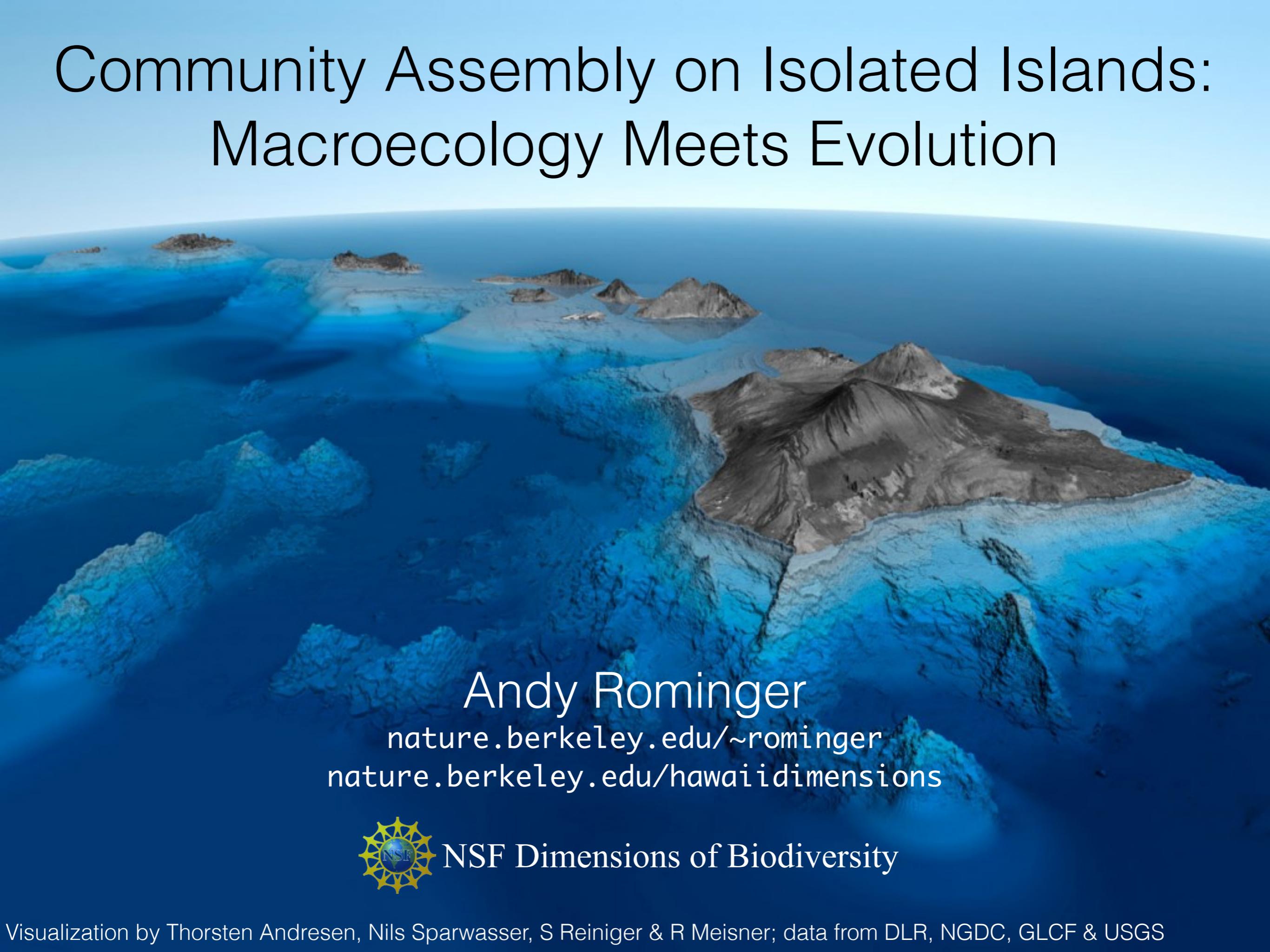


Community Assembly on Isolated Islands: Macroecology Meets Evolution

A 3D visualization of a volcanic island chain in the ocean. The islands are rugged and rocky, with deep blue water surrounding them. In the background, more small, isolated islands are visible on the horizon under a clear sky.

Andy Rominger
nature.berkeley.edu/~rominger
nature.berkeley.edu/hawaiidimensions

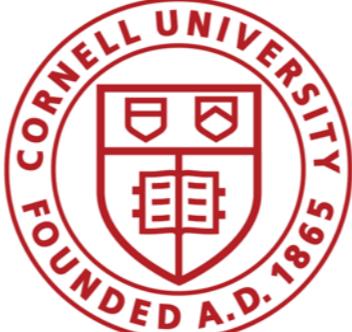


NSF Dimensions of Biodiversity

Community Assembly on Isolated Islands: Macroecology Meets Evolution



K. R. Goodman, J. Y. Lim, E. E. Armstrong, L. E. Becking, G. M Bennett, M. S. Brewer, D. D. Cotoras, C. P. Ewing, J. Harte, P. M. O'Grady, D. M. Percy, D. K. Price, G. K. Roderick, K. L. Shaw, D. S. Gruner, R. G. Gillespie

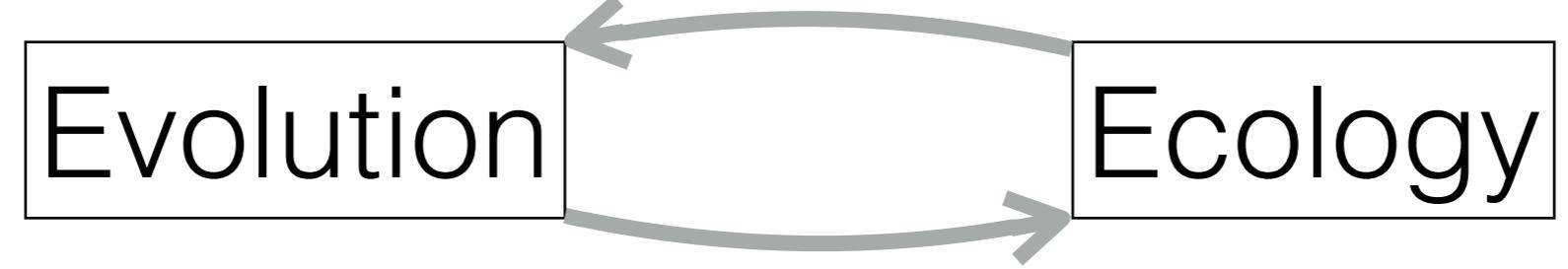


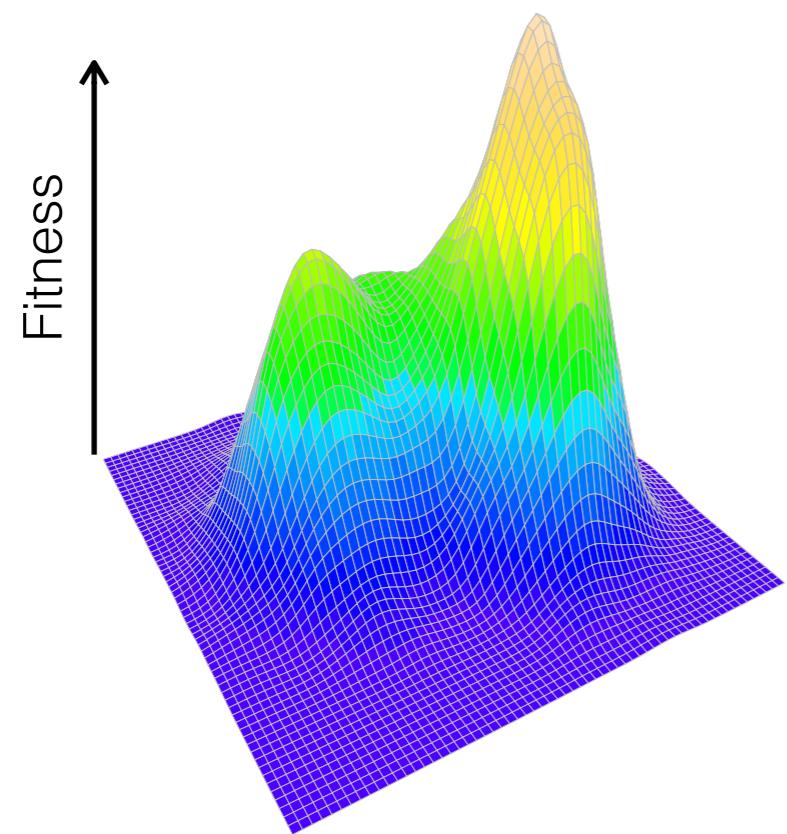
I'm not Rosie





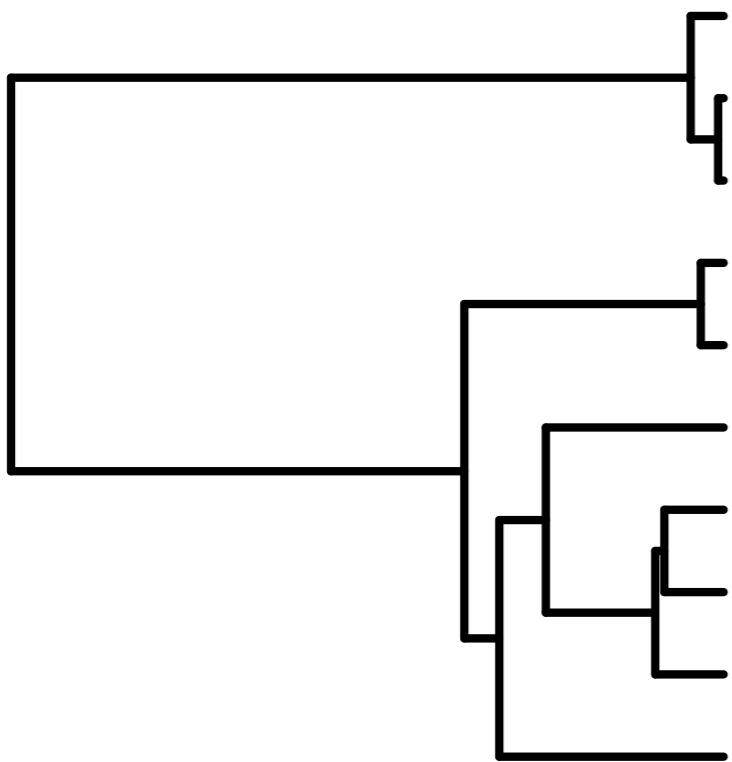


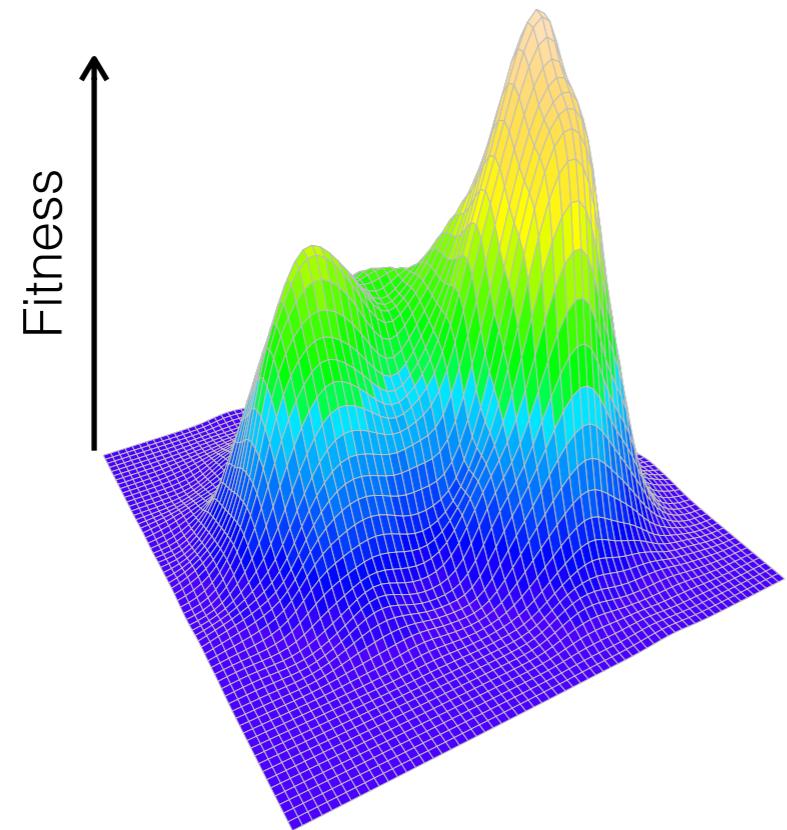




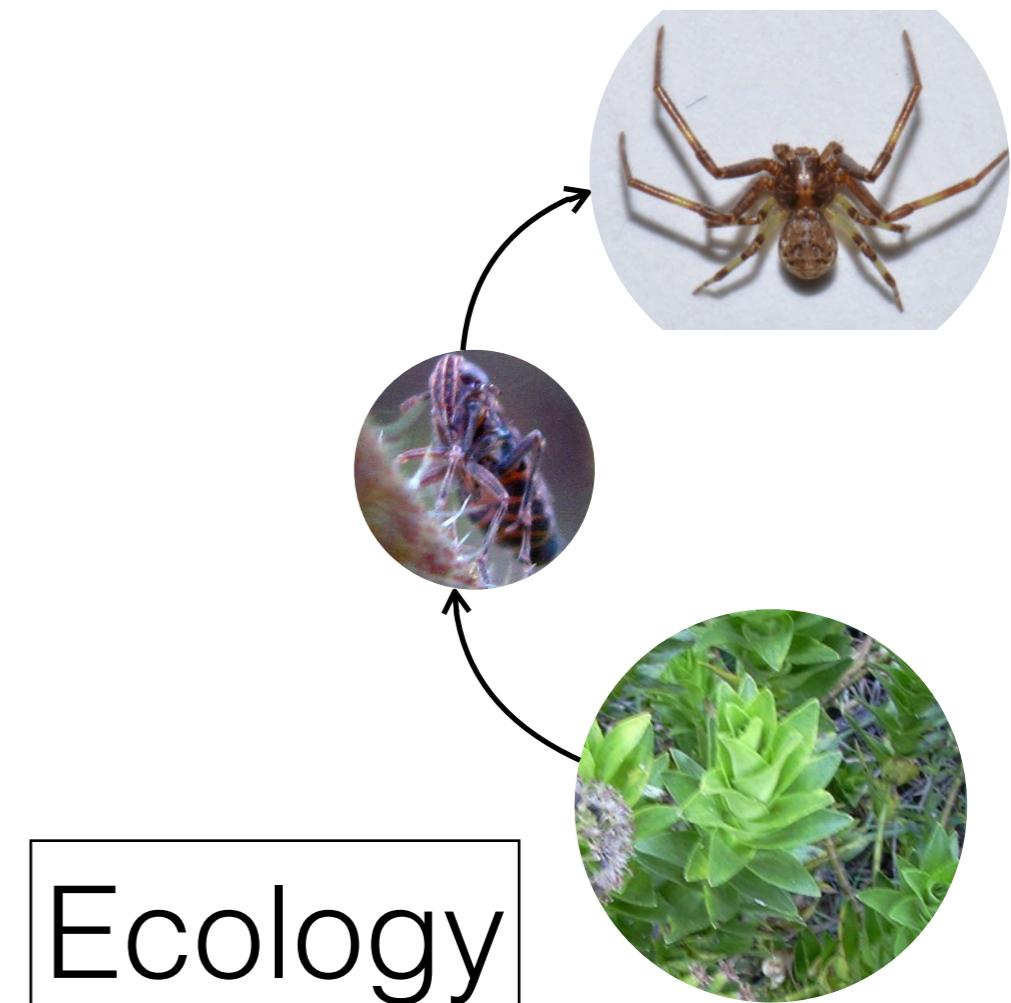
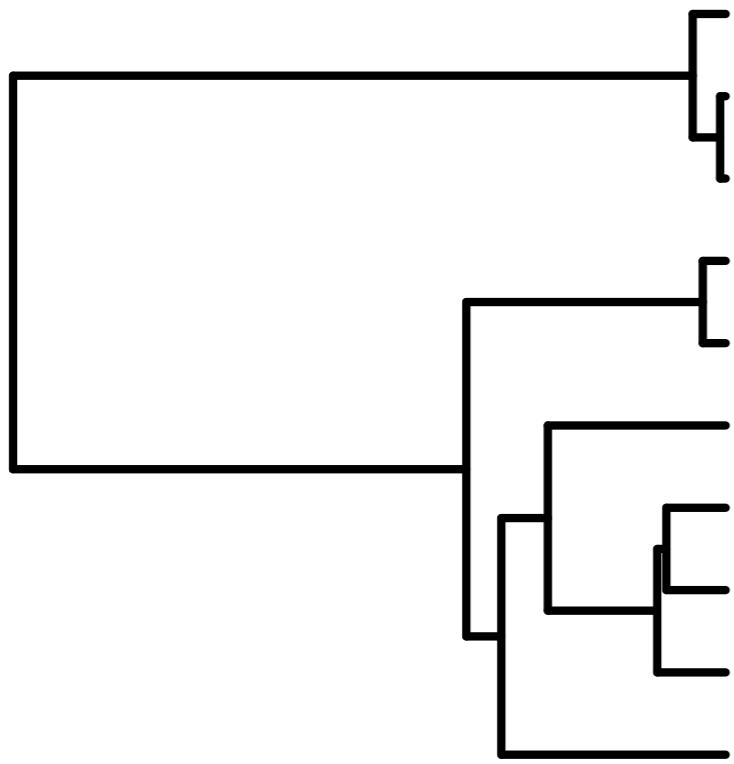
Evolution

