Diversification in Space and Time:
Using phylogenies to understand the formation of species assemblages

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Why Care?

1. How do species assemblages form?
2. What are the properties of colonising lineages?
3. Do colonisation rates decline over time?
4. Are colonisation and speciation rates independent?

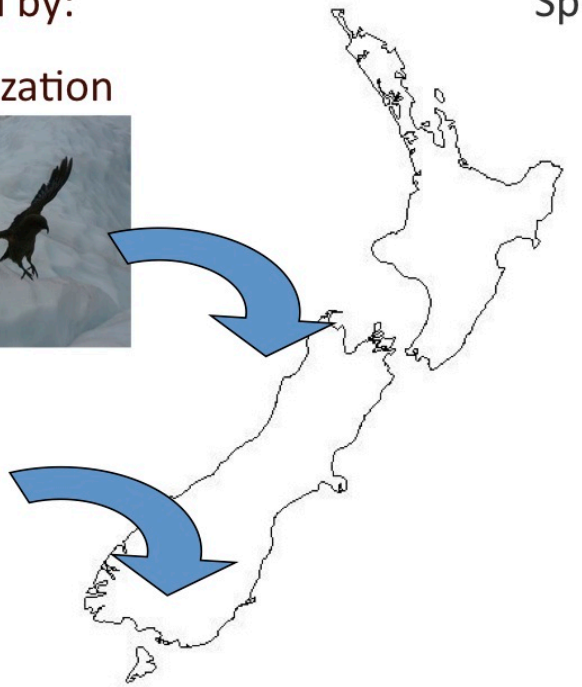
Species Assemblages

'species assemblage' is a neutral term for the species found in a defined location

Species are added by:

1. colonization

2. speciation

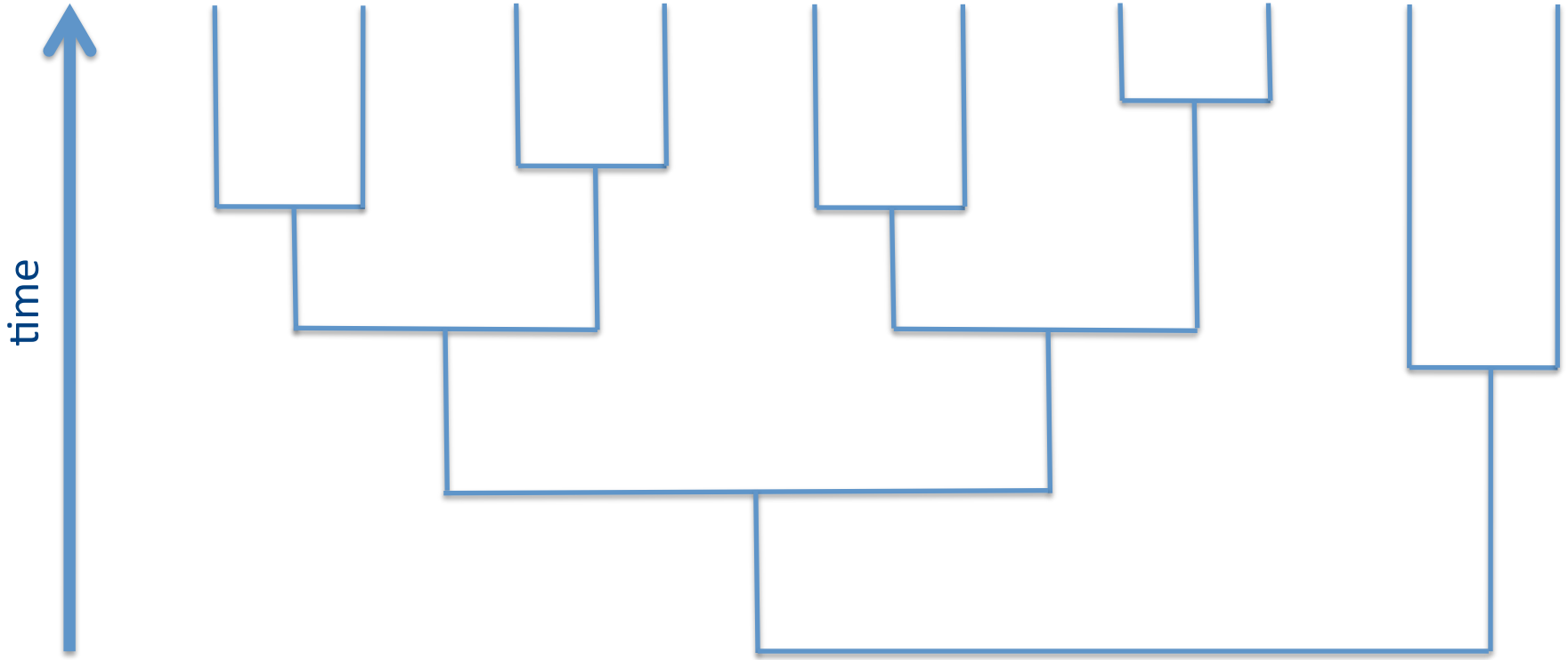


Species are subtracted by:

3. extinction

Species Assemblages

What can phylogenies do for us?



Species Assemblages

What can phylogenies do for us?

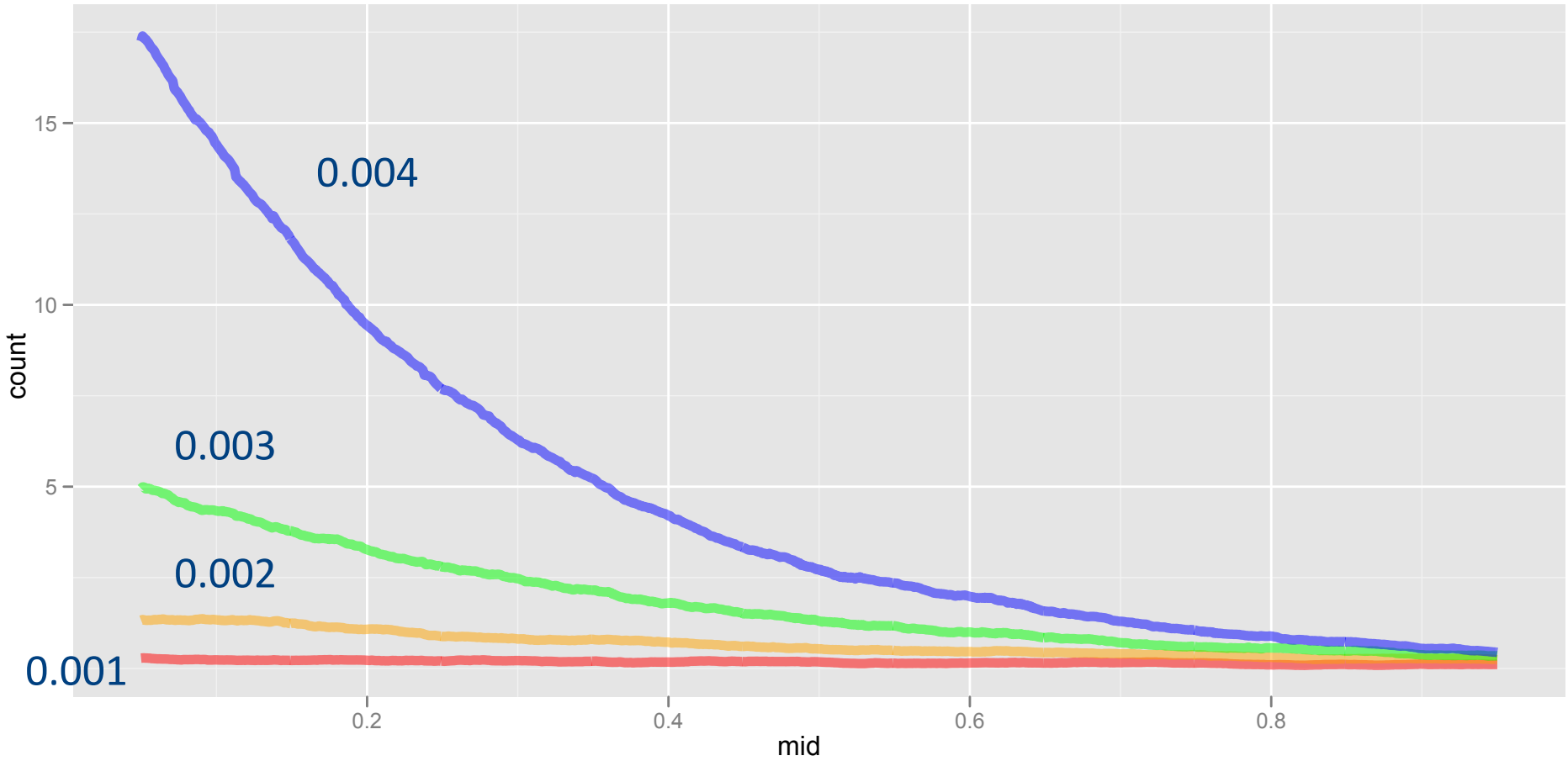
1. Tell us when in-situ diversification events and colonisation events happened

