Since last meeting

Current projects

- Brachiopods
- Mammals

Time till completion

Post-doc opportunities

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Since last meeting

- Evolution 2015 talk
- GSA 2015 talk
- Chapter 1 published (PNAS)
  - Effects of biotic traits on mammal species duration
- Chapter 2 submitted (Evolution)
  - Interplay between extinction intensity and selectivity in brachiopod extinction
  - Submitted early October, still in review?
- Did not submit DDIG

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Regional patterns in the diversification of Paleozoic brachiopods

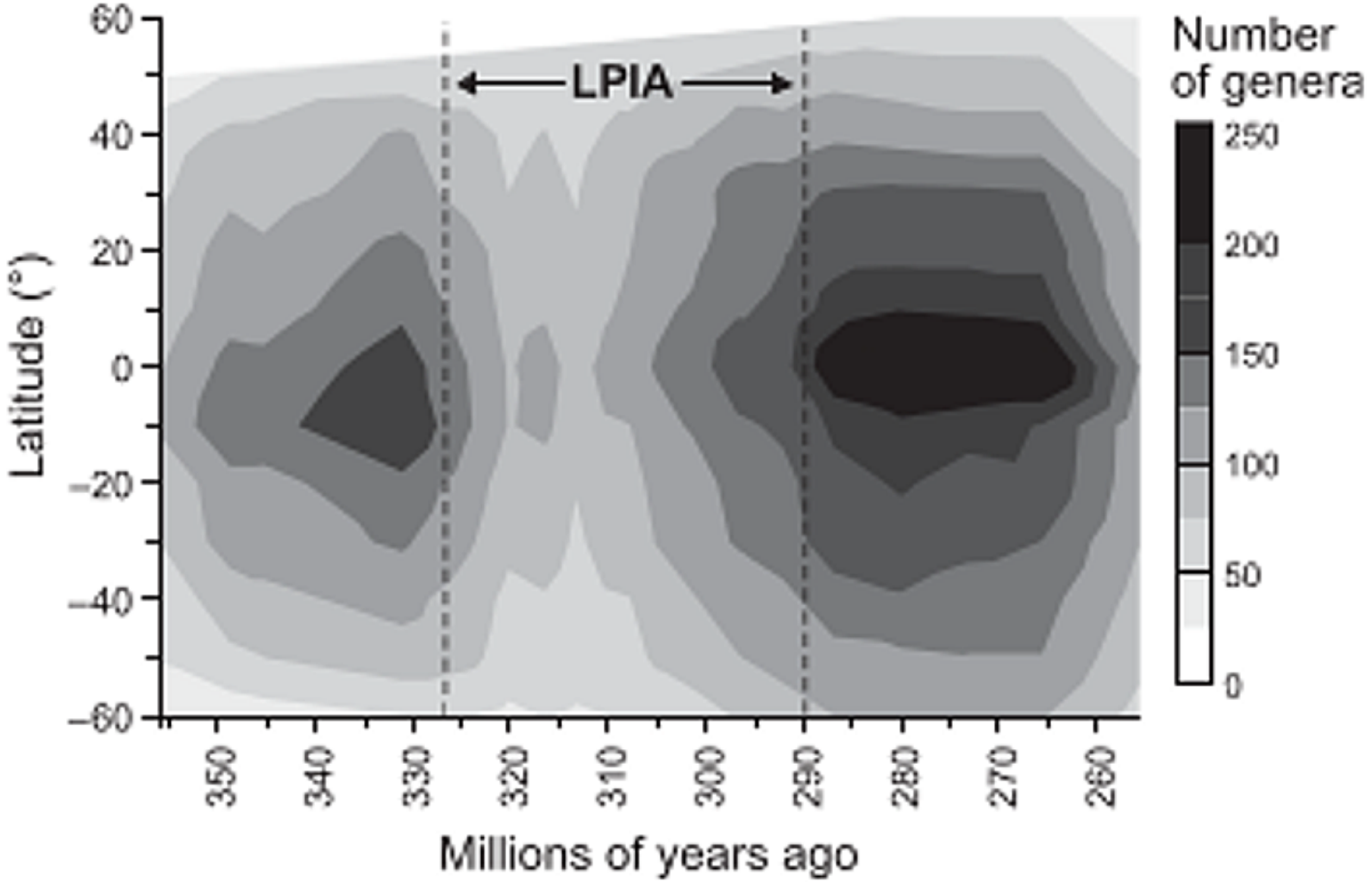
Question

How does differential taxonomic entrance and loss contribute to regional (e.g. latitudinal) diversity?