Ecology

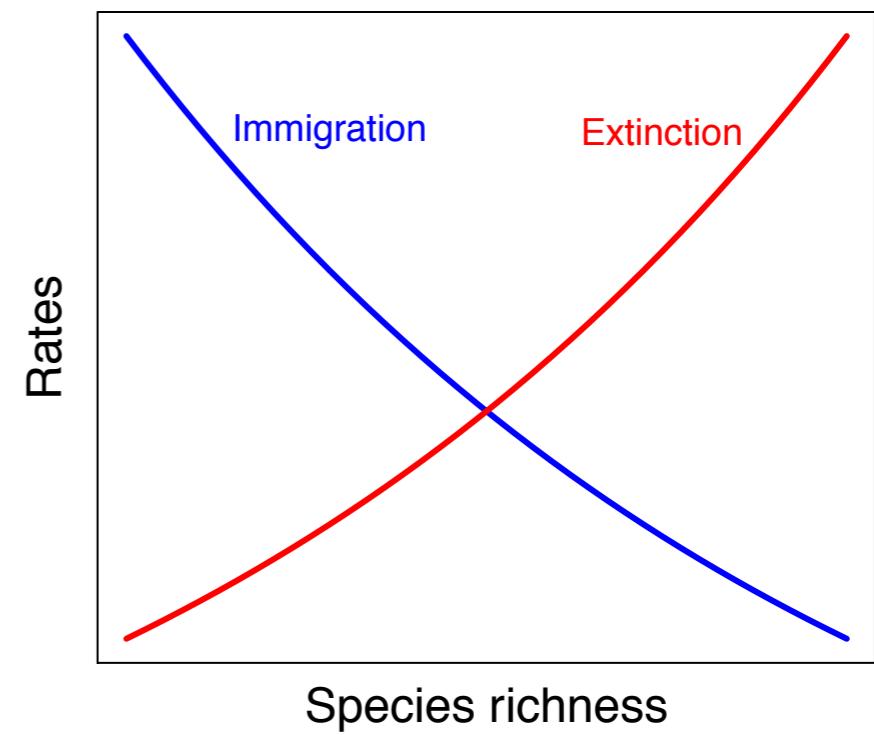


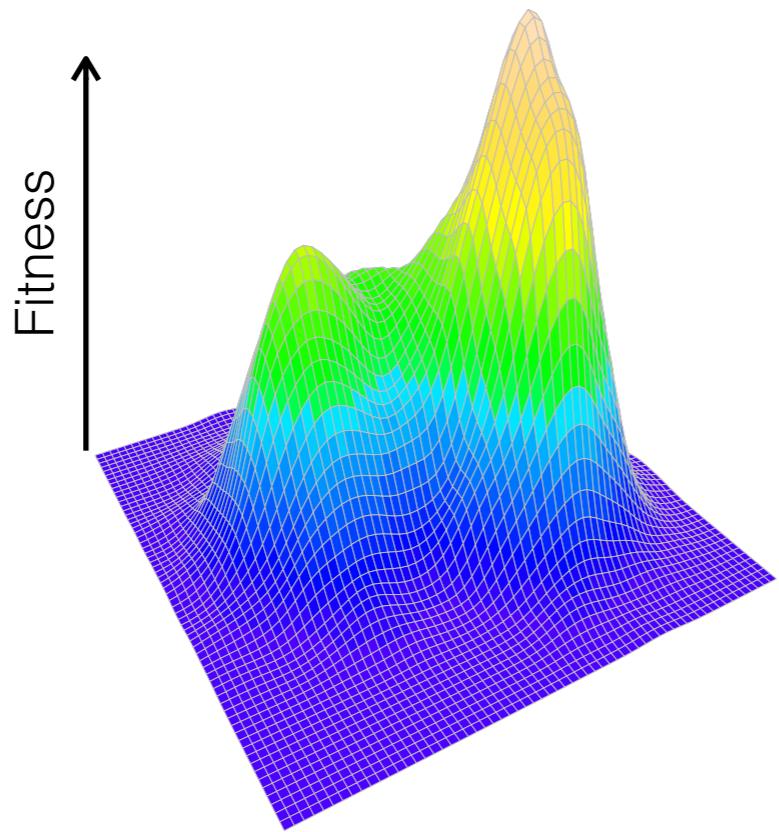


Evolution

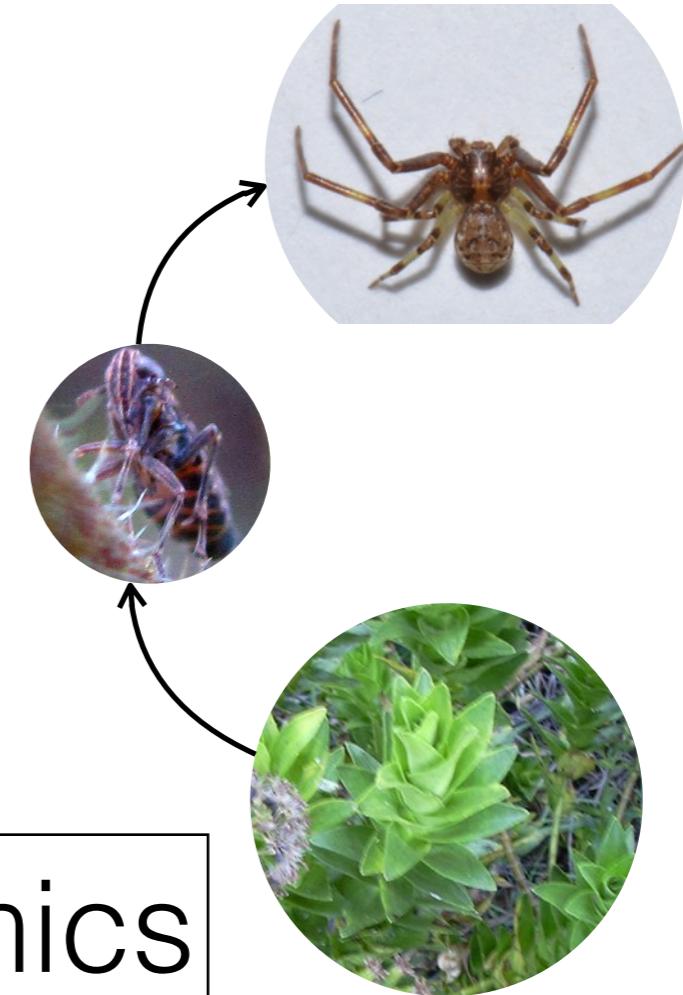
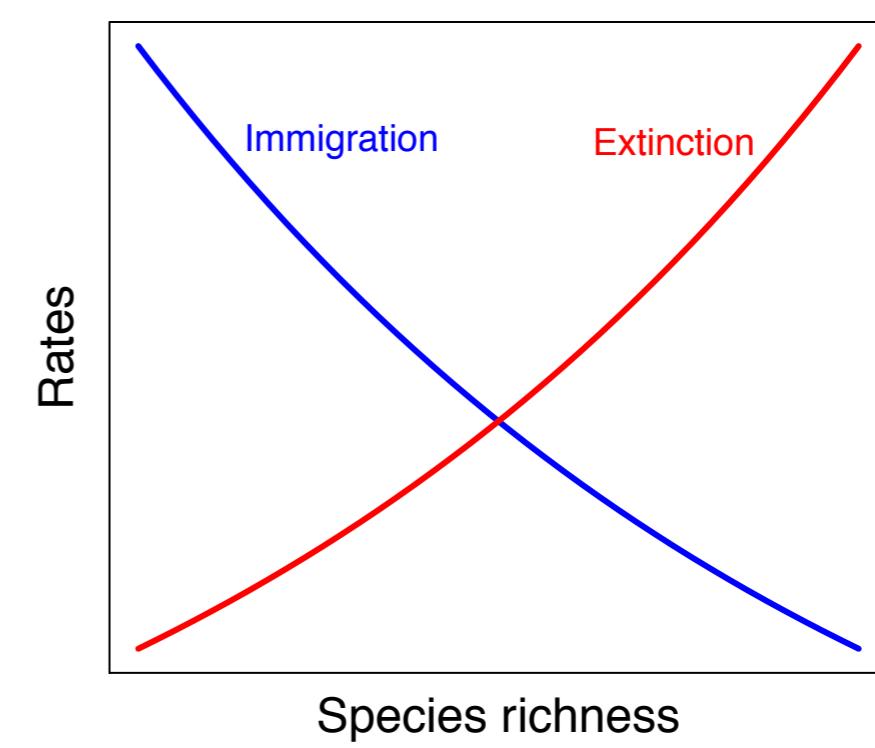
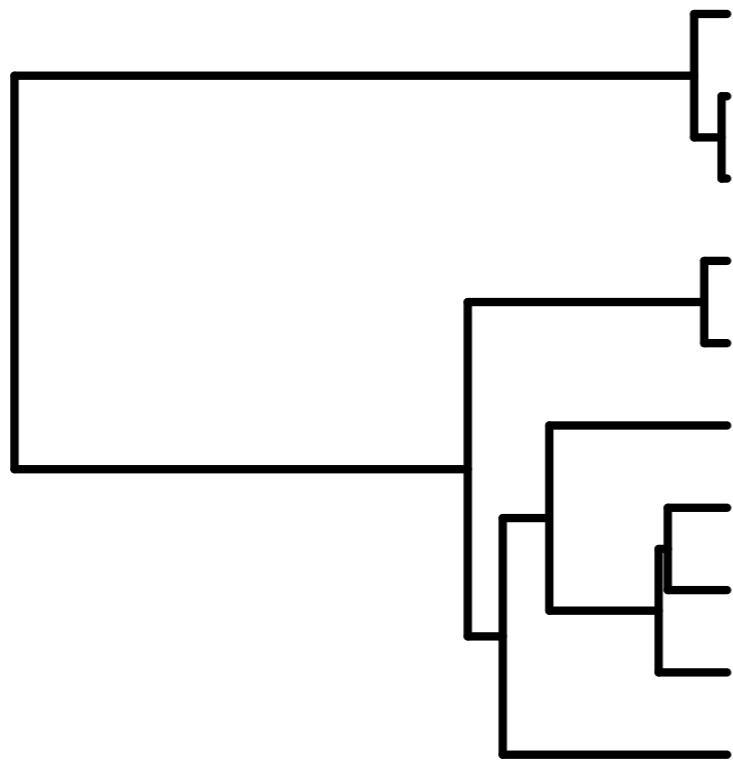


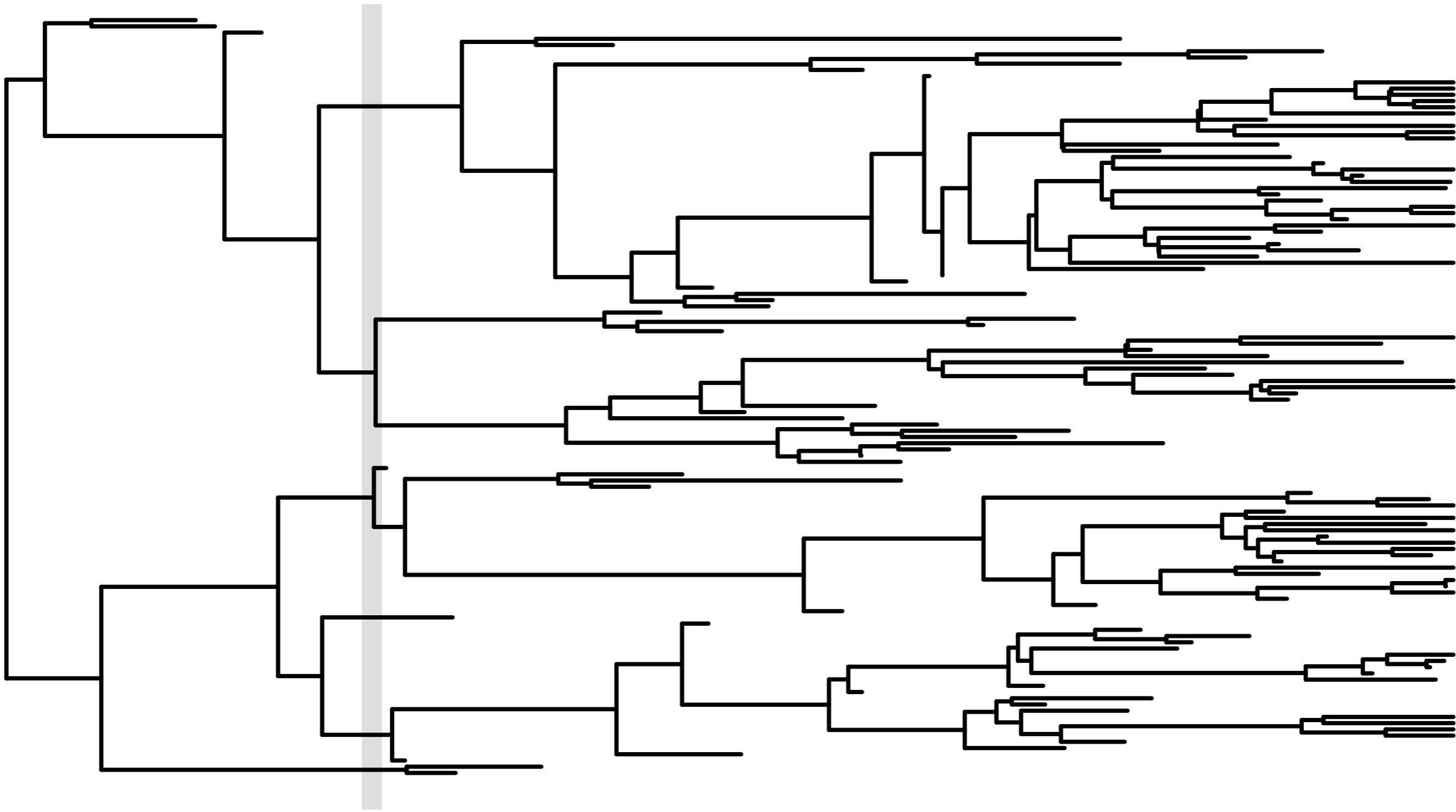
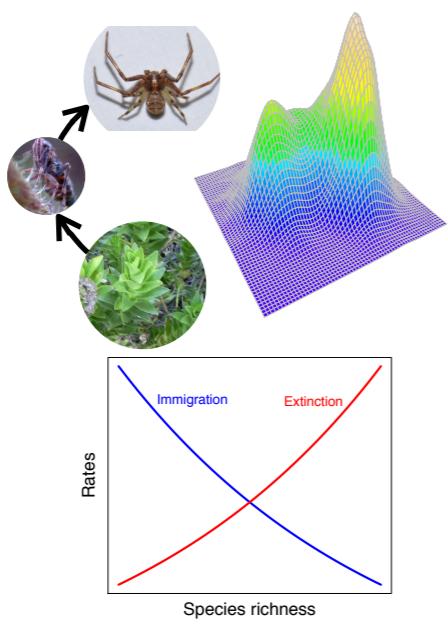
Ecology