2. Allow us to compare different models of colonisation and diversification

Work in progress*

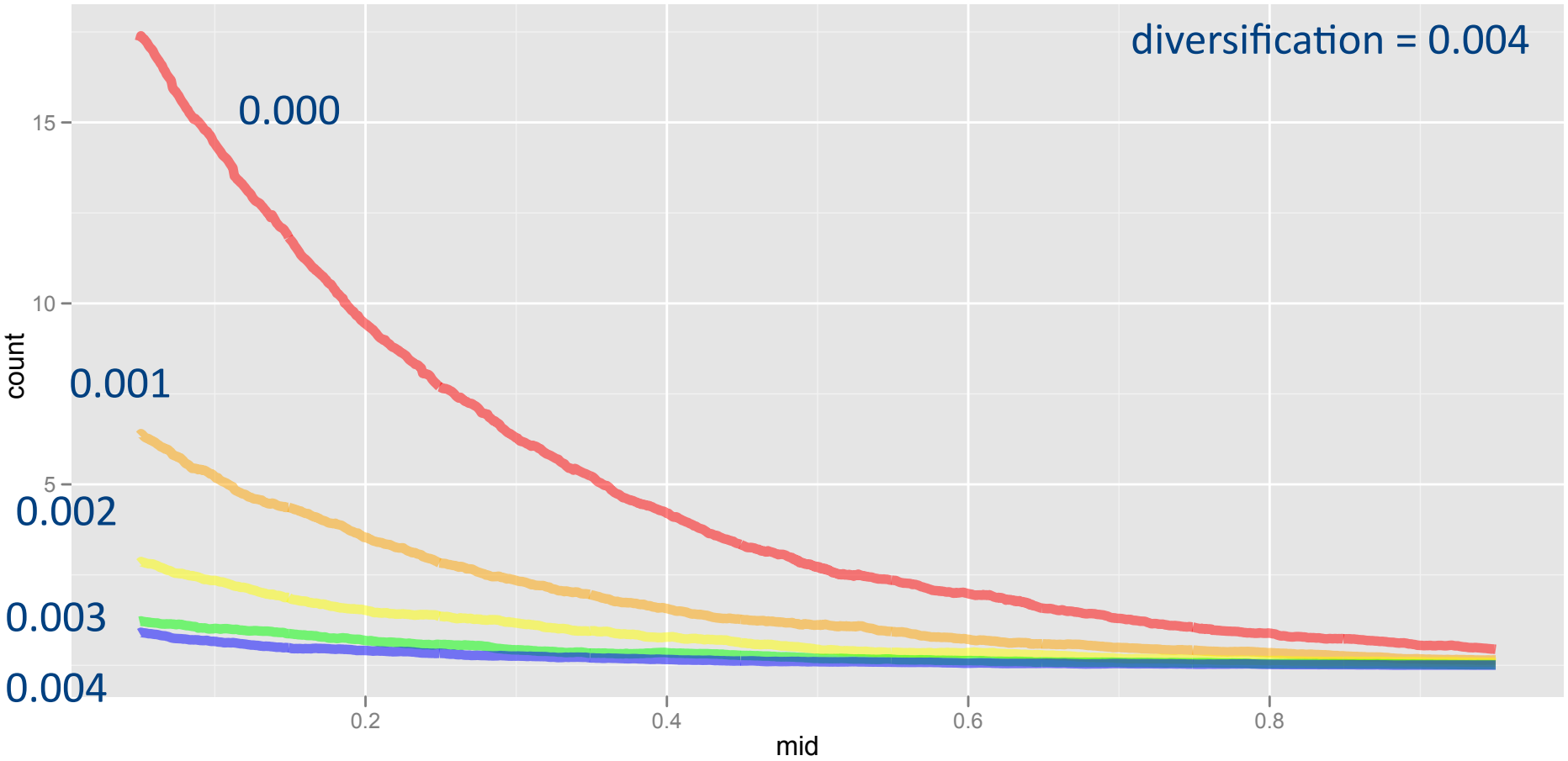
Null Models

Expected arrival rate of extant species, with diversification,
but no colonisation or extinction



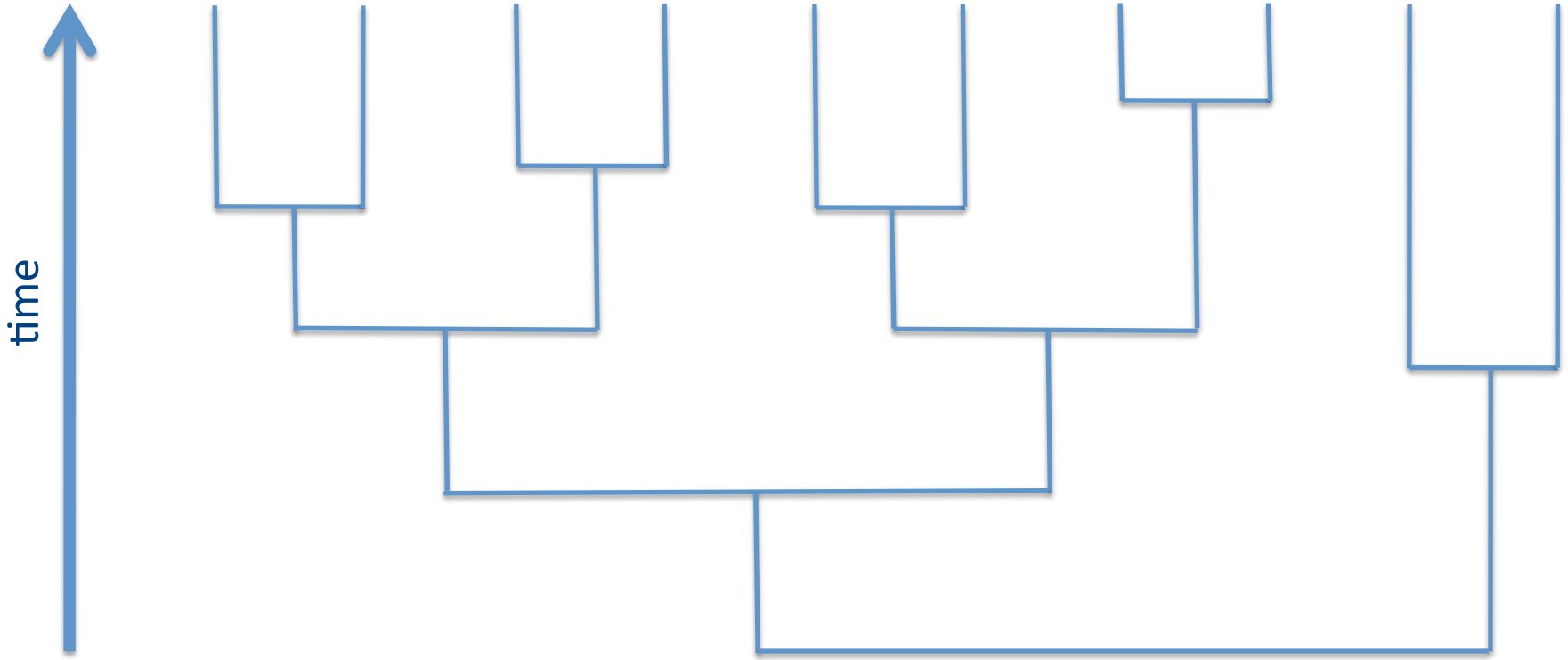
Null Models

Expected arrival rate of extant species, with constant diversification rate, variable extinction rates, and no colonisation