Motivation

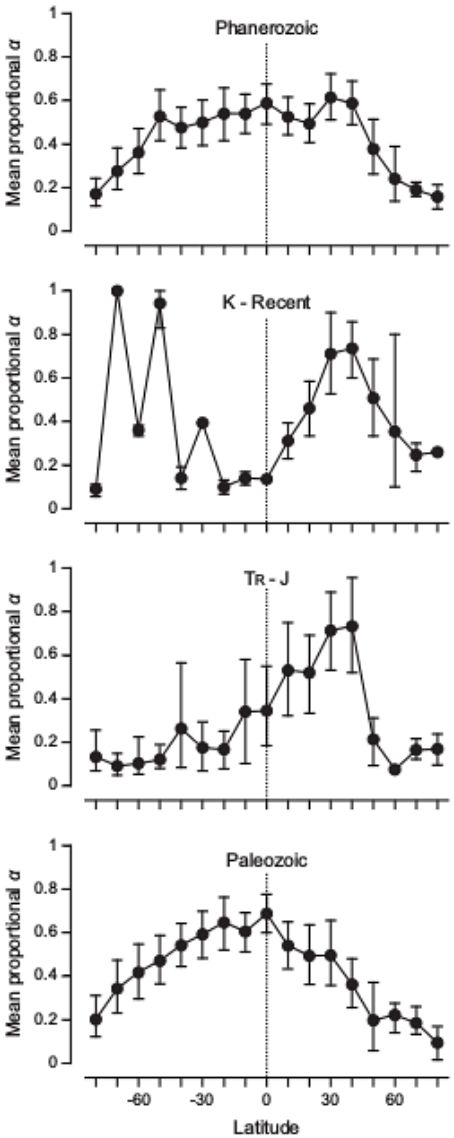
- latitudinal diversity gradients
  - through lense of a diversification process
- regional as opposed to global
  - variation within regions may not match global pattern (more biologically relevant?)
  - partial follow up to brachiopod survival work

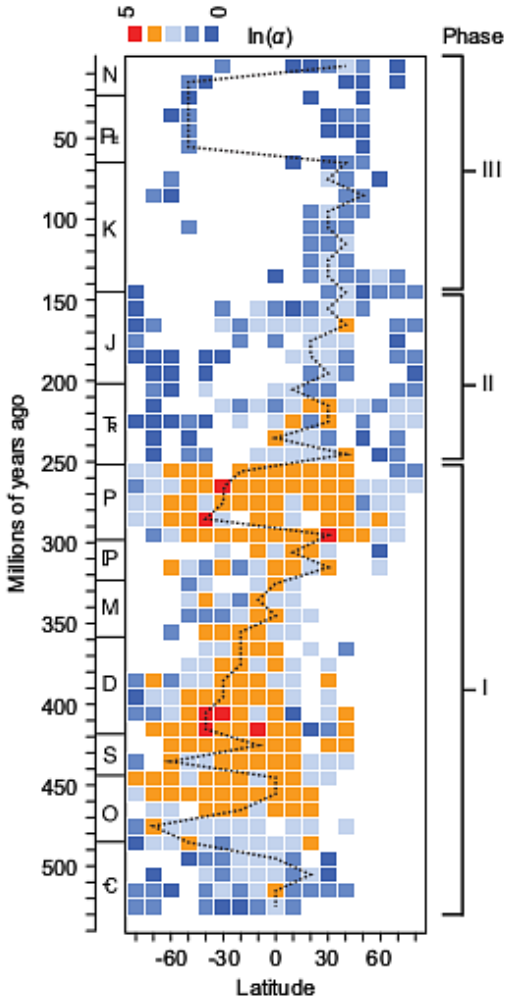
Brachiopod latitudinal diversity



(Powell 2007 *G. Eco. Biogeo.*)