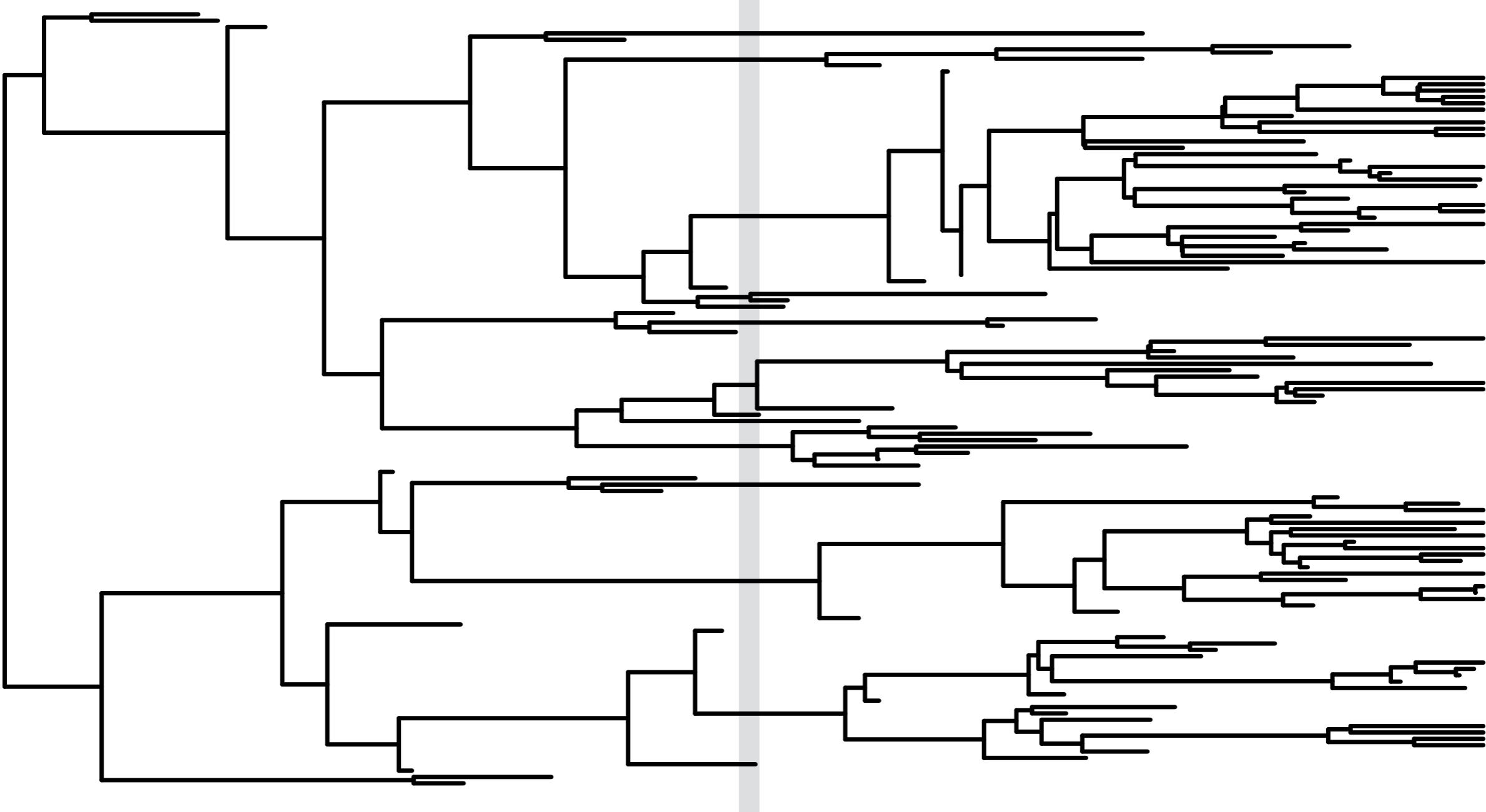
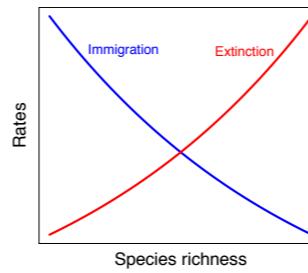
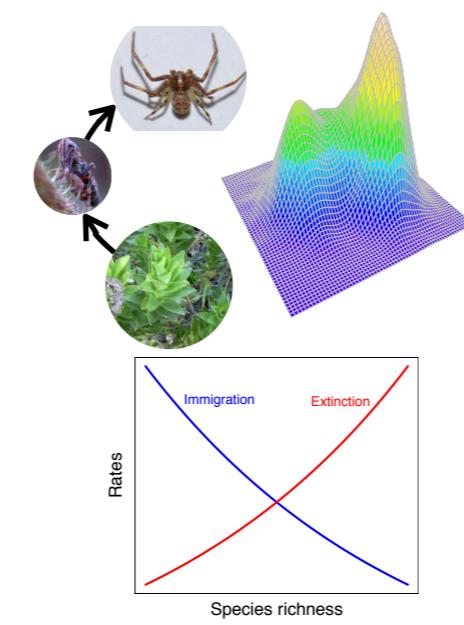


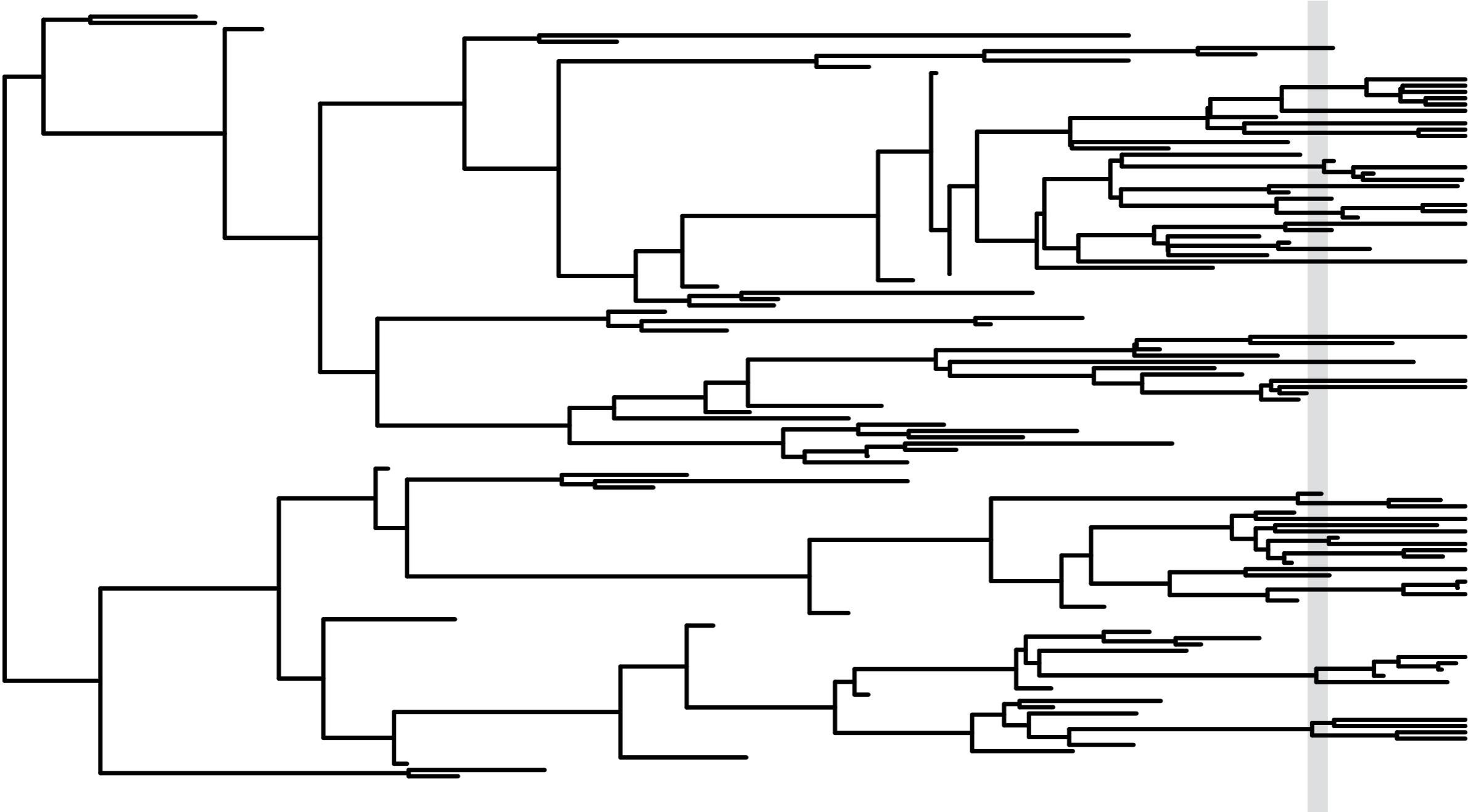
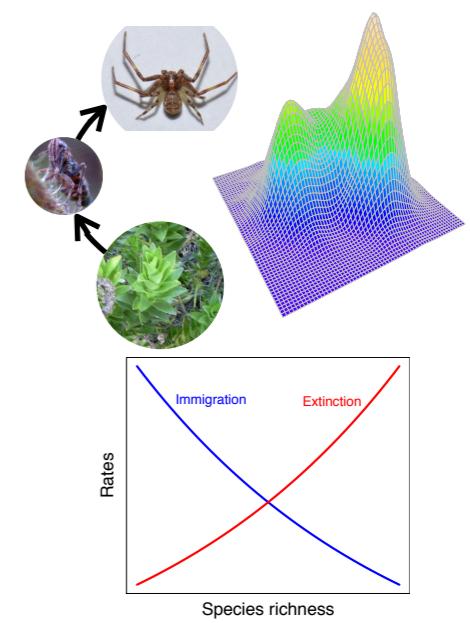