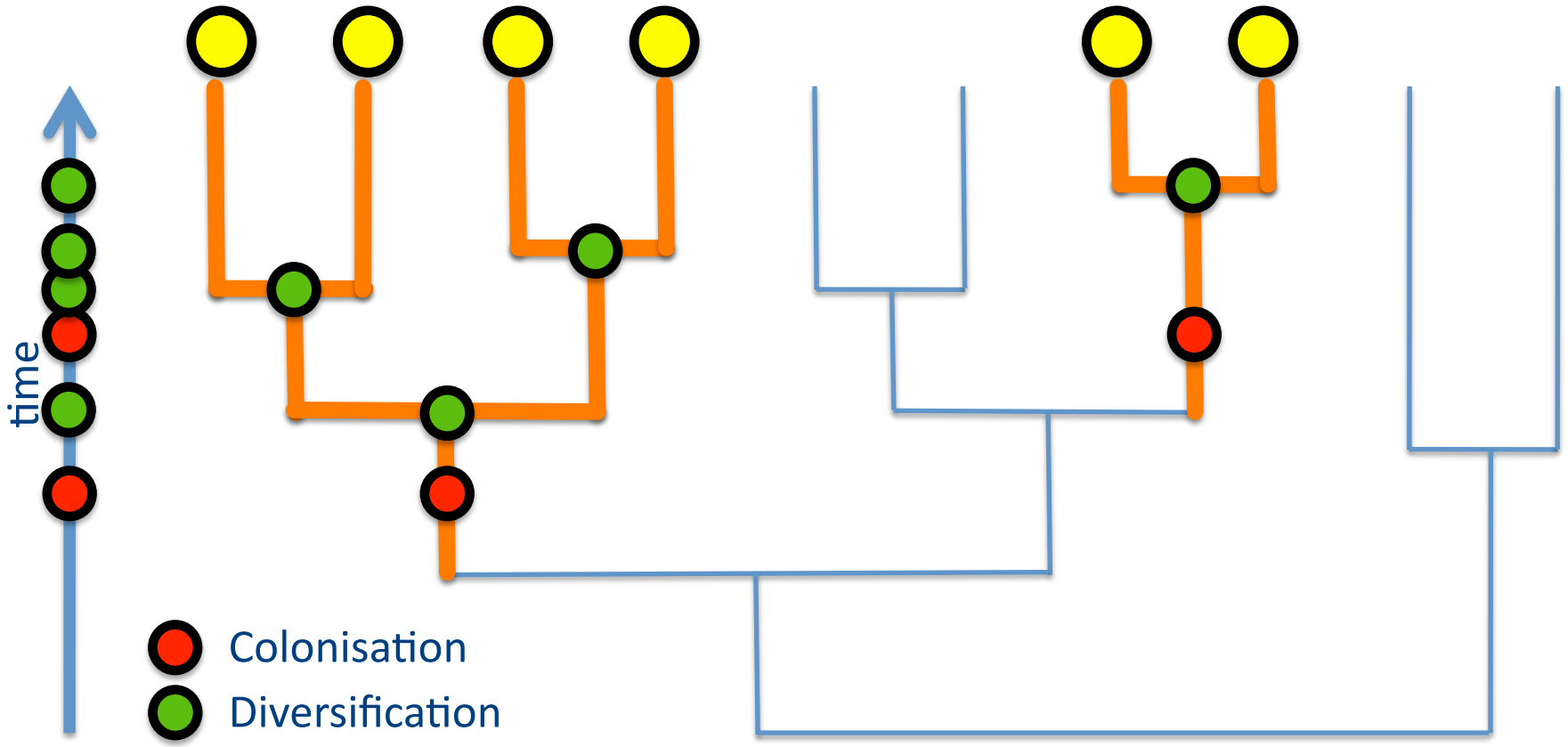
Species Assemblages

What can phylogenies tell us about these processes?

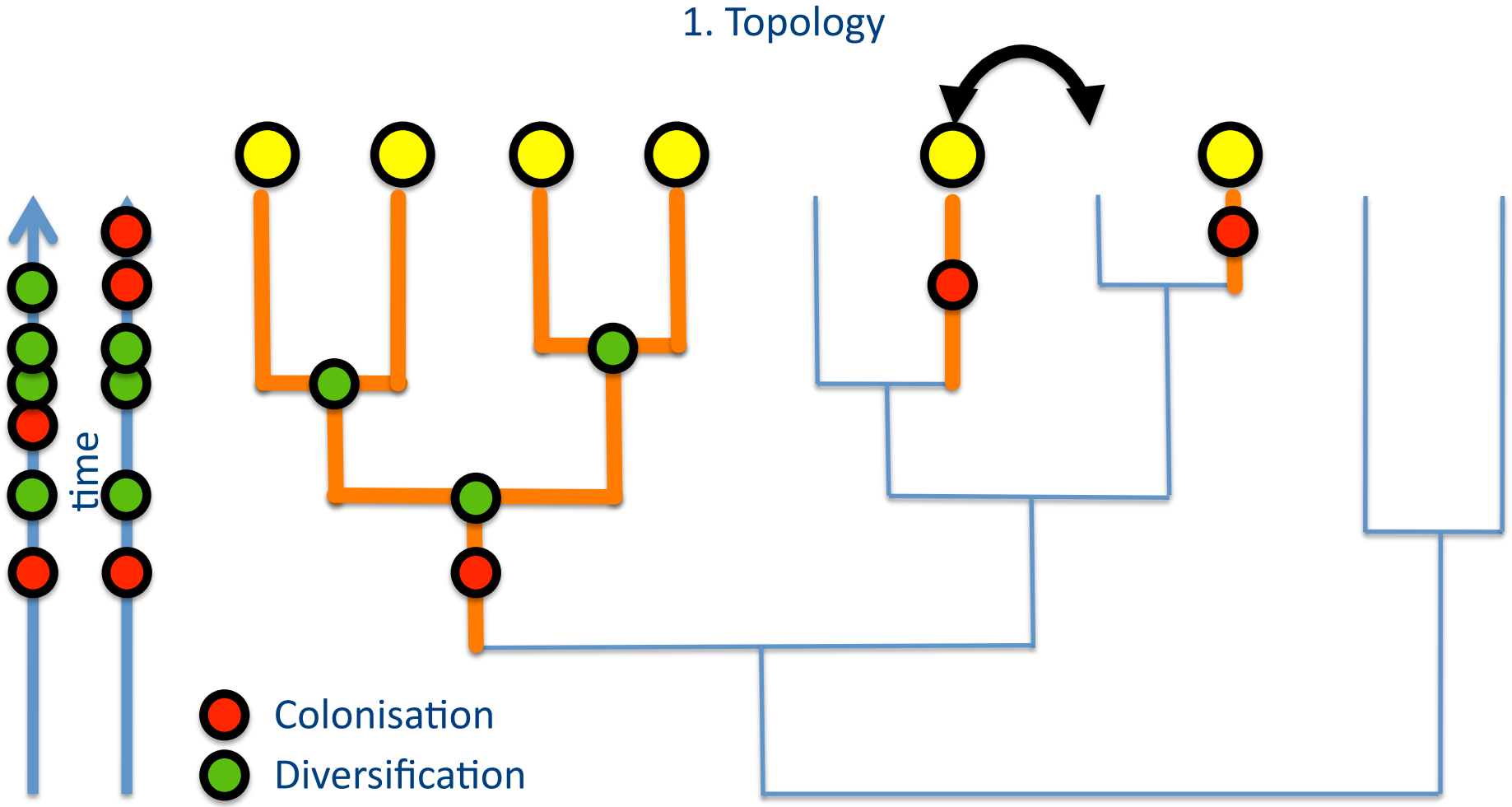


Species Arrival

What can molecular phylogenies tell us about these processes?