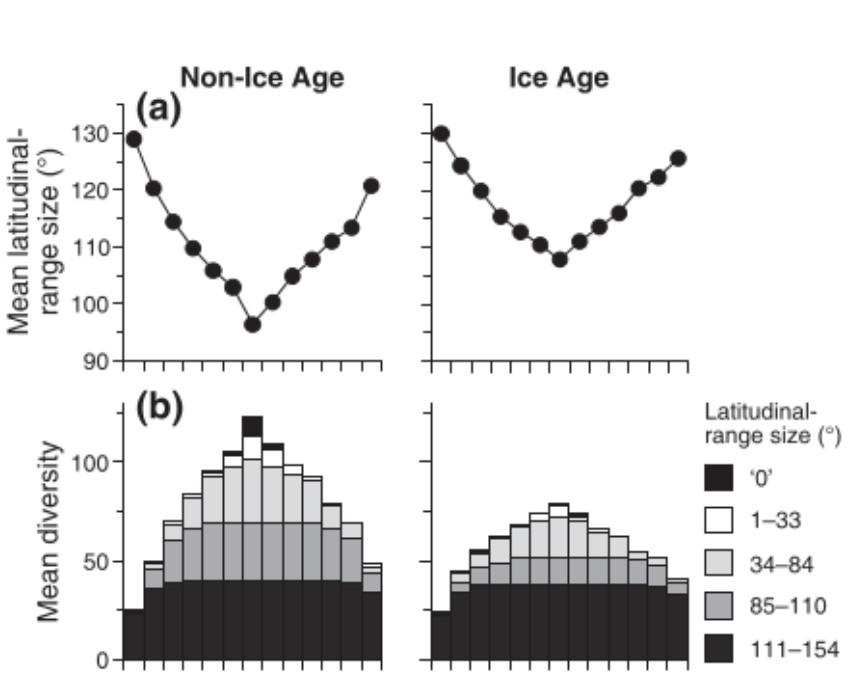
Variation in biversity gradient

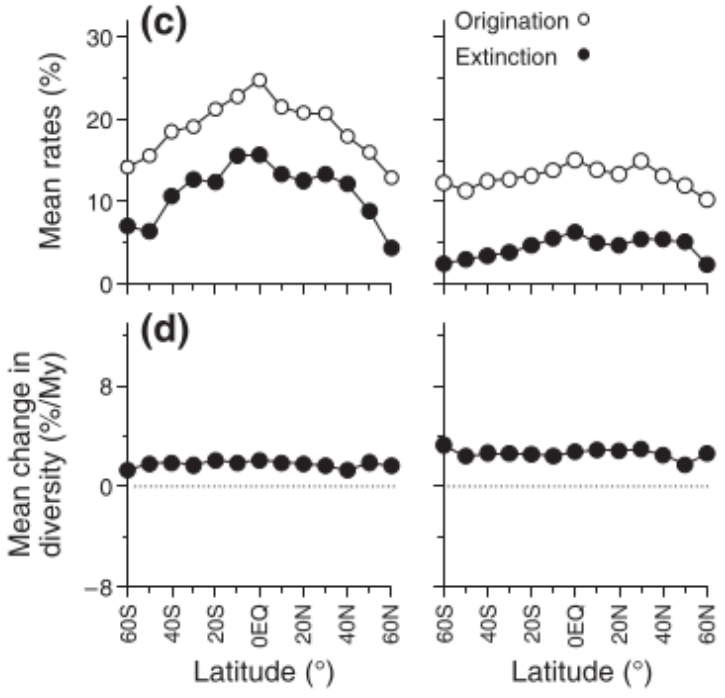




(Powell *et al* 2015 *Paleobio.*)