Biodiversity dynamics









Changing effective immigration



Changing effective immigration



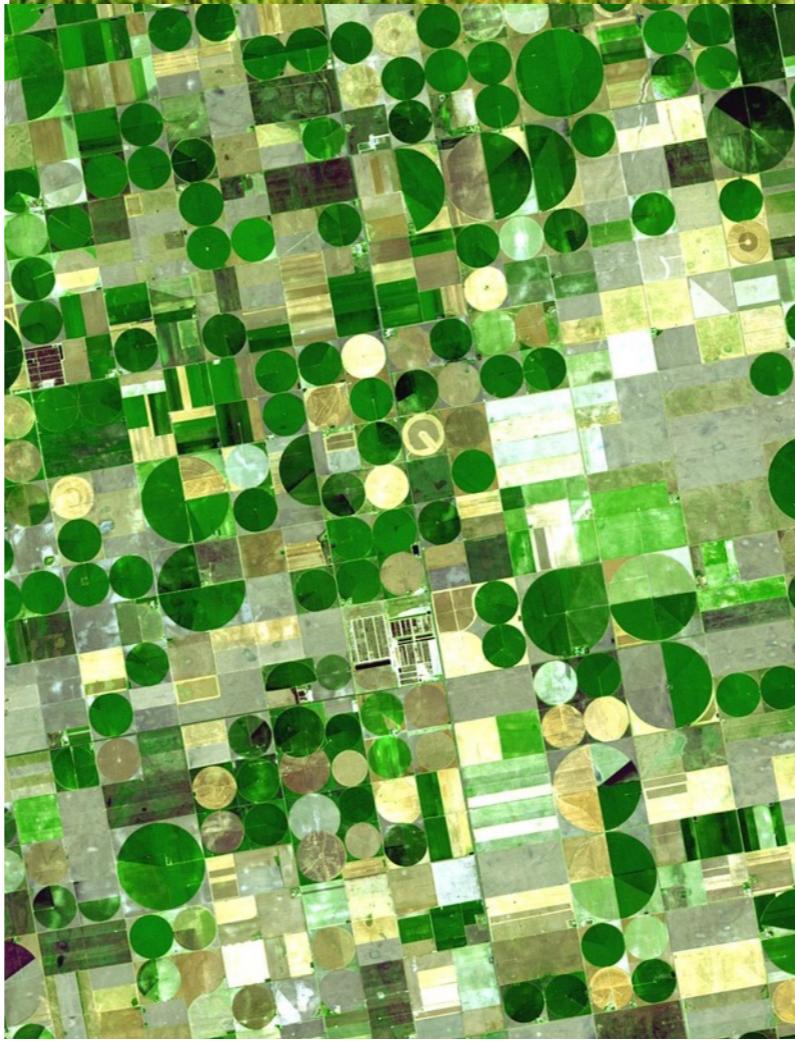
Changing selective pressures



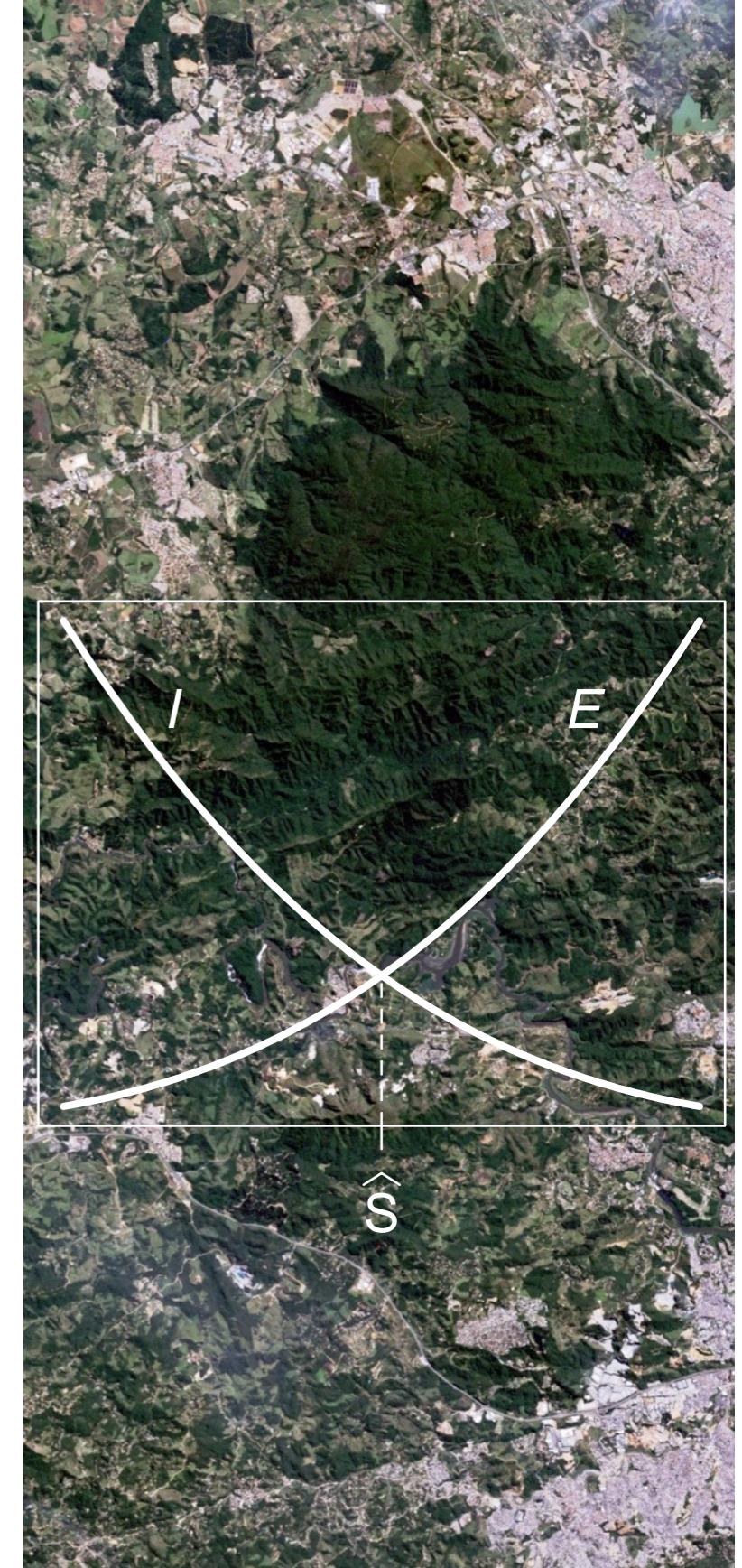
Changing effective immigration

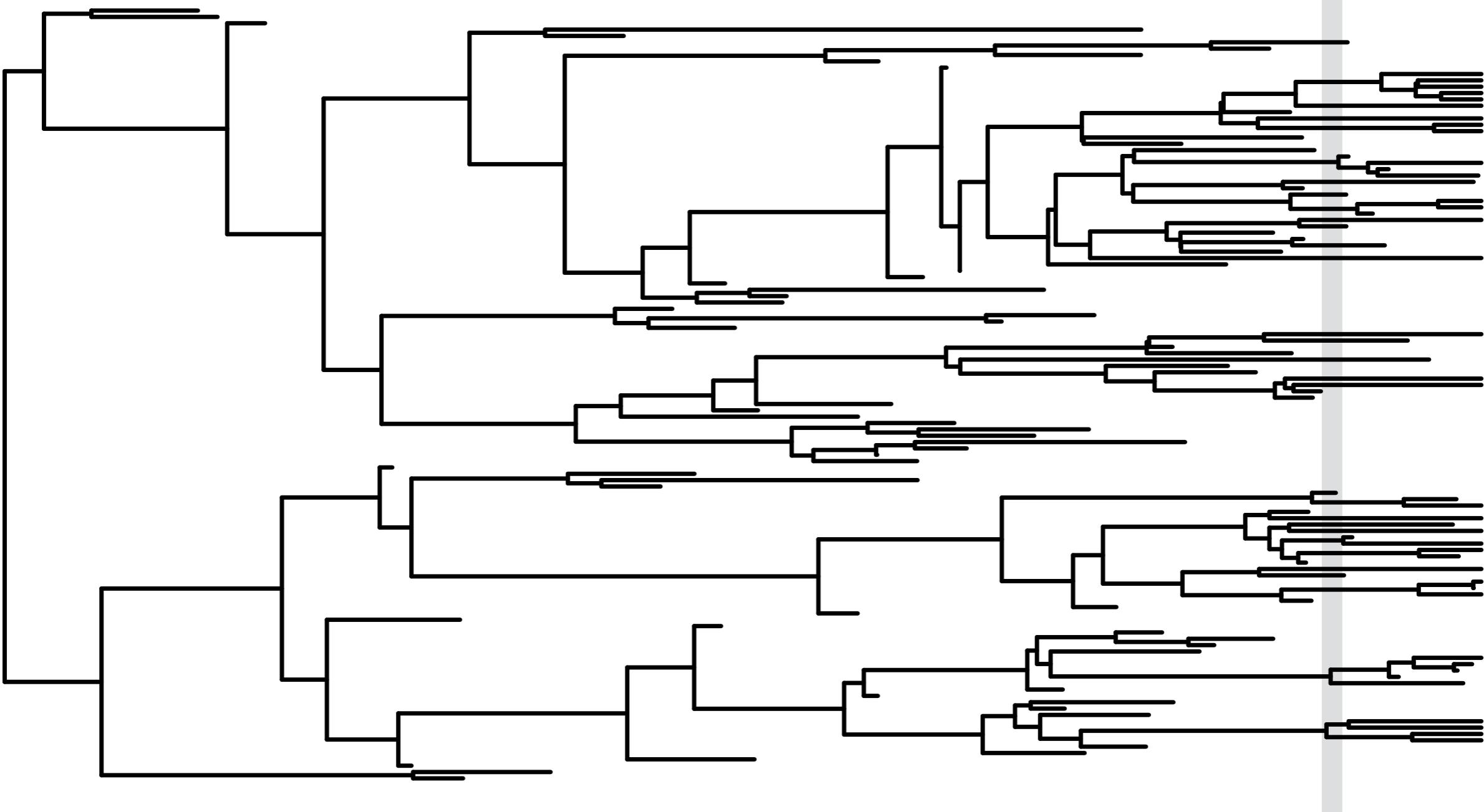
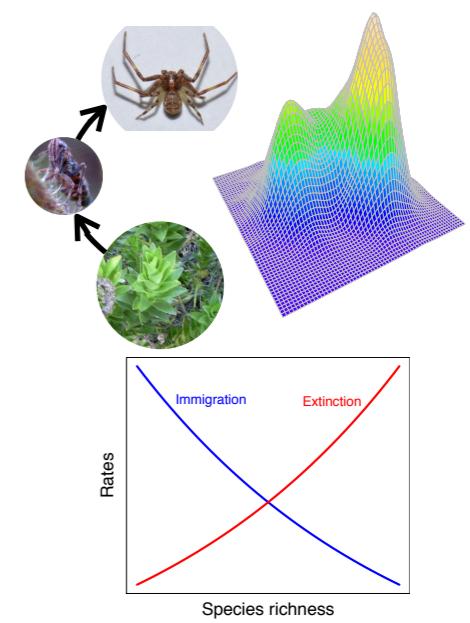


Changing selective pressures



Changing extinction

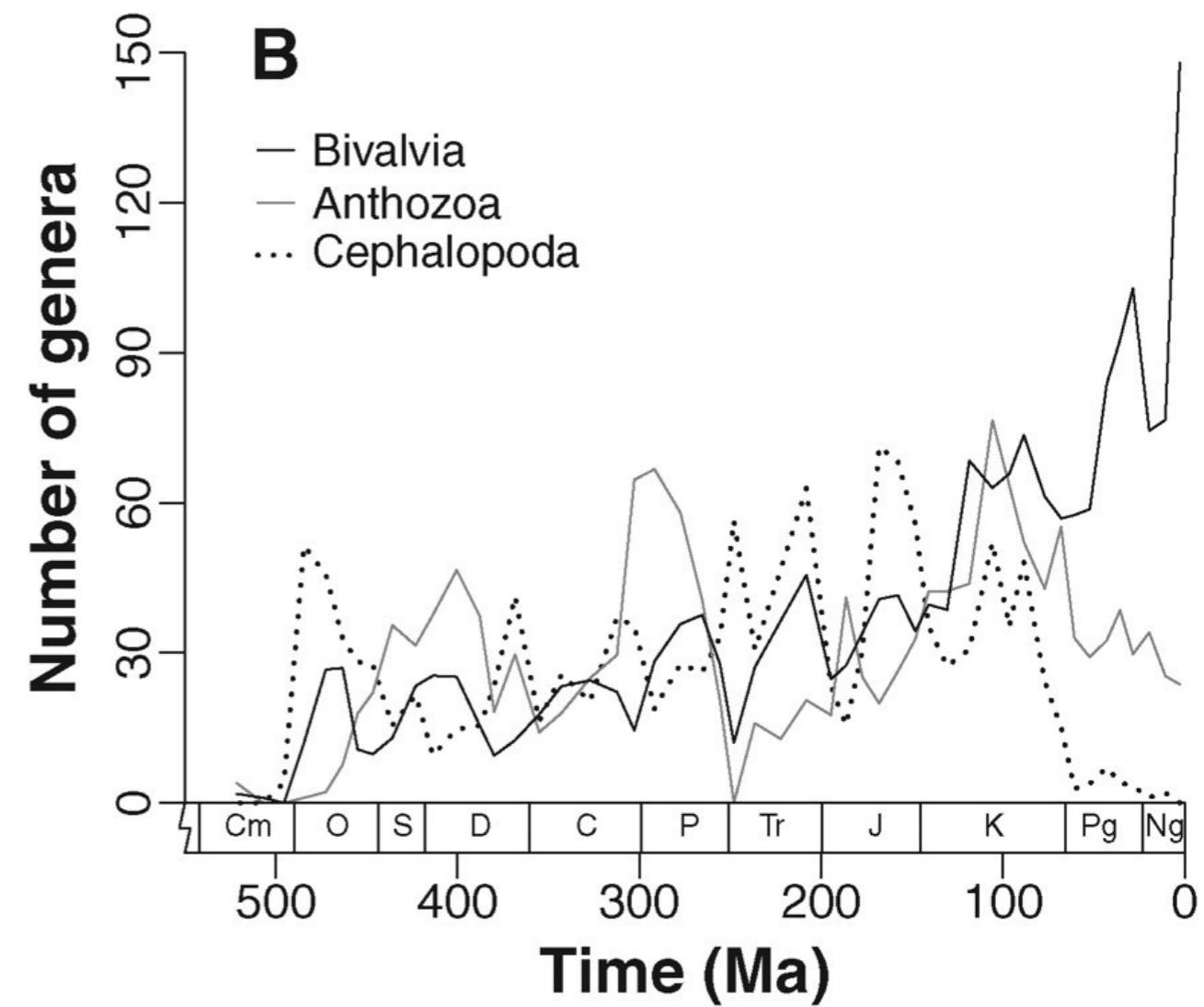
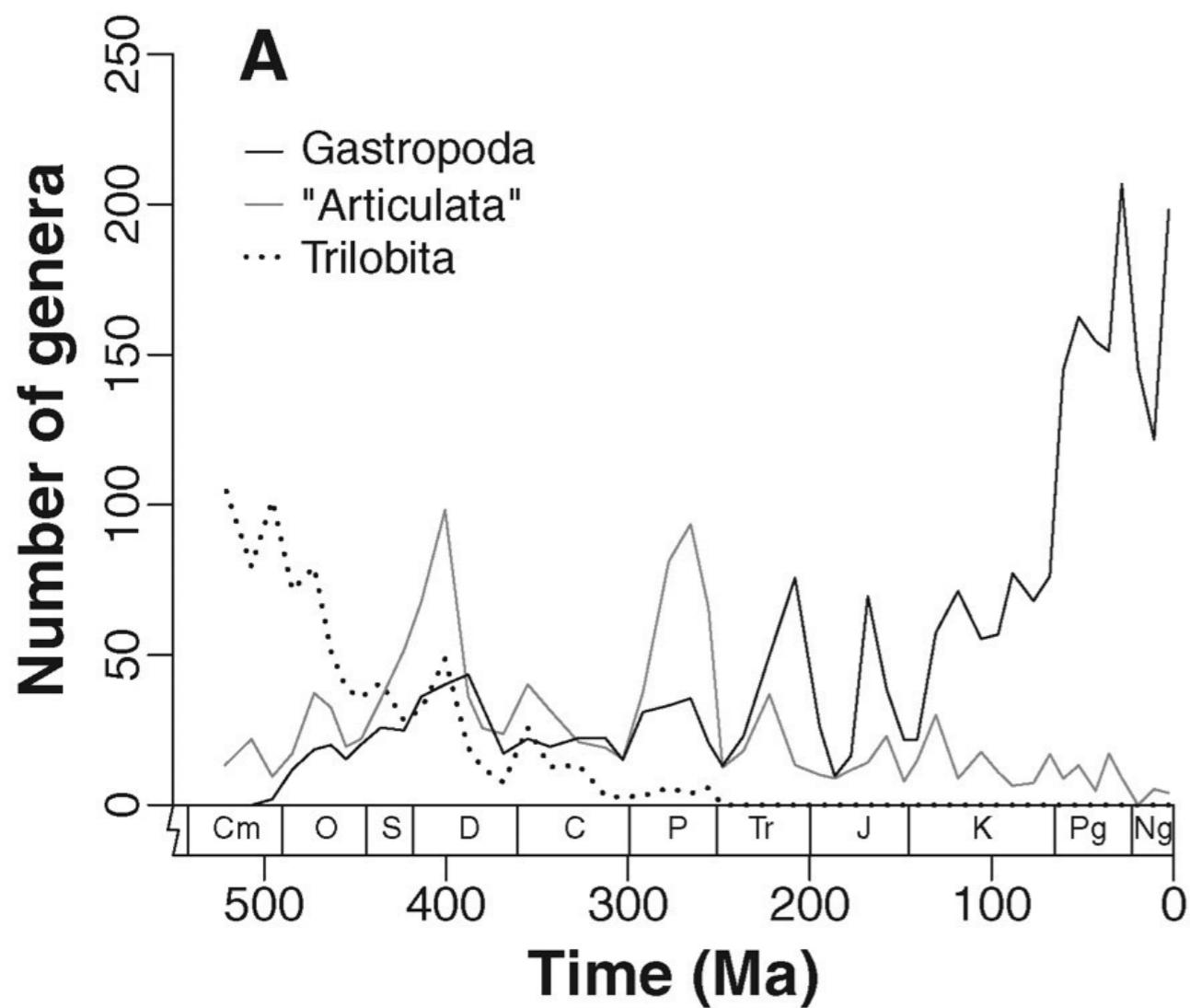