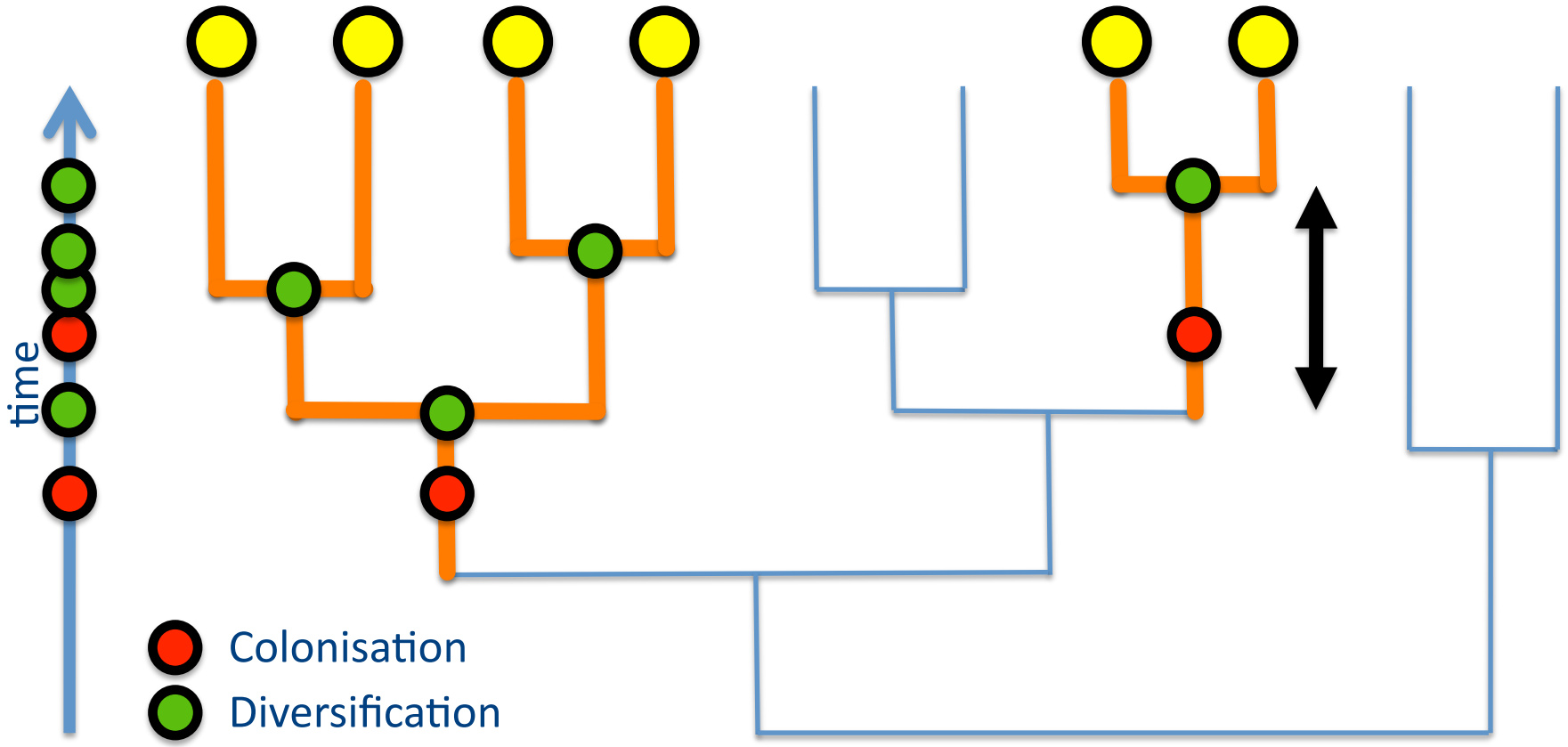


Sources of Uncertainty



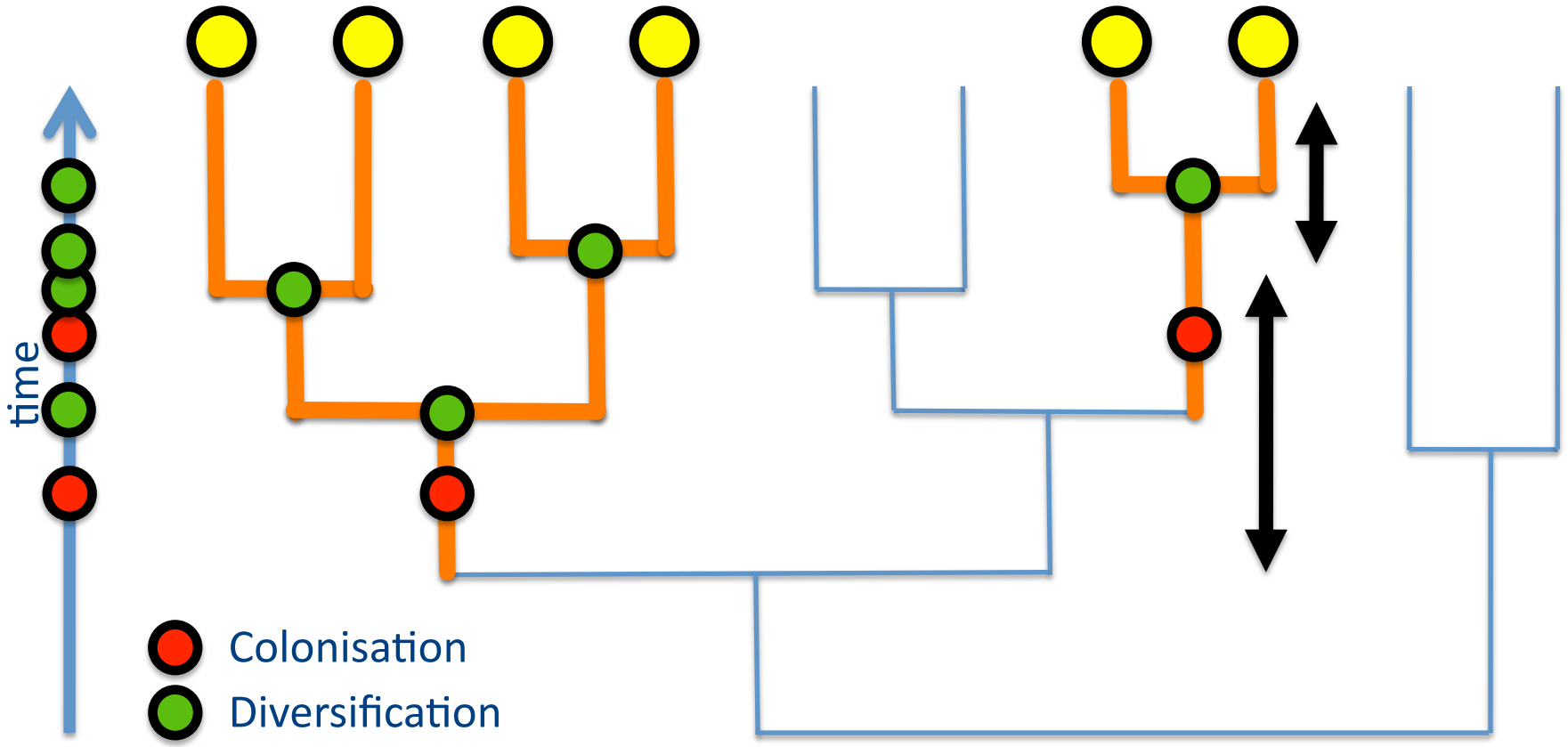
Sources of Uncertainty

2. Colonisation times



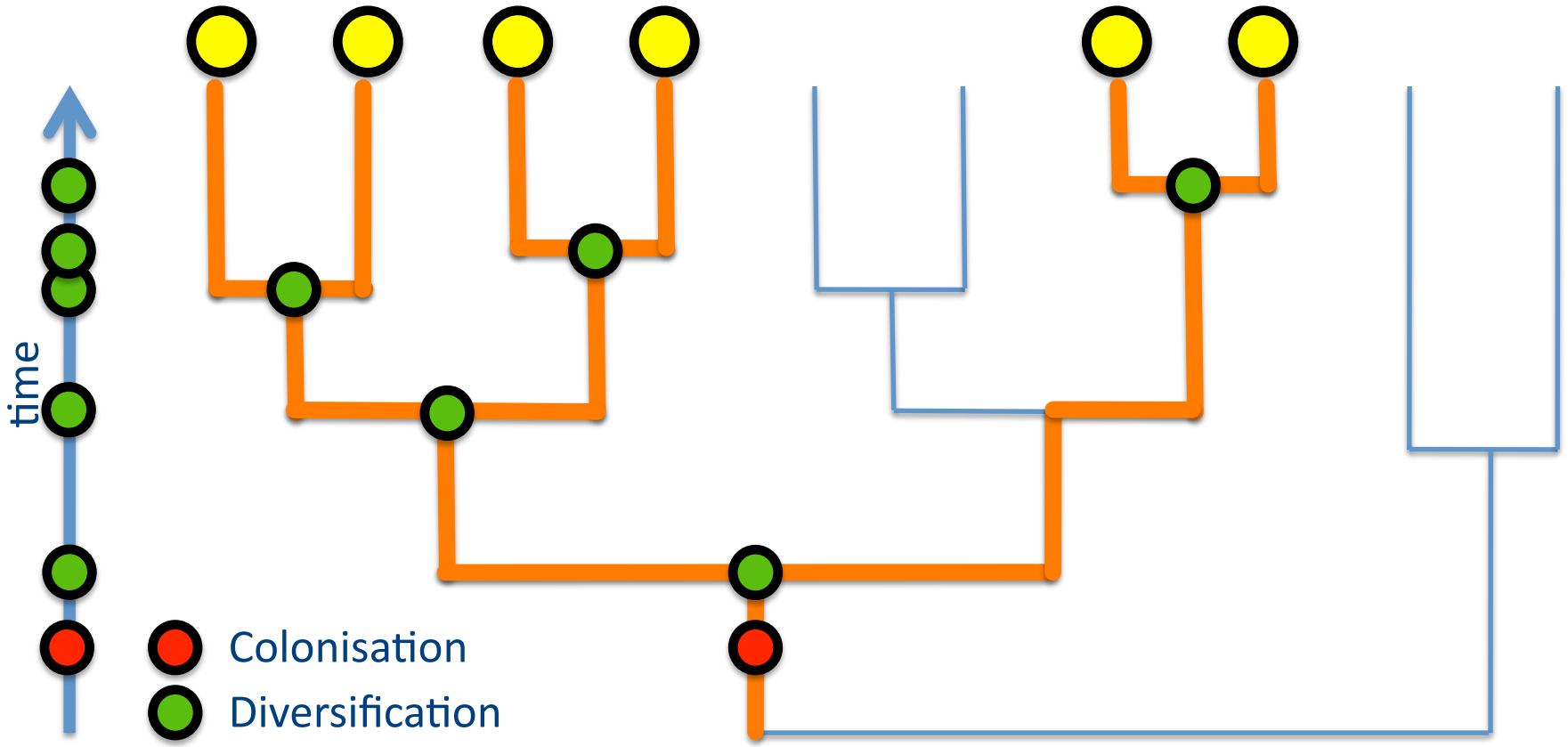
Sources of Uncertainty

3. Node heights



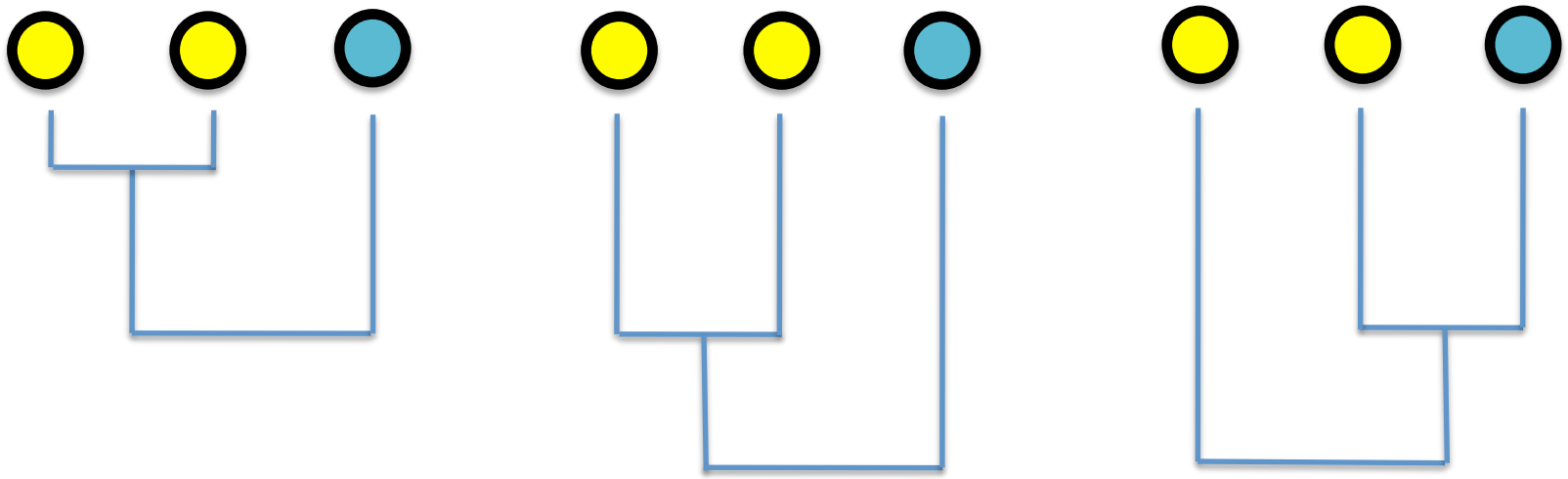
Sources of Uncertainty

4. Ancestral states



Sources of Uncertainty

1. Topology ✔
2. Node Heights ✔
3. Ancestral States
4. Colonisation Times



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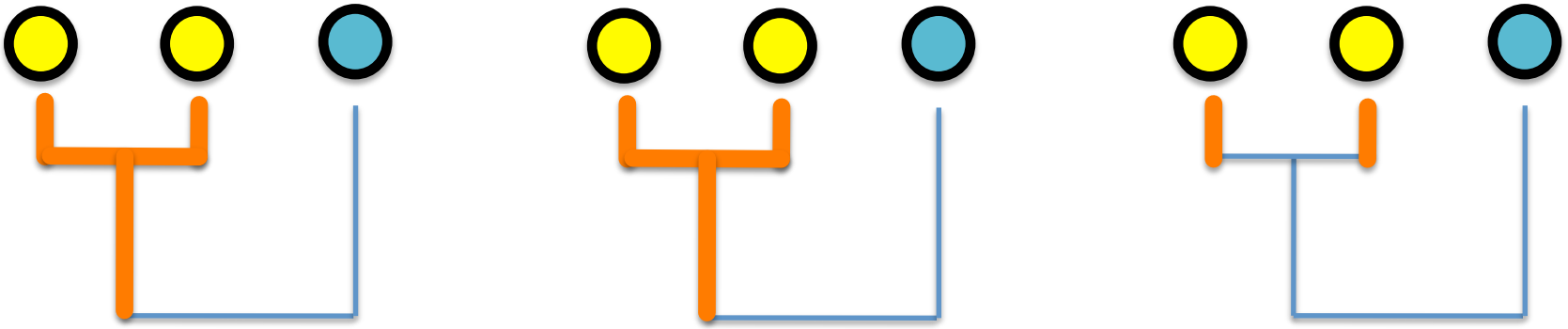

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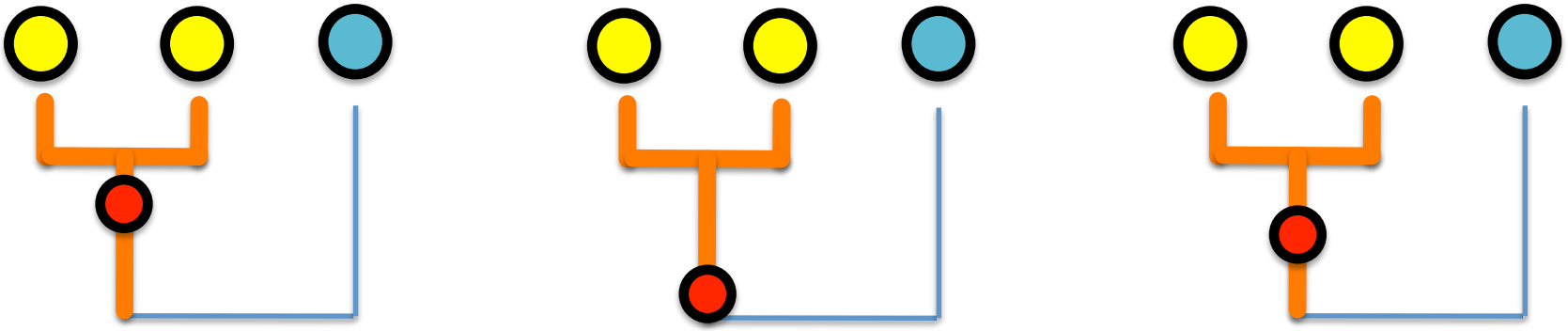

The Method

1. Collect dataset of all members of an assemblage

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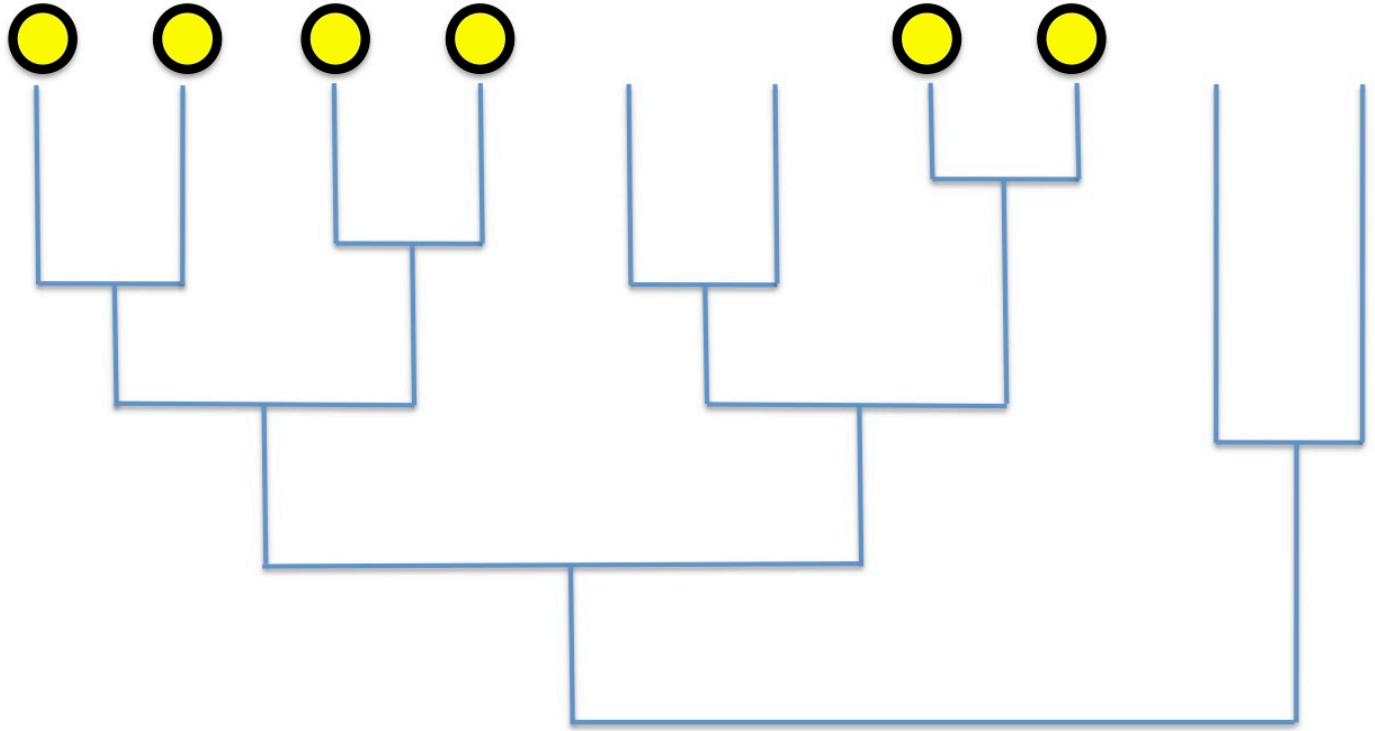
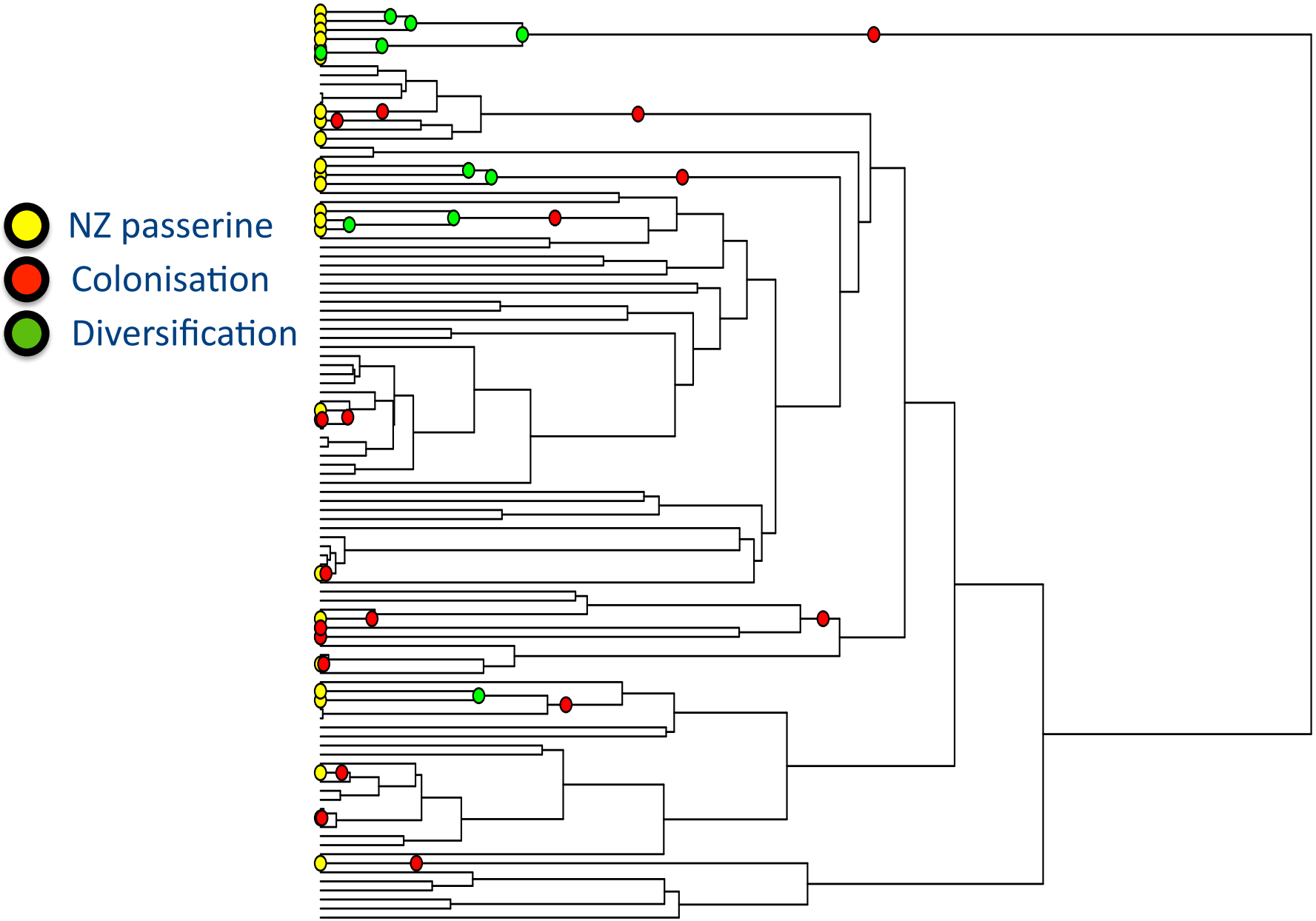
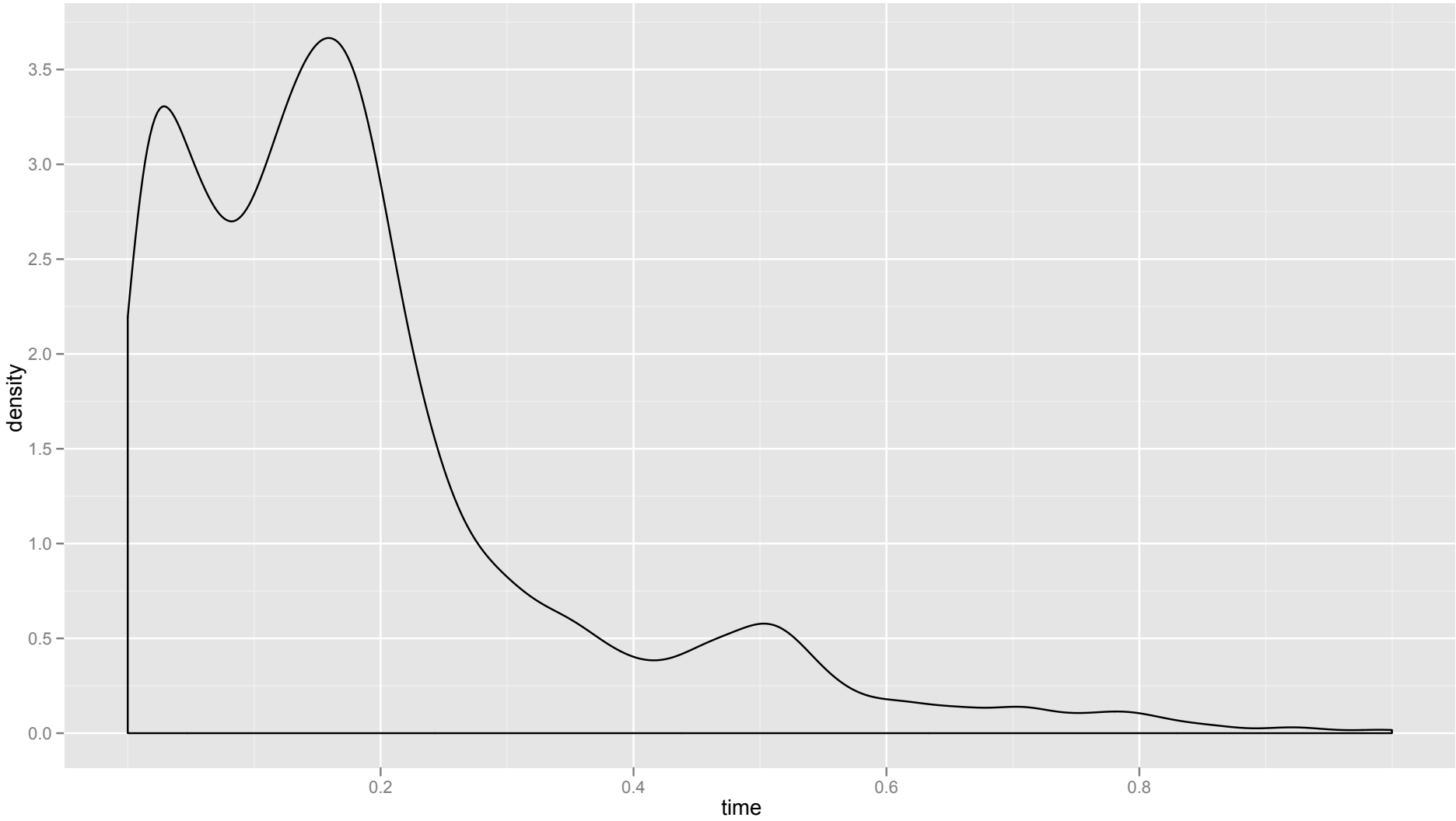
2. Add in phylogenetic nearest neighbours
3. Estimate the posterior distribution of the dated phylogeny
4. For each tree, probabilistically reconstruct ancestral states
5. Reconstruct colonisation and diversification events

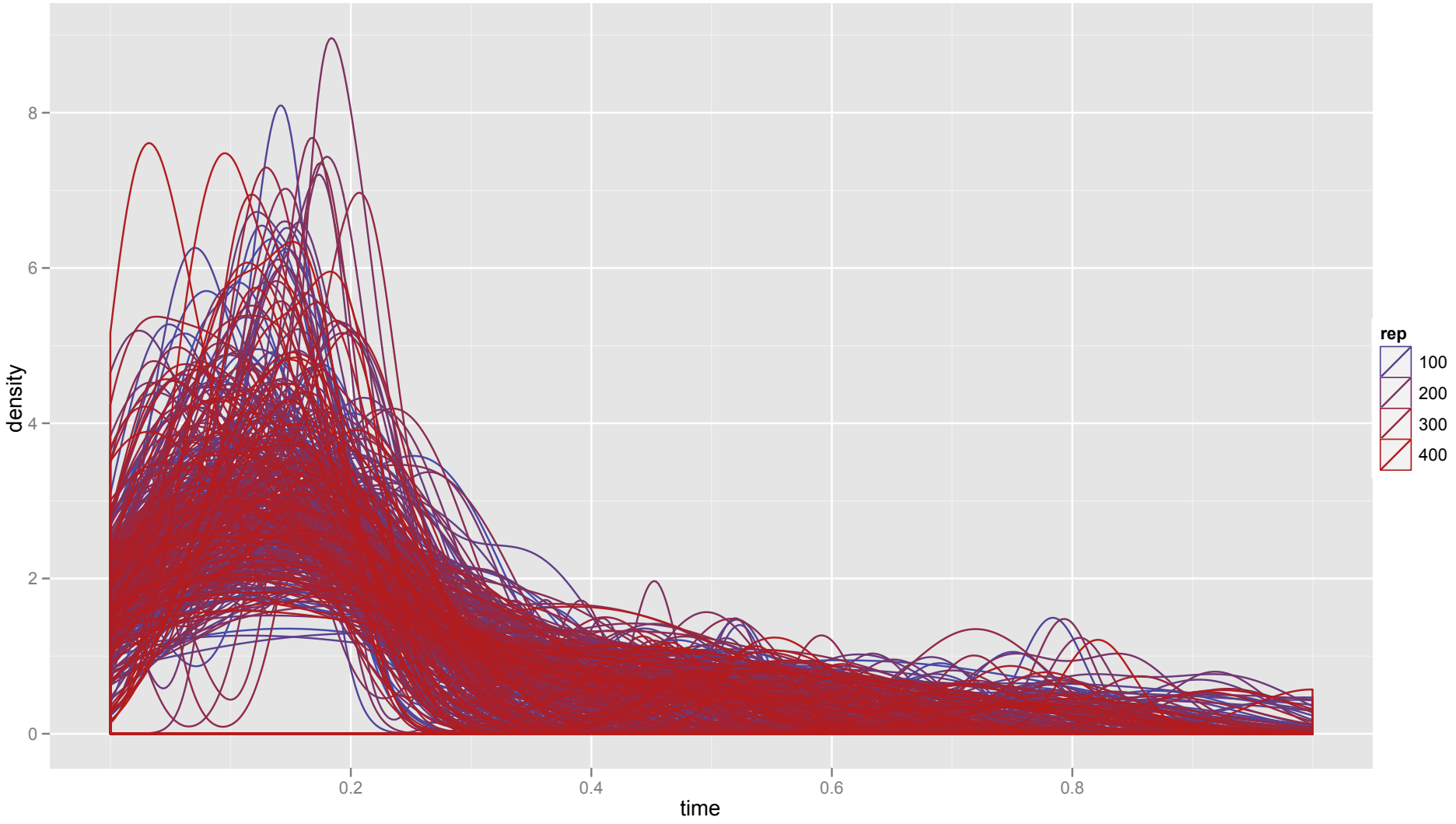



NZ passerine
Colonisation
Diversification

A single estimate of in-situ diversification rate



401 estimates of in-situ diversification rate



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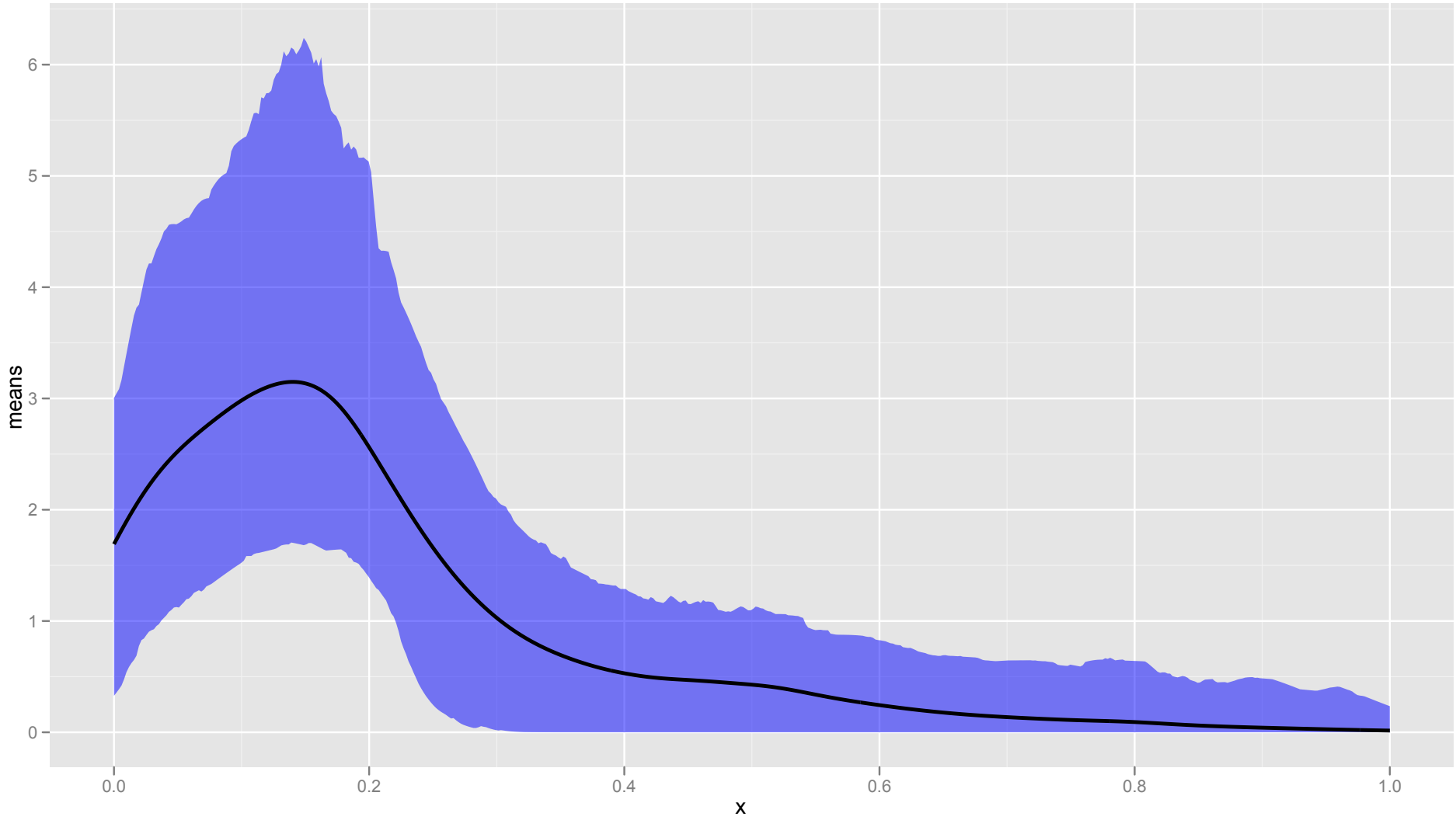
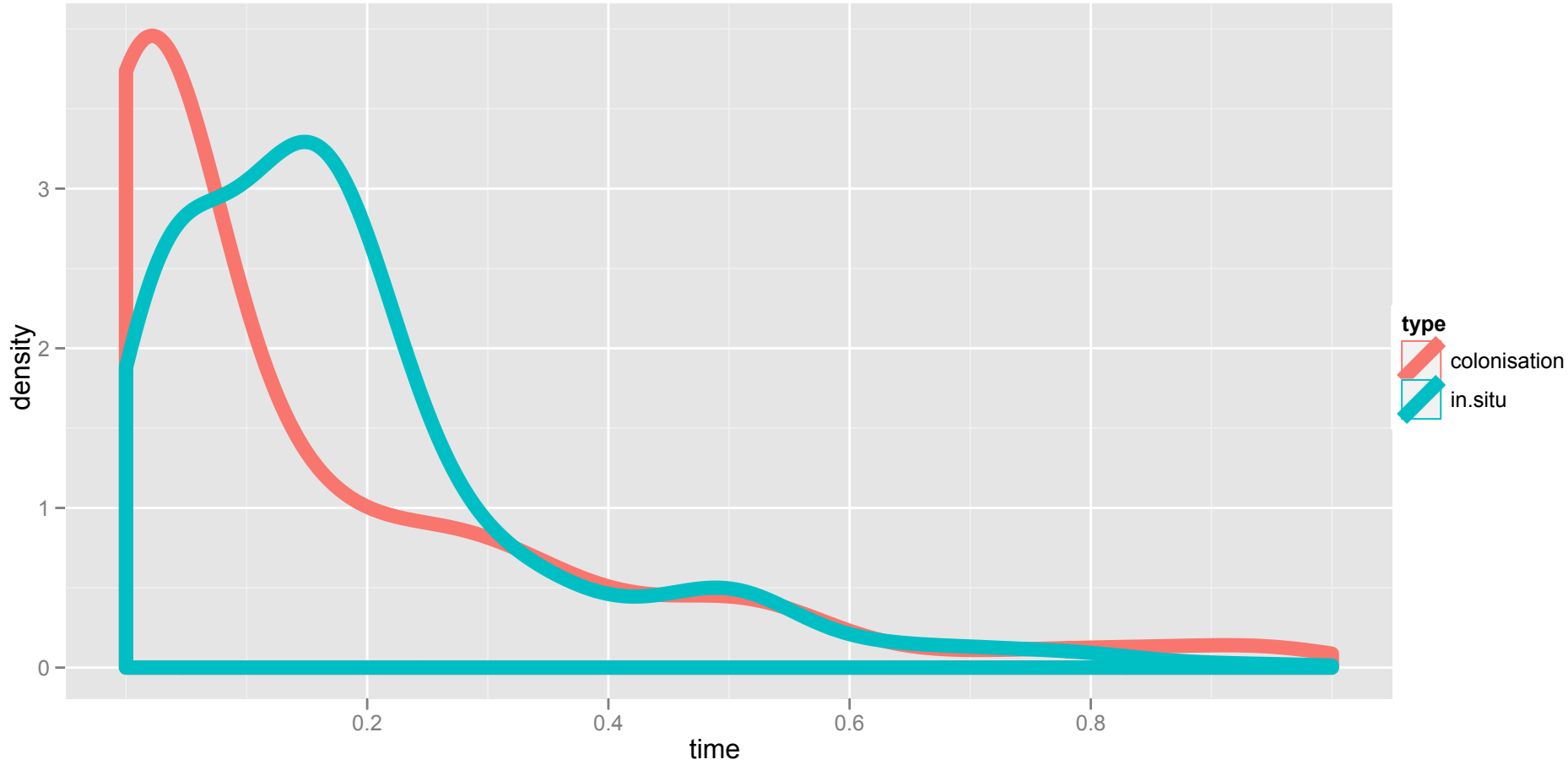
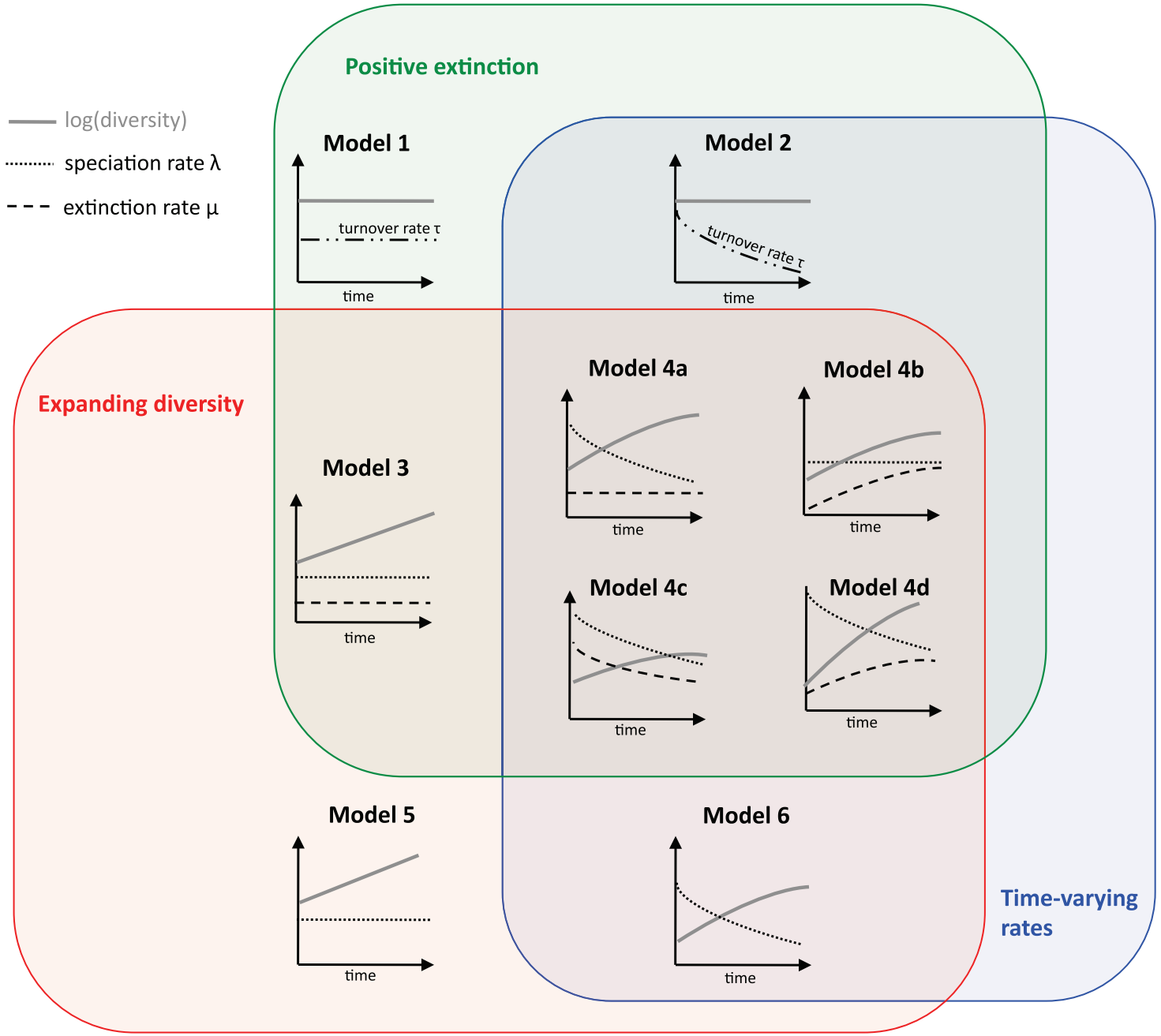
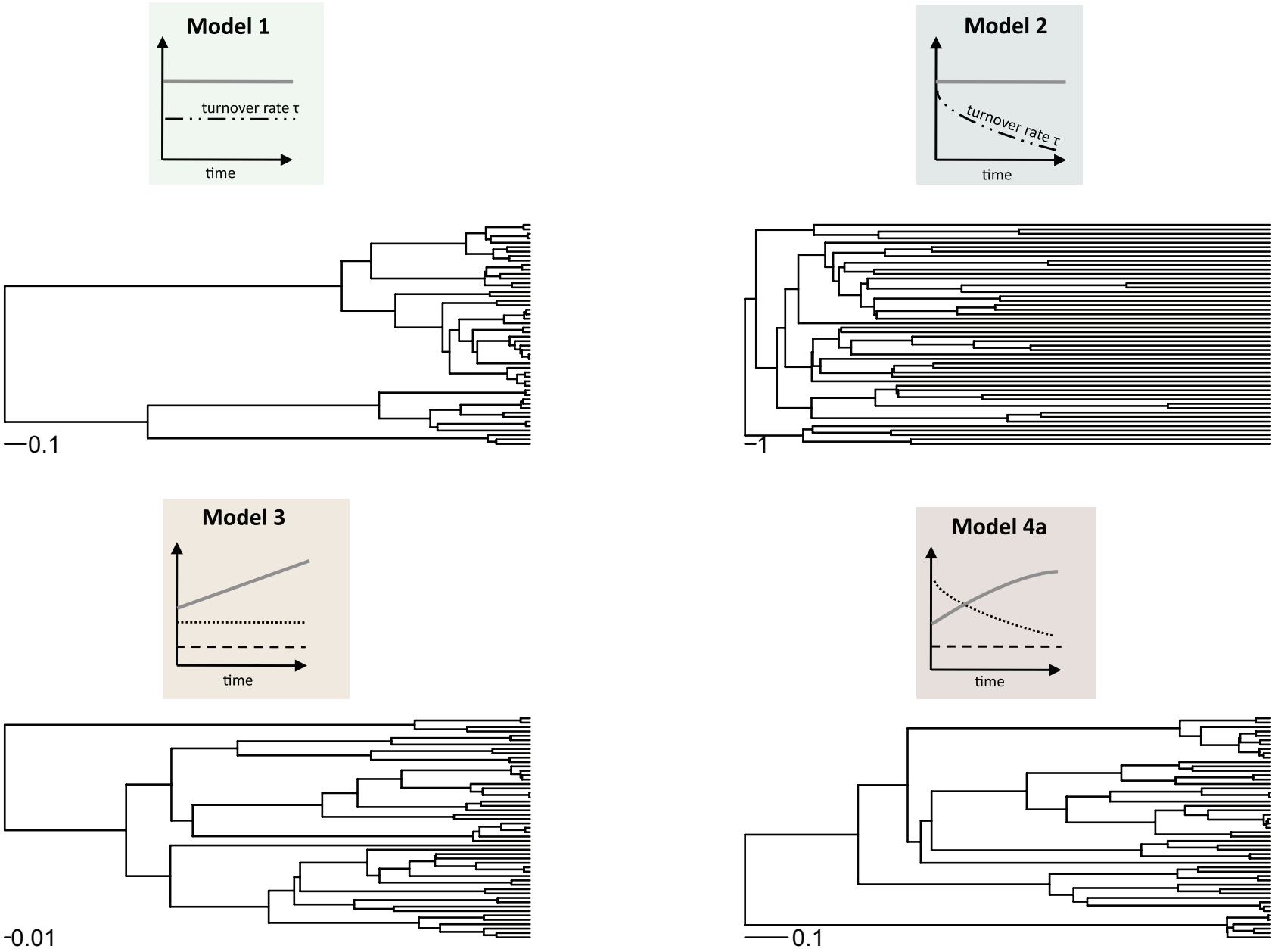


Colonisation and diversification





Morlon et al, PLoS Genetics, 2010



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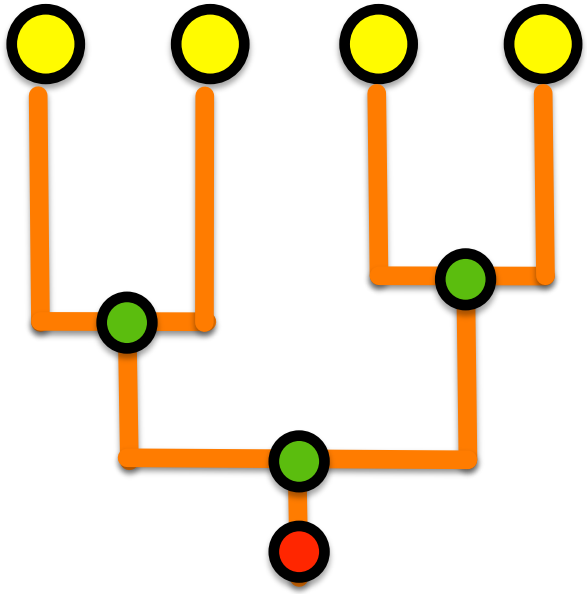
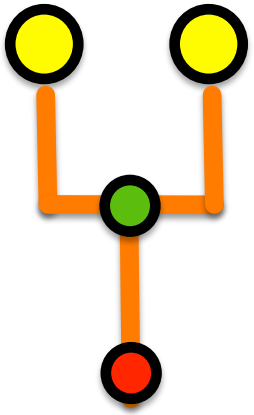
Comparing models of assemblage formation





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