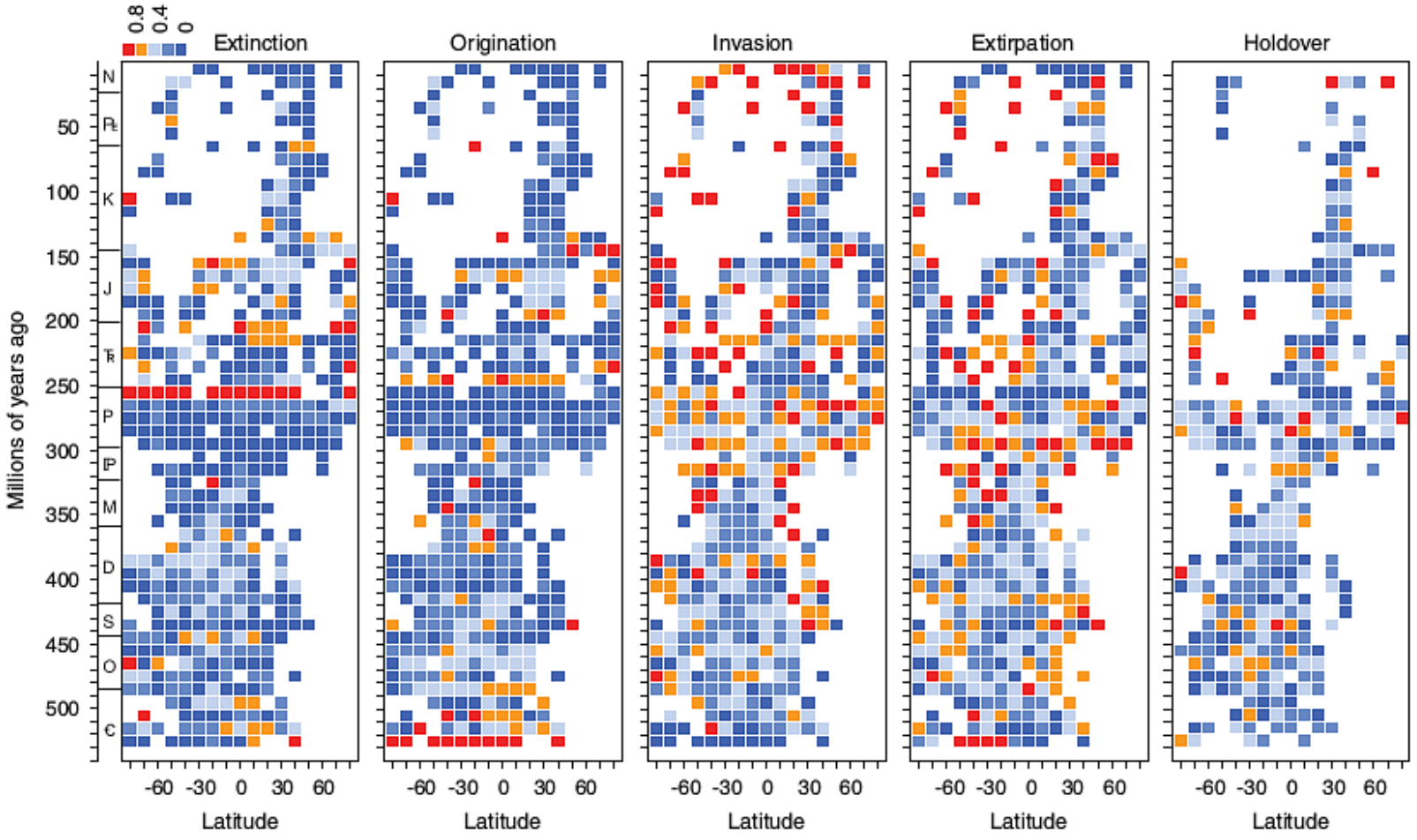
“Modes” of latitudinal diversity