Insights from the fossil record

Insights from the fossil record

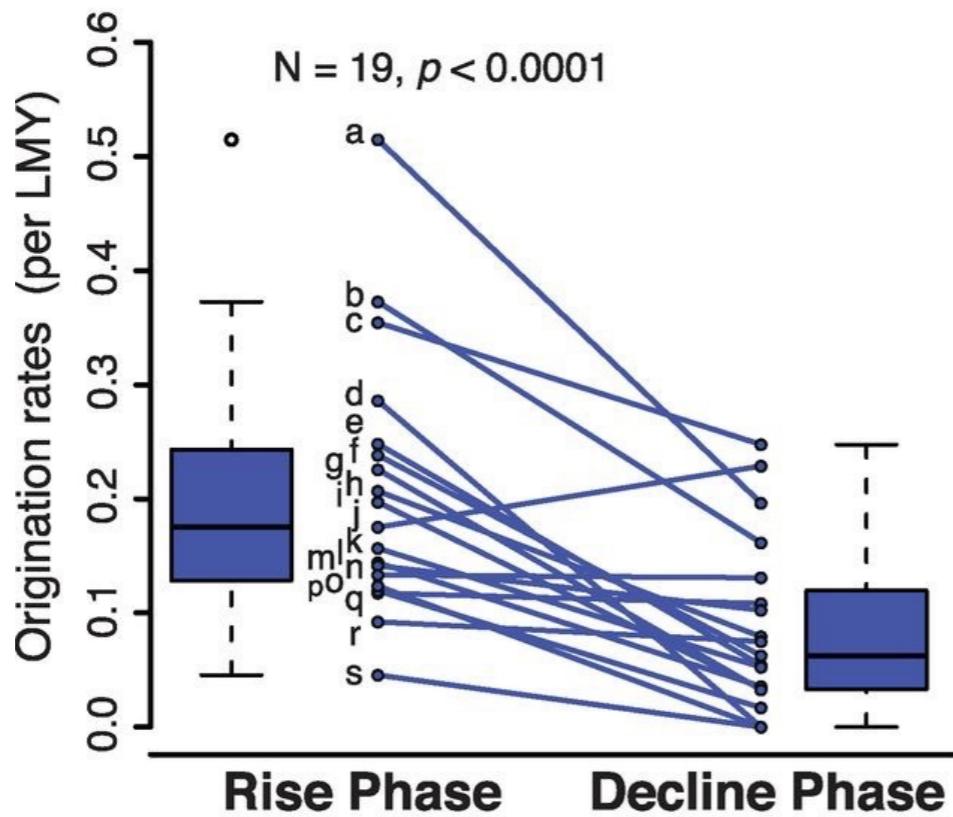
Change is pervasive



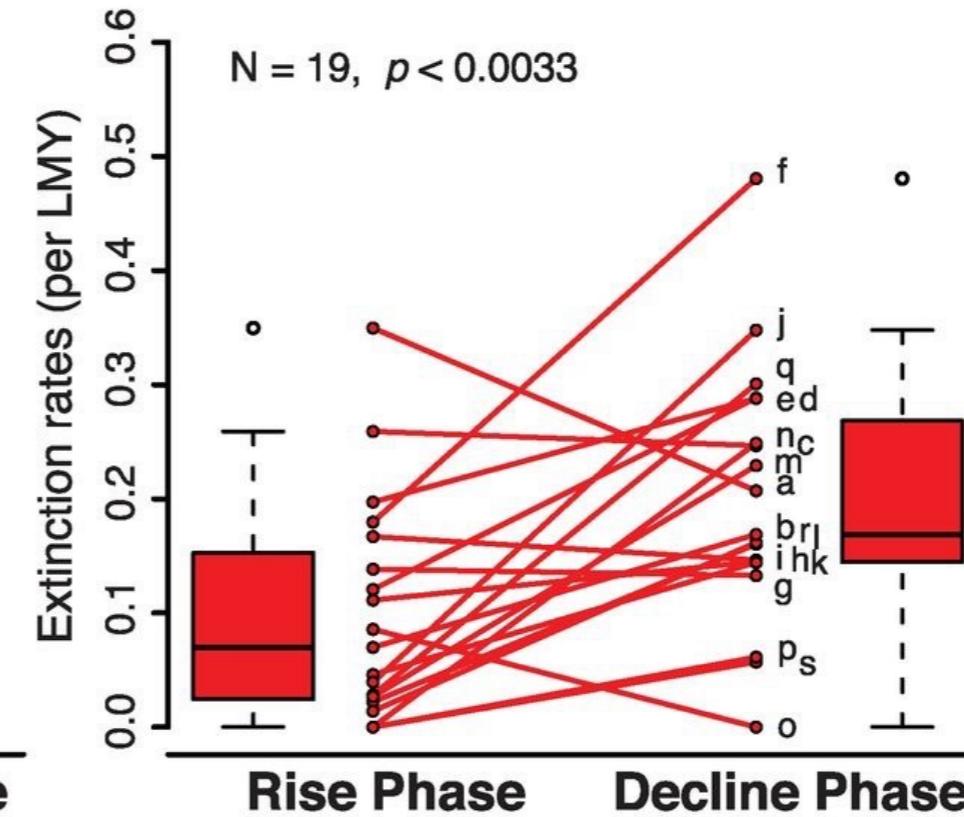
Insights from the fossil record

Change is systematic

A Average origination rates



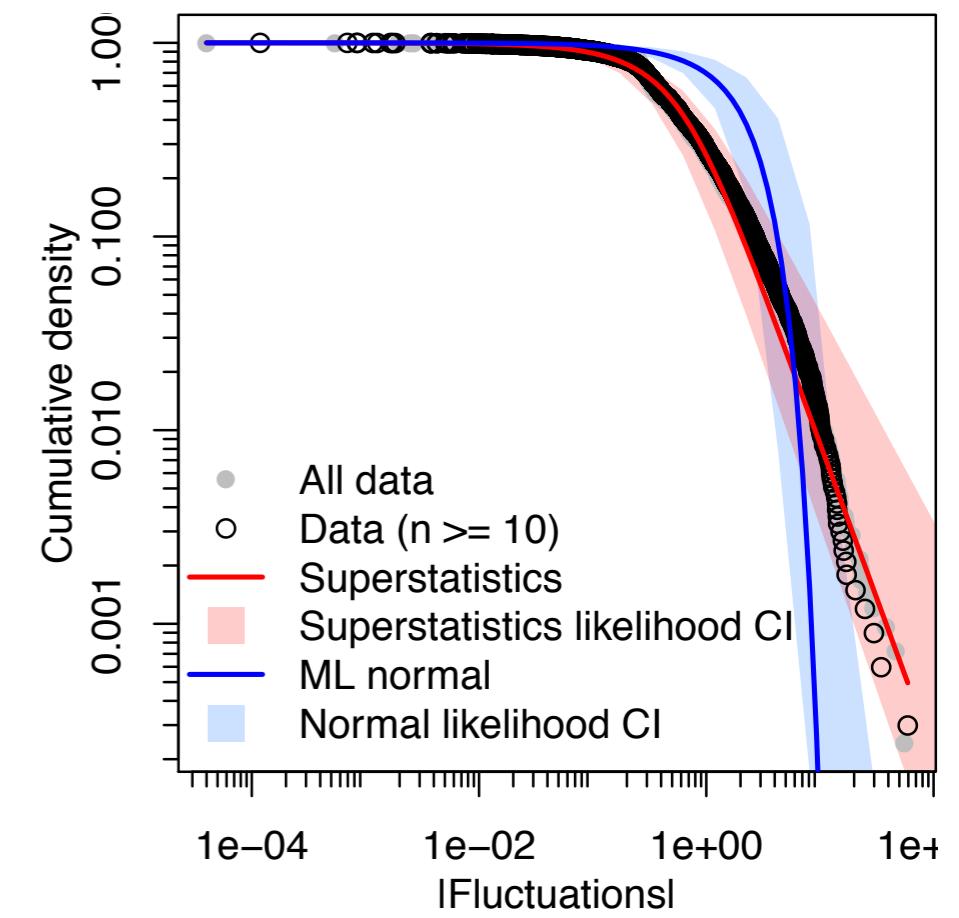
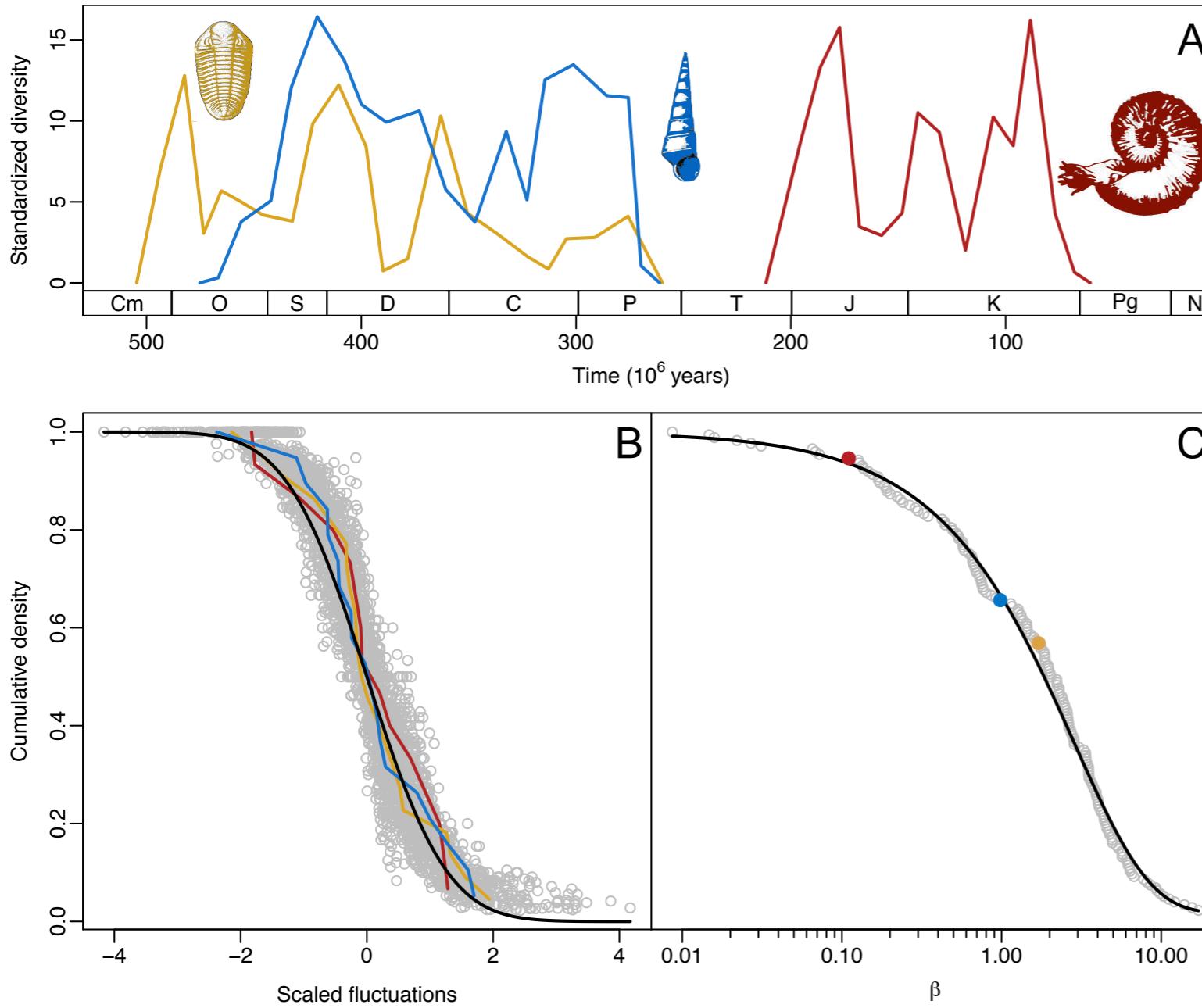
B Average extinction rates



- | | | | |
|-----------------------------------|-------------------------------|---------------------------------|----------------------------------|
| a– Antilocapridae | f– Amphicyonidae [†] | k– Tayassuidae | p– Perapectidae [†] |
| b– Nyctitheriidae [†] | g– Eomyidae [†] | l– Gliridae | q– Omomyidae [†] |
| c– Camelidae | h– Rhinocerotidae | m– Castoridae | r– Ochotonidae |
| d– Elephantidae | i– Equidae | n– Palaeomerycidae [†] | s– Herpetotheriidae [†] |
| e– Merycoidodontidae [†] | j– Hyaenidae | o– Hyracodontidae [†] | |

Insights from the fossil record

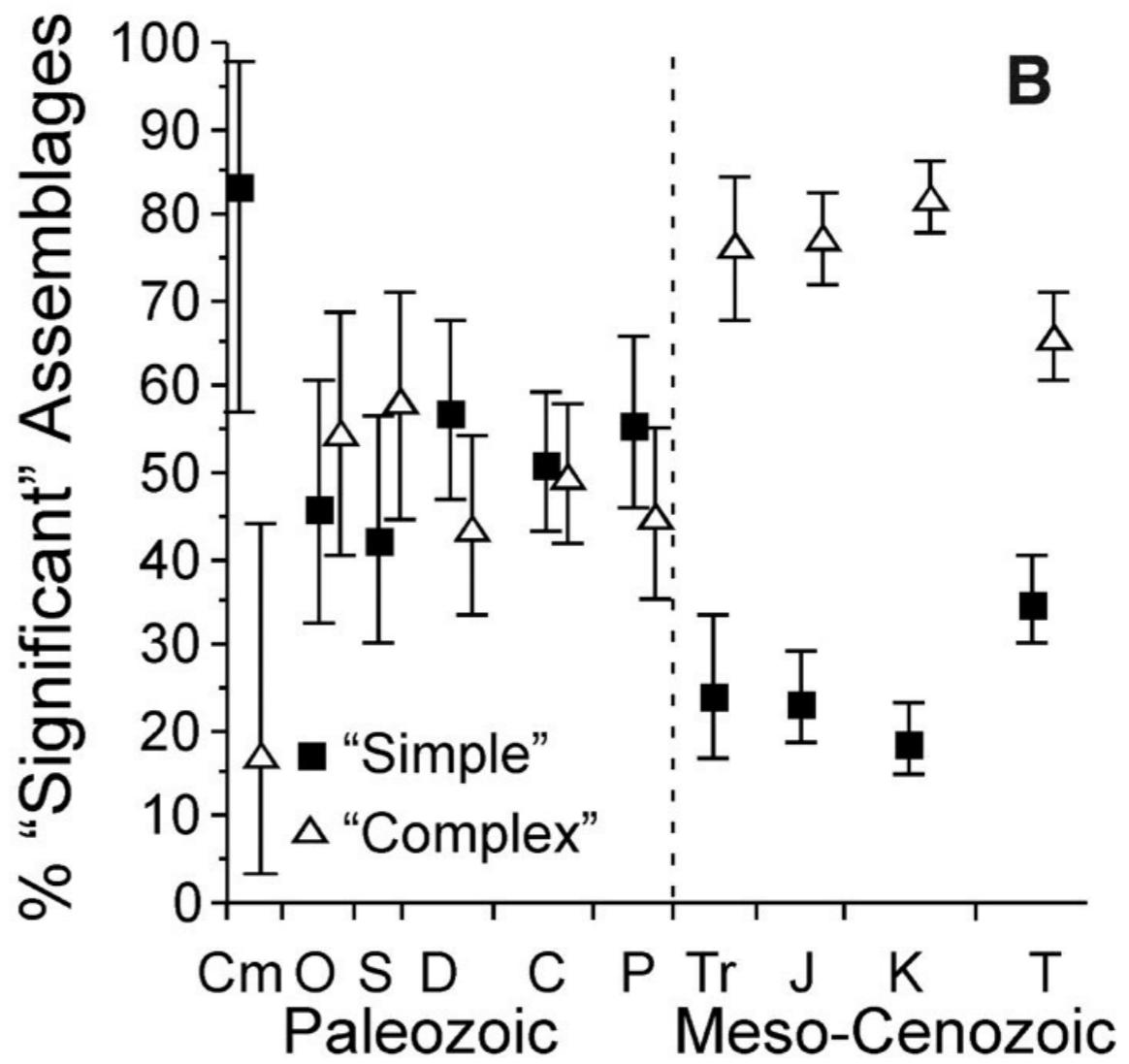
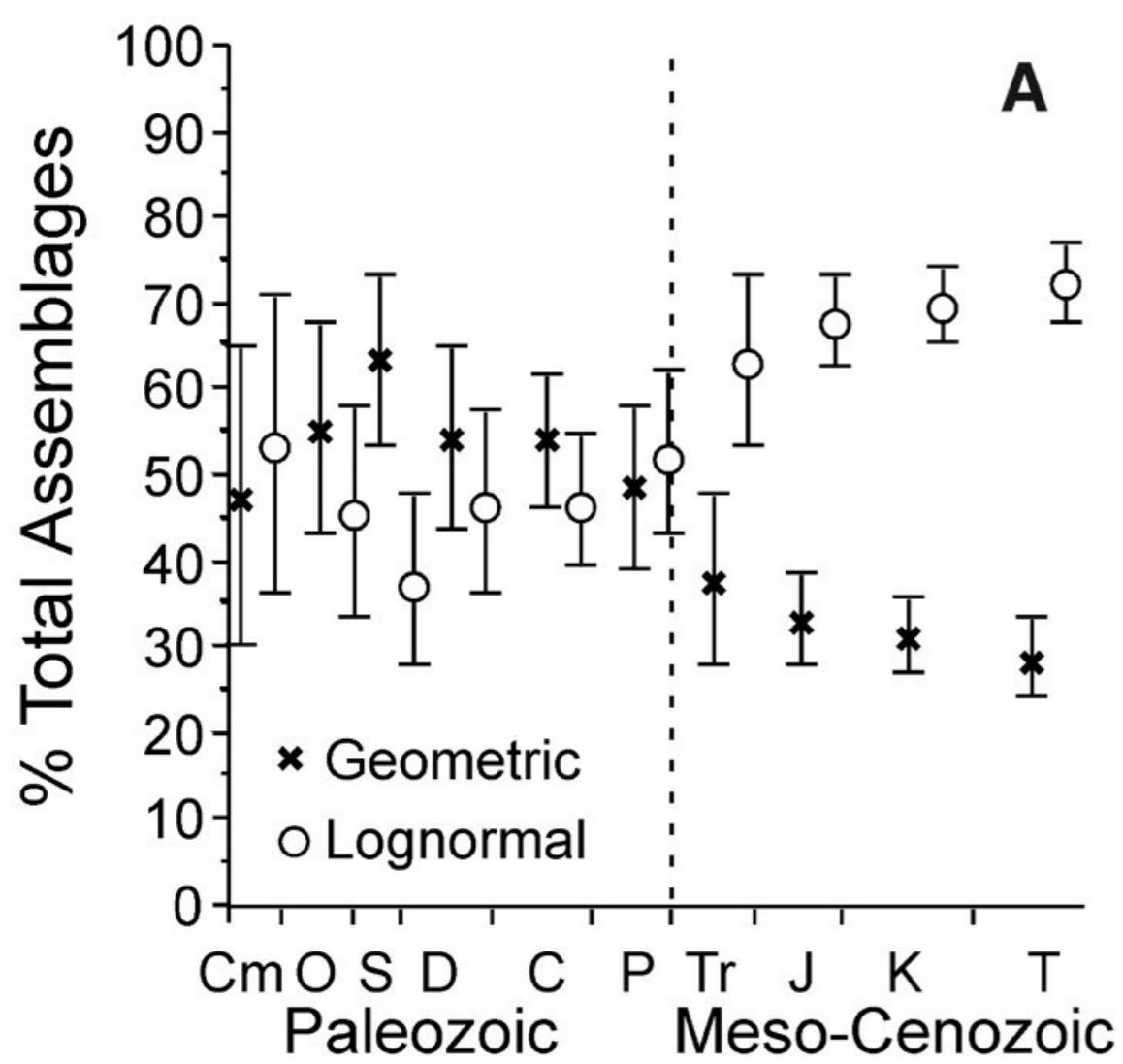
Change is non-equilibrium



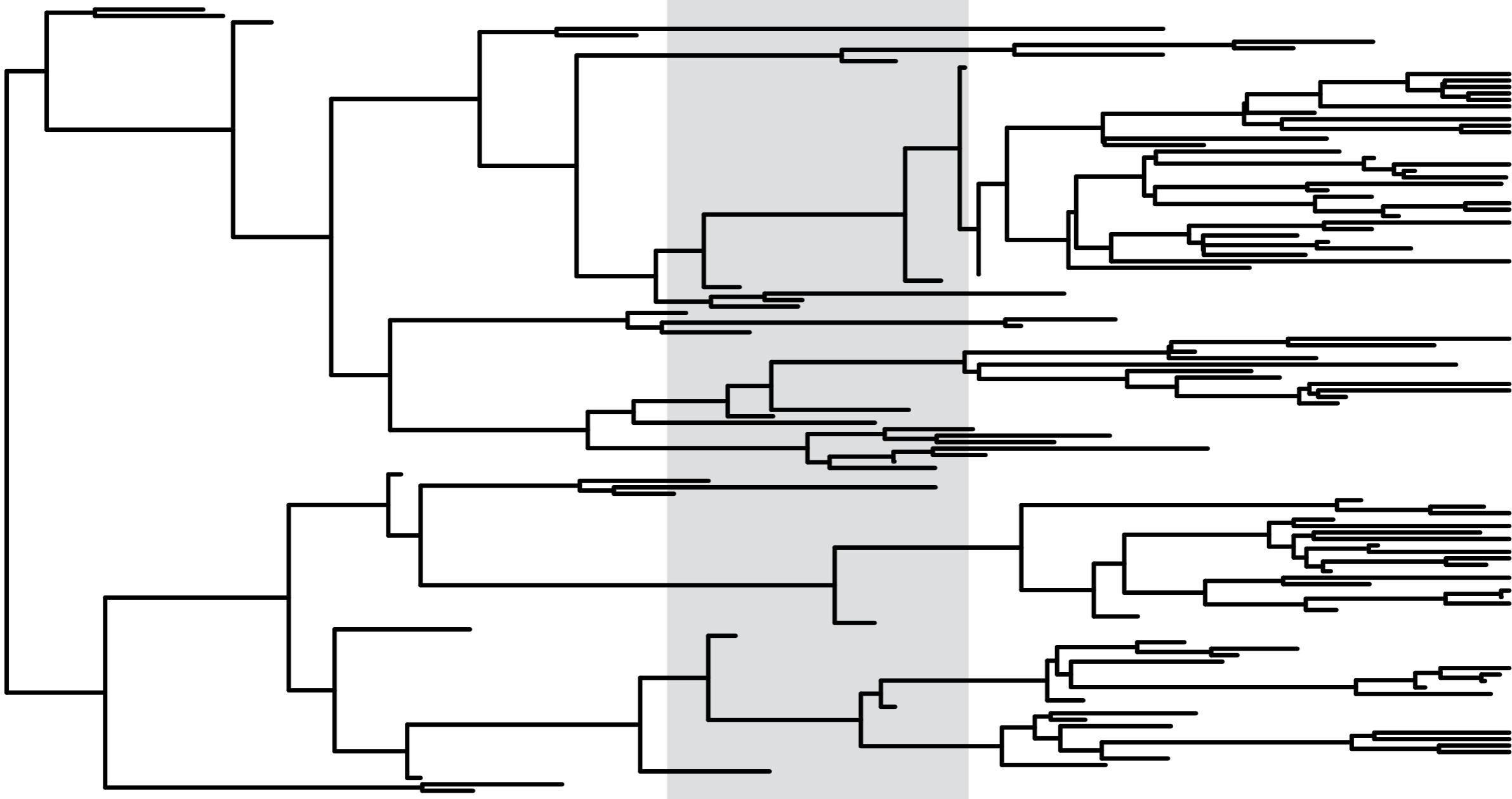
Data: Paleobiology Database

Insights from the fossil record

Change is non-equilibrium



Insights from the fossil record



Insights from phylogenetics

Insights from phylogenetics

Evolutionary history underlying communities

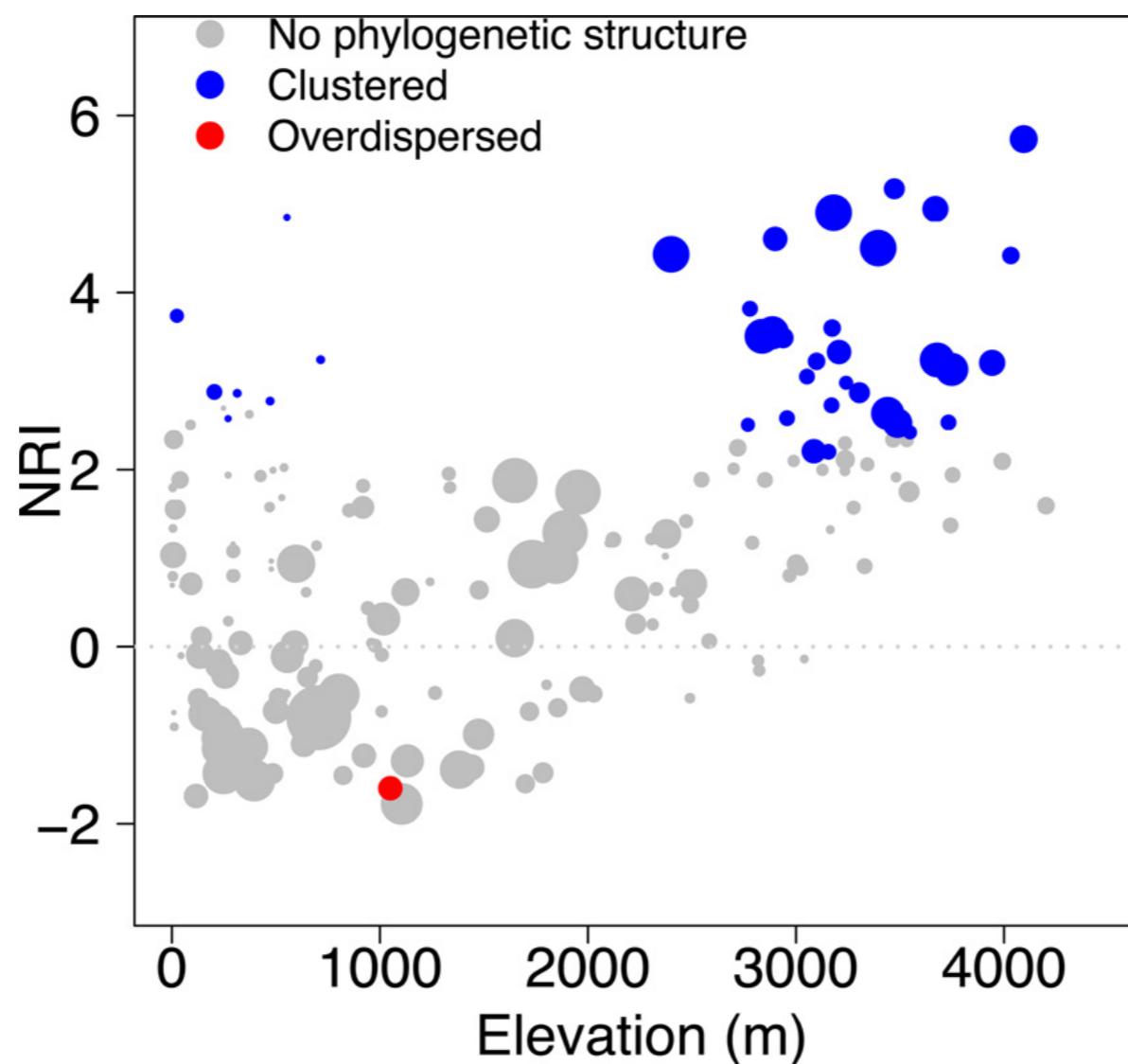
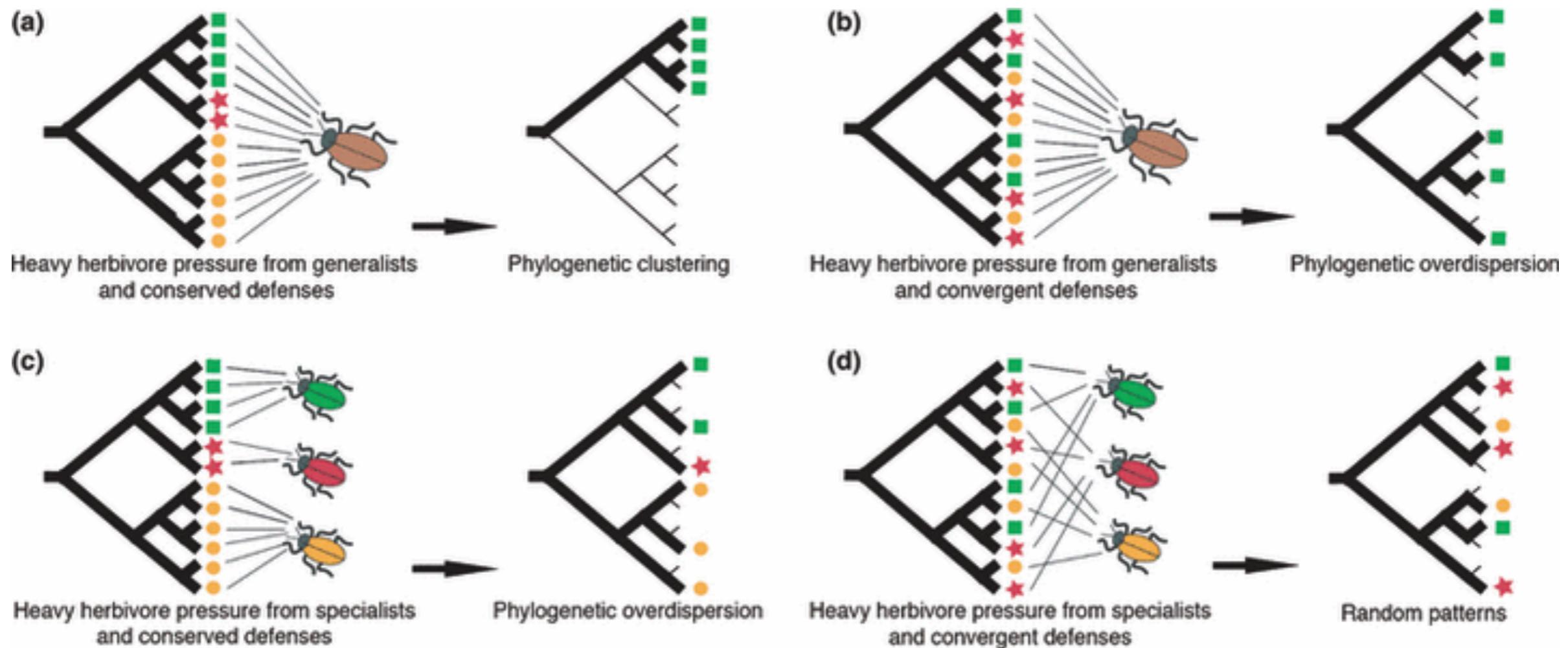


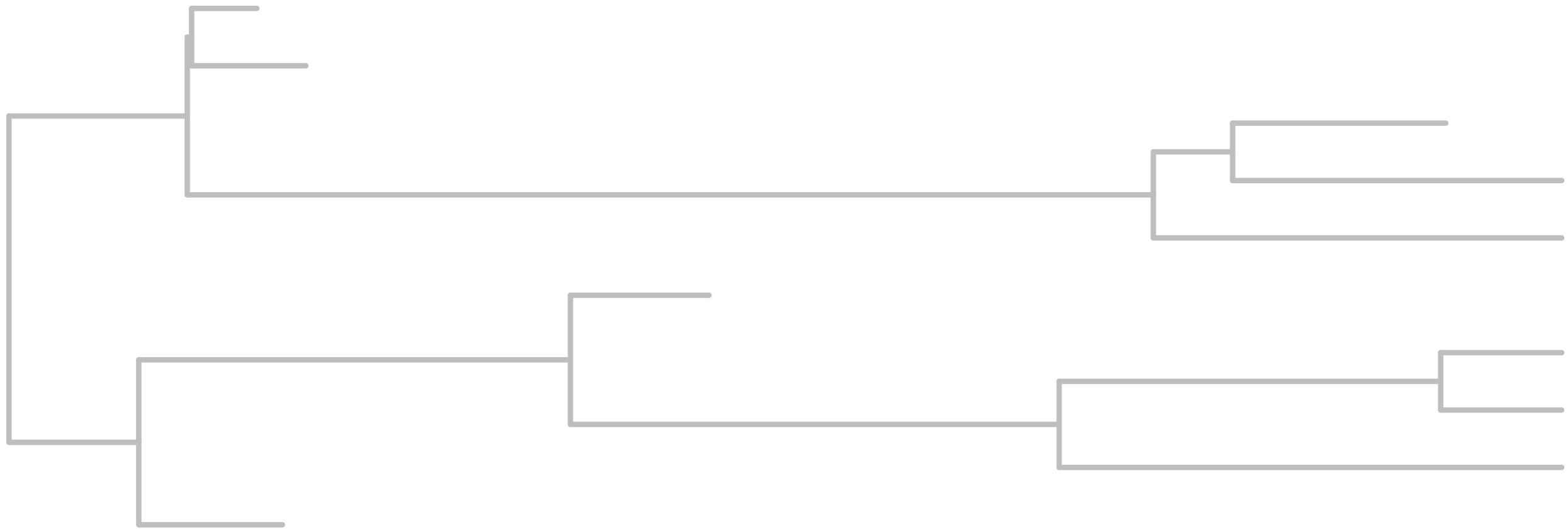
Fig. 2. Plot of NRI versus elevation. The size of the circle is proportional to the number of species in the community.

Insights from phylogenetics

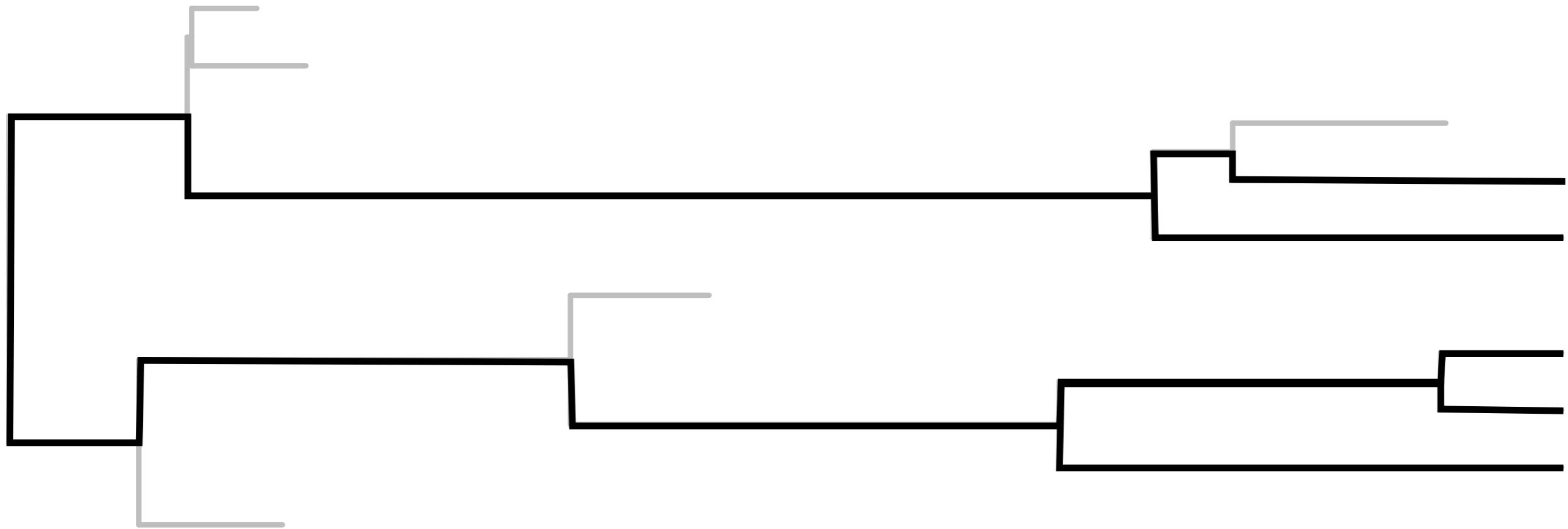
Evolution of species interaction and community assembly



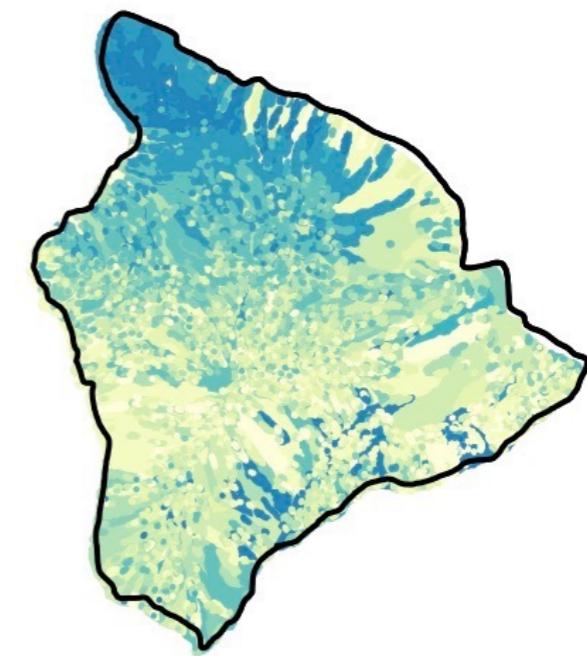
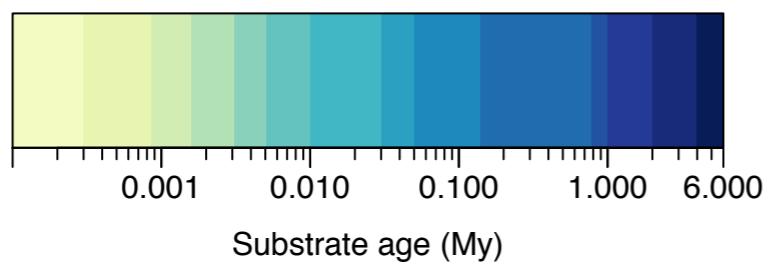
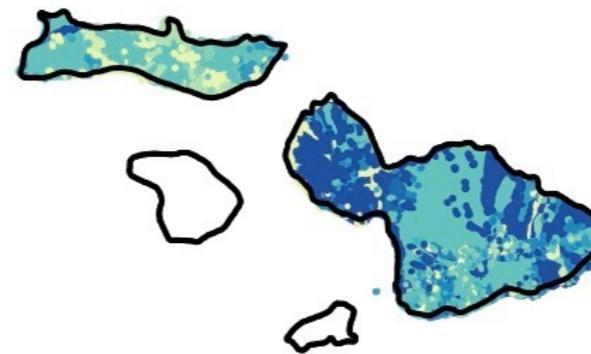
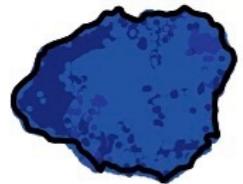
Insights from phylogenetics



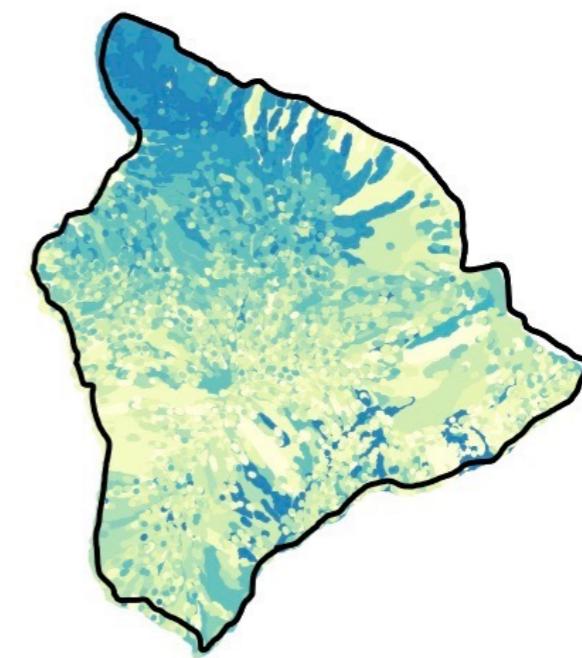
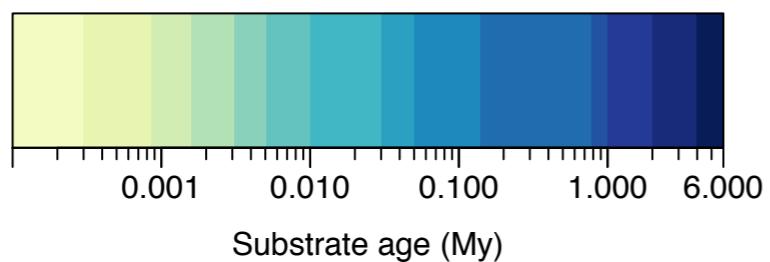
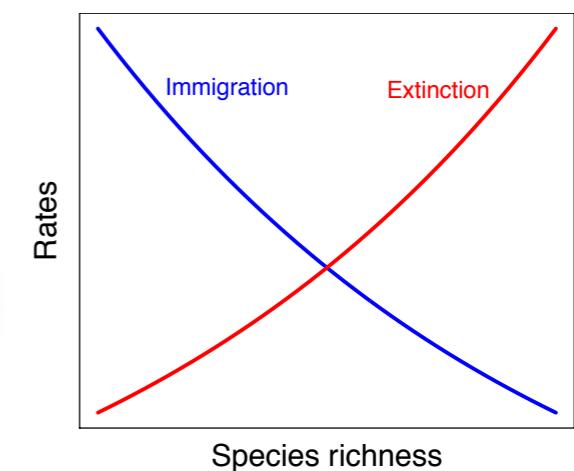
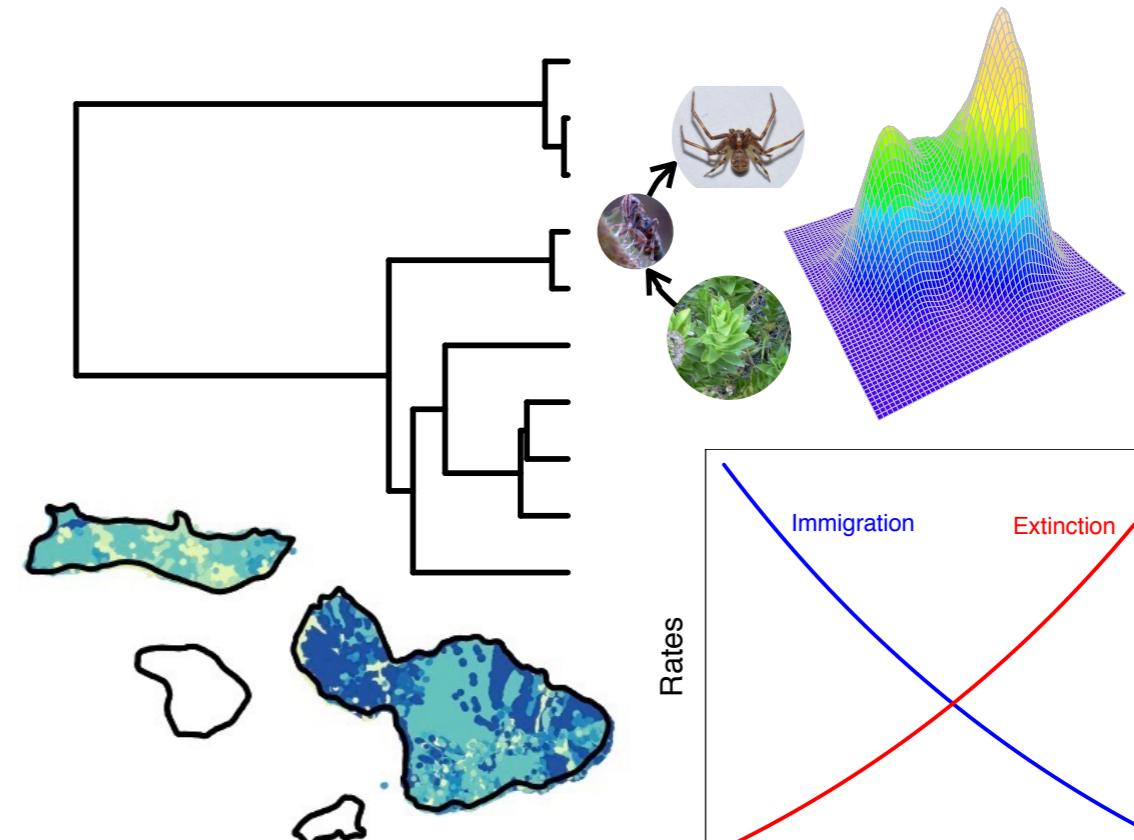
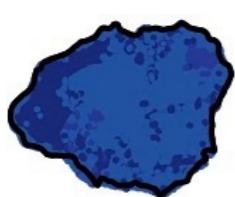
Insights from phylogenetics



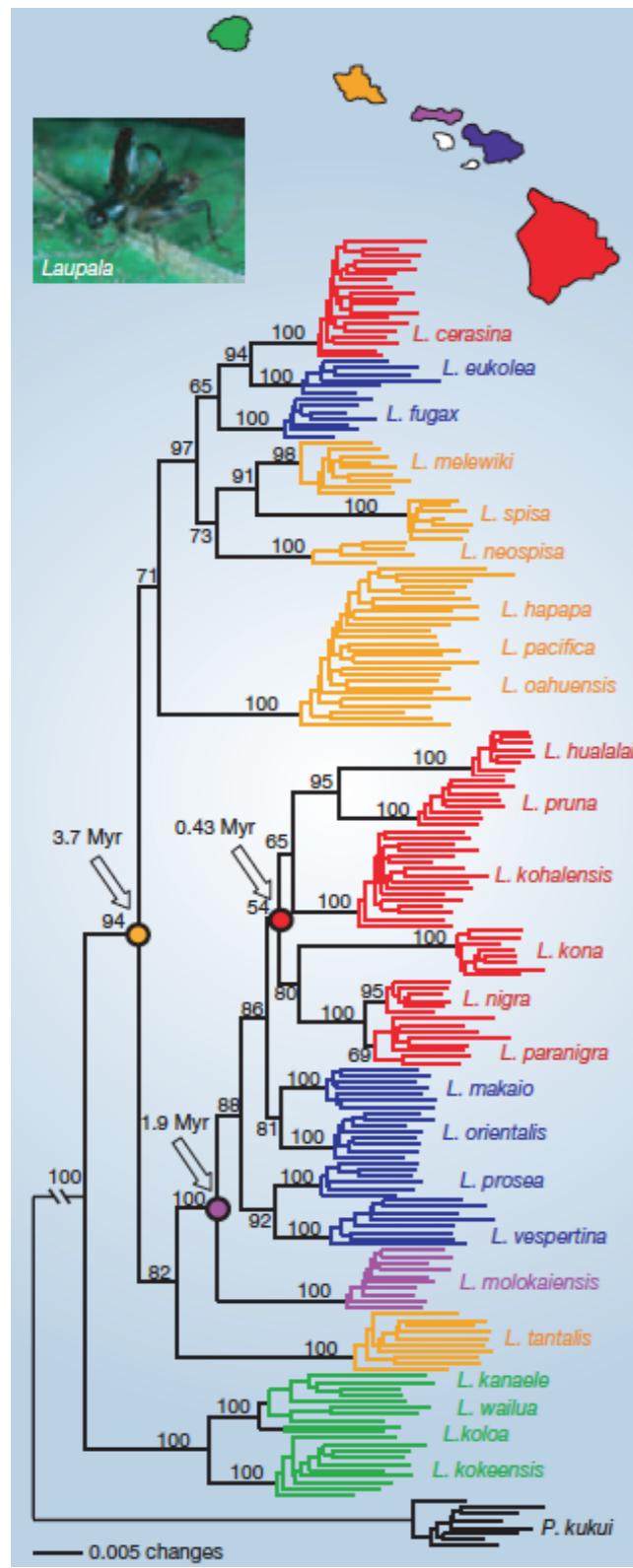
Island chronosequence



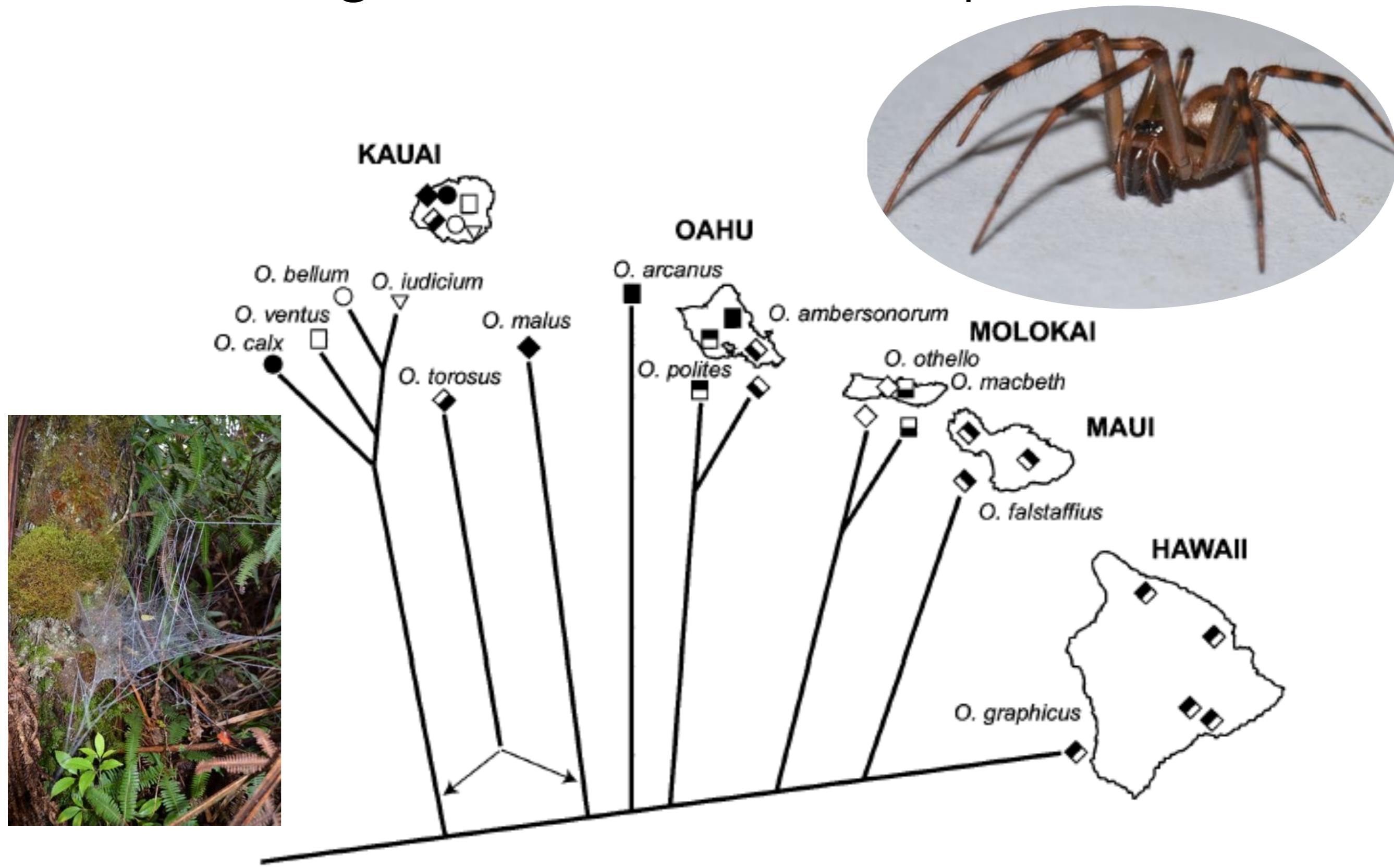
Island chronosequence



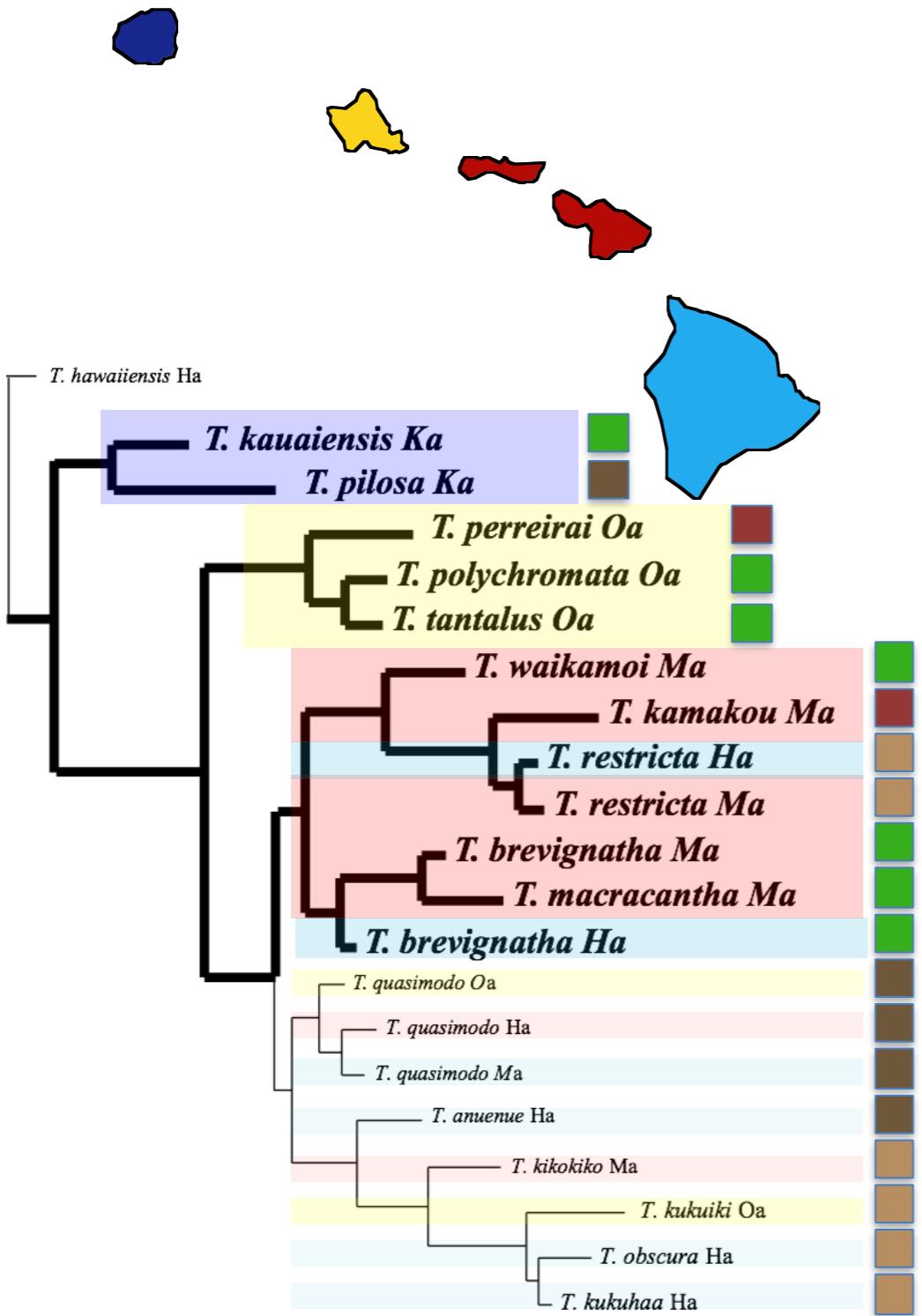
Insights from chronosequence



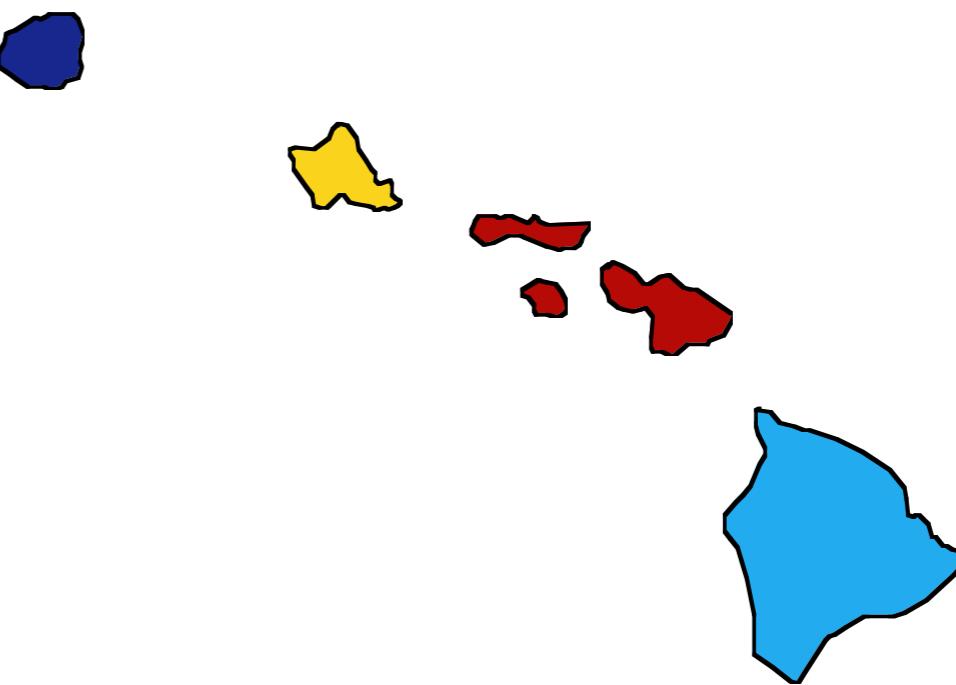
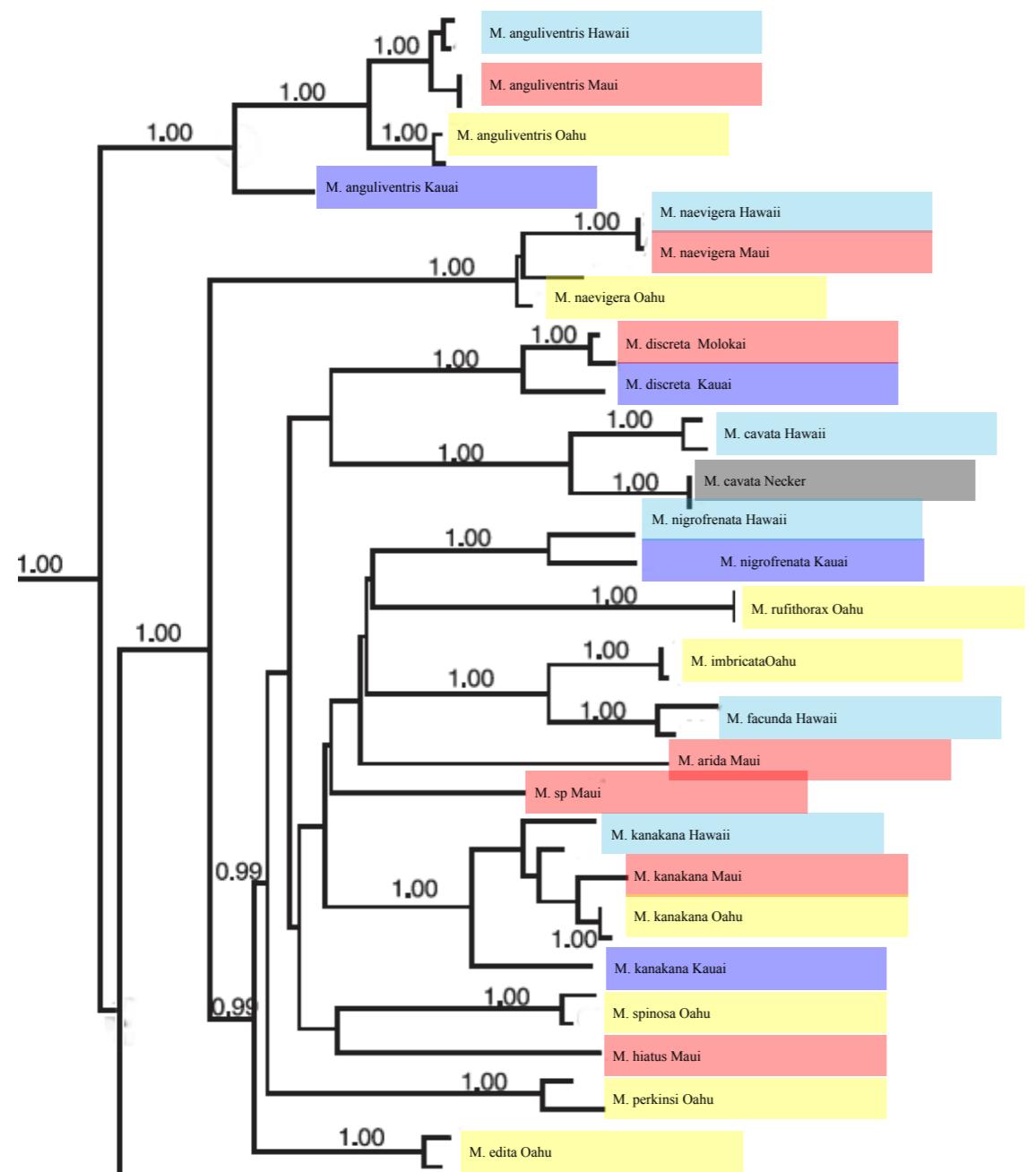
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