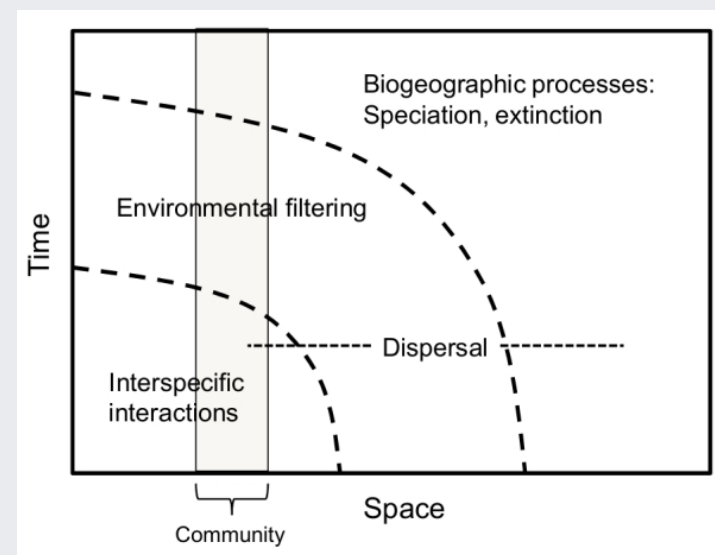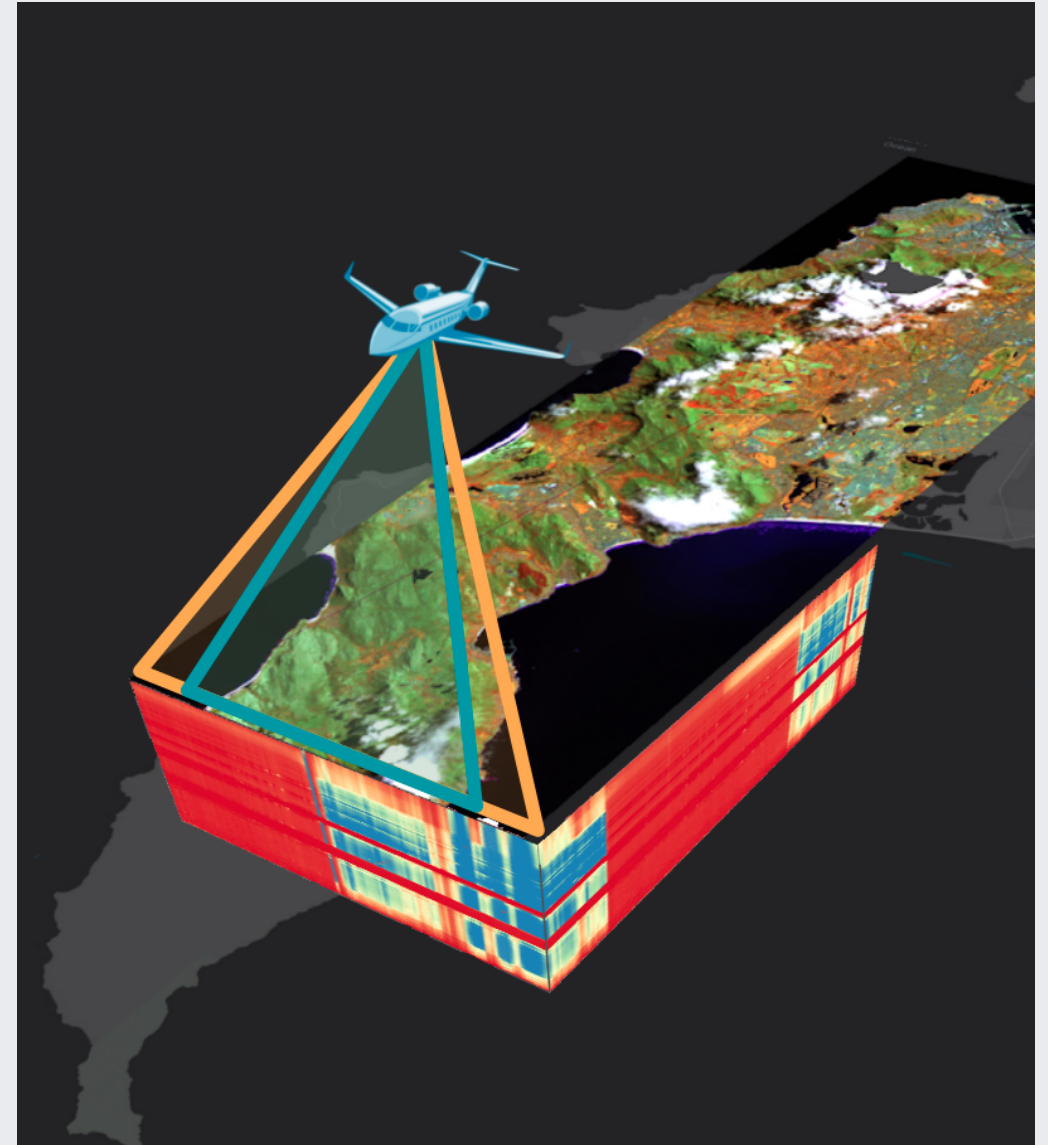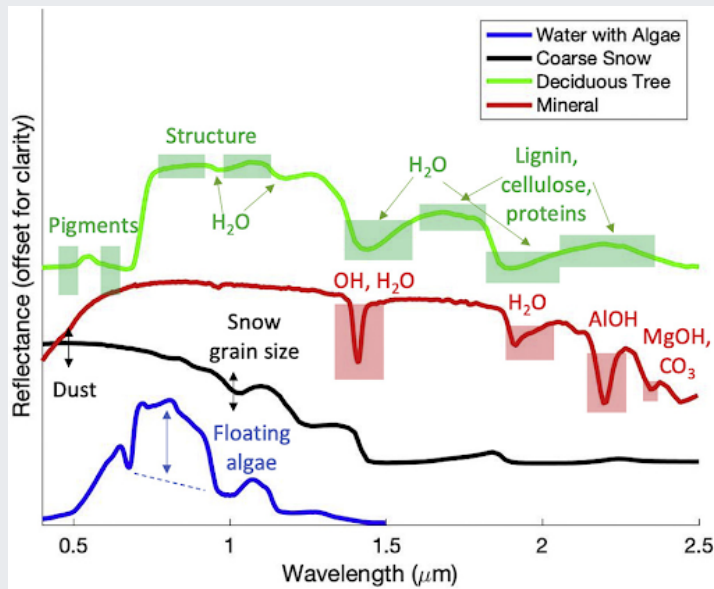

We often split it into **regional** versus **local** processes, but they are intricately intertwined...

7. What are the mechanisms by which biodiversity affects ecosystem function?

...and what are the implications of biodiversity loss?

8. What is the promise of and potential challenges for remote sensing of biodiversity?

Thanks!

Slides created via the R packages:

xaringan
gadenbuie/xaringanthemer

The chakra comes from remark.js, **knitr**, and R Markdown.