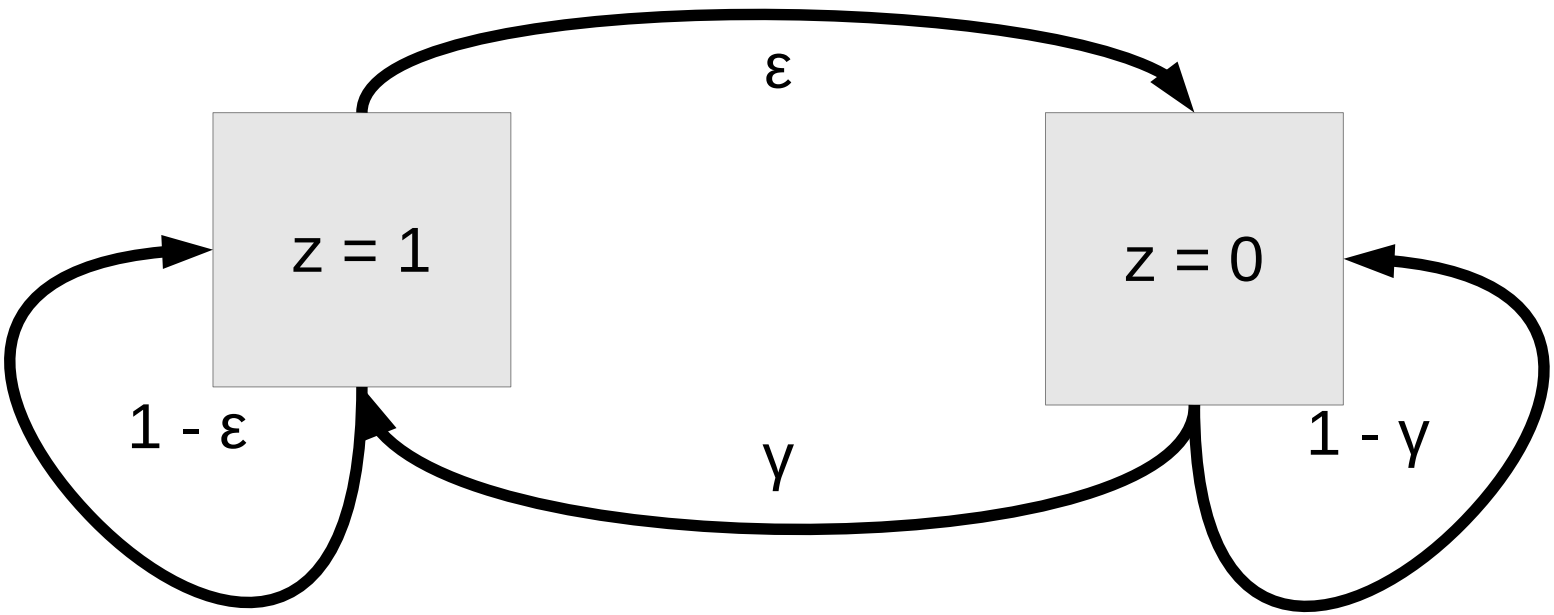
(Powell 2007 *G. Eco. Biogeo.*)

Purported changes in diversity

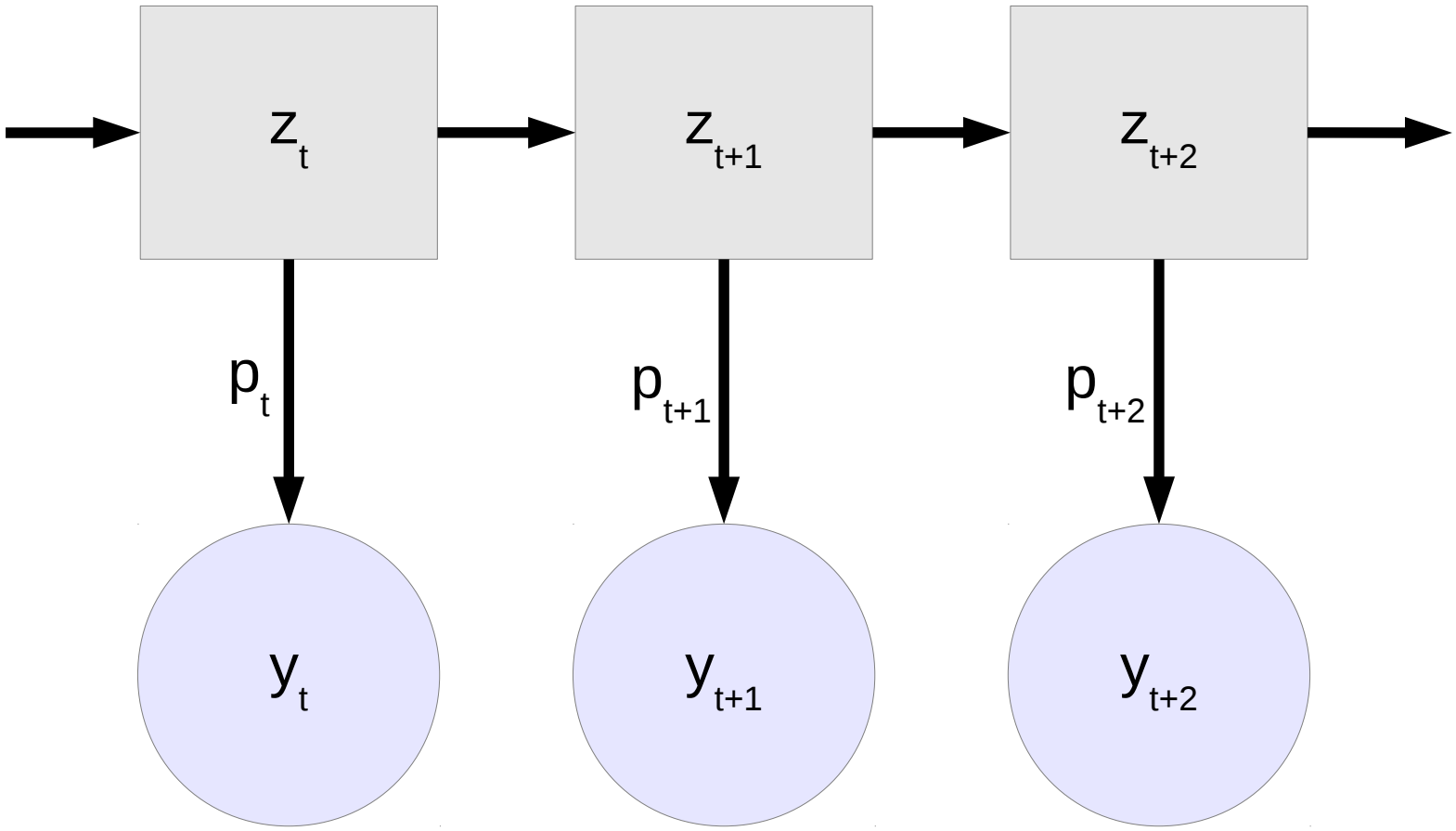


(Powell *et al* 2015 *Paleobio.*)

Model structure: Markov model



Model structure: Markov model



Major assumptions

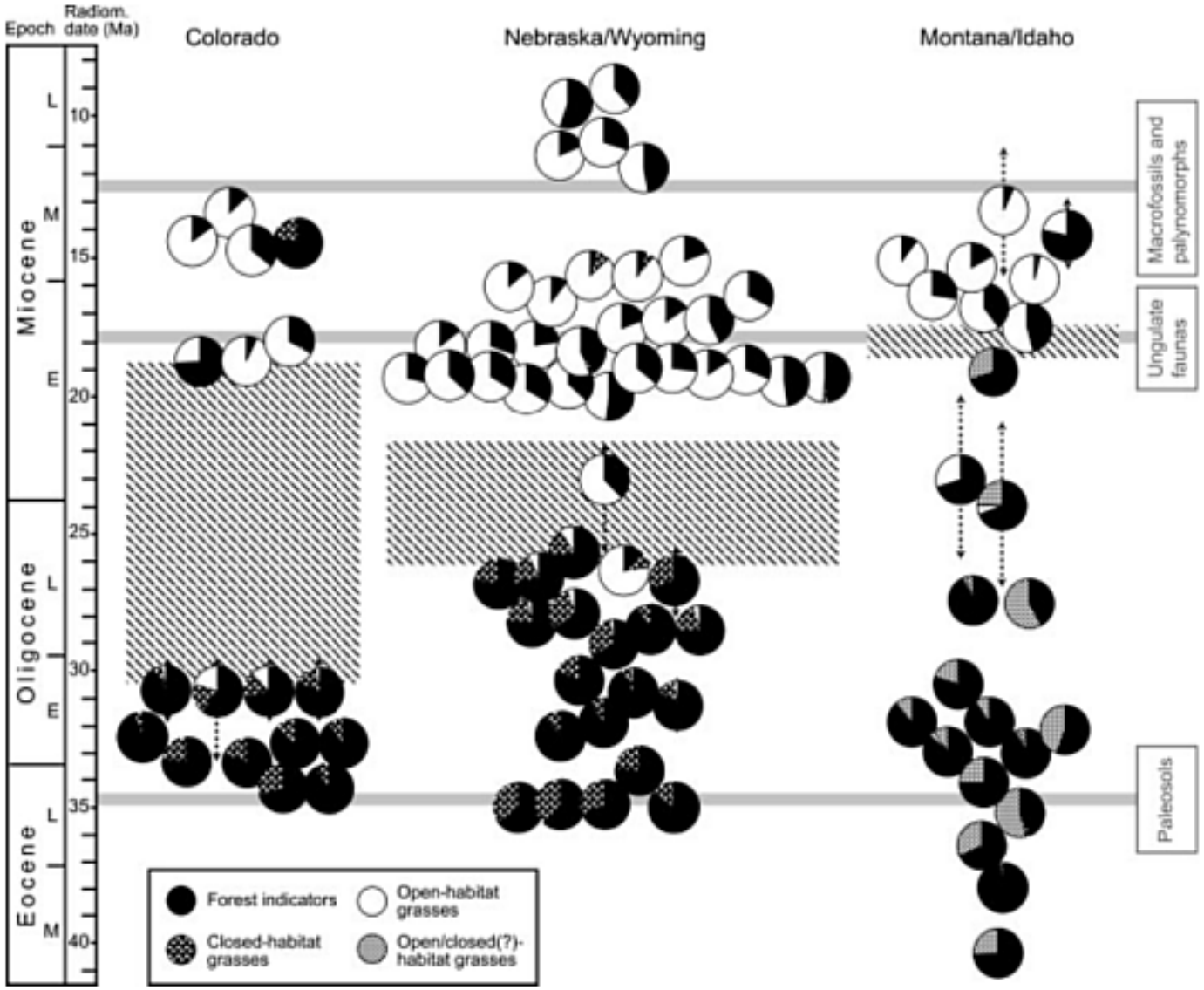
- model is only a first-order Markov process
  - can lead to some taxa existing longer than in actuality
- any taxon can occur in any geographic unit independent of other units
- possibly controlled for by sampling rate through time
  - further assumes all times and places can be considered similar
- relaxing this assumption is extremely parameter intensive

Changes in Cenozoic mammal ecotype composition

Question

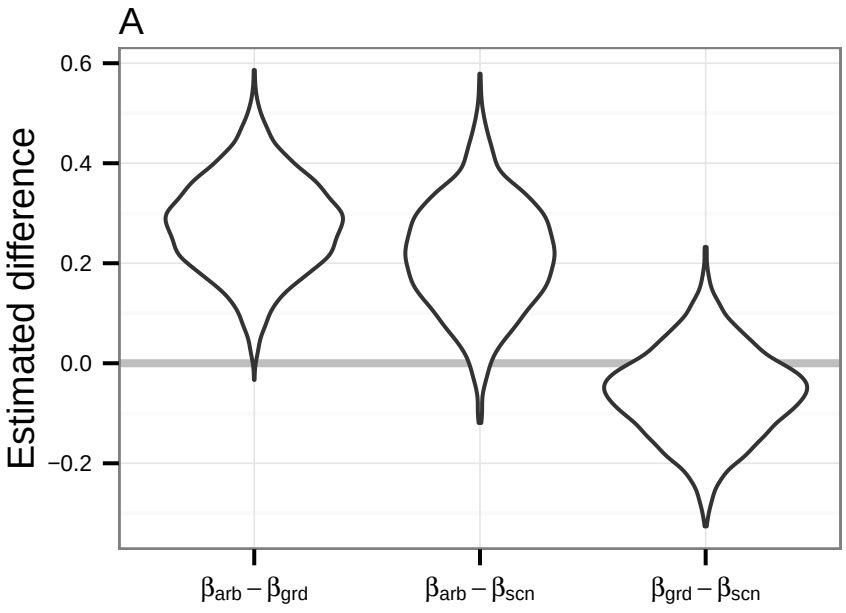
How do occurrence ratios of mammalian ecotypes change over time?

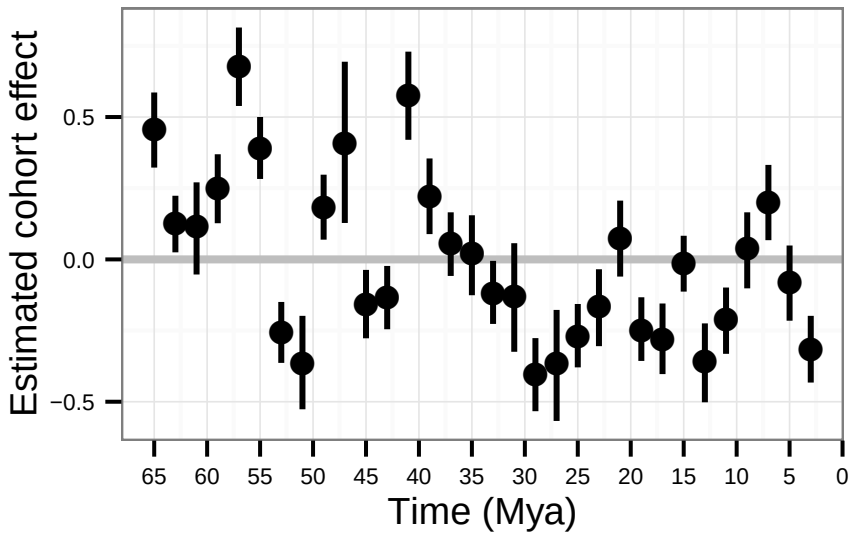
Environmental shift



(Stromberg 2005 *PNAS*)

Possible link?





(Smits 2015 *PNAS*)

Multi-logit regression

$$
\begin{aligned}
y_i &\sim \text{Categorical}(K, \pi) \\
\pi_k &= \frac{\exp(\beta_{k,j[i]} X_i + \lambda_k)}{\sum_{k=1}^{K} \exp(\beta_{k,j[i]} X_i + \lambda_{k,i})} \\
&\text{where } \beta_{K,j[i]} X_i + \lambda_{K,i} = 0 \\
\lambda_k &\sim \text{MVN}(0, \tau_k^2 \Sigma) \\
\beta_{k,j} &\sim \mathcal{N}(\beta'_k, \sigma_k)
\end{aligned}
$$

Further developments

- NOTE technically no phylogenetic effect for $k = K$
- increased categorization (e.g. frugivory)?
- covariates (e.g. body size)?
- time order is not currently modeled; all times exchangable
- observed taxa represent a proportional sample of reality
  - how can this be overcome in a model based framework?
- improve "phylogeny"; I should do better than Smits 2015.

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Things to consider

- TAing
  - Spring quarter (expected)
  - next year?
- Funding?
  - FMNH fellow, but I don't spend time at the museum.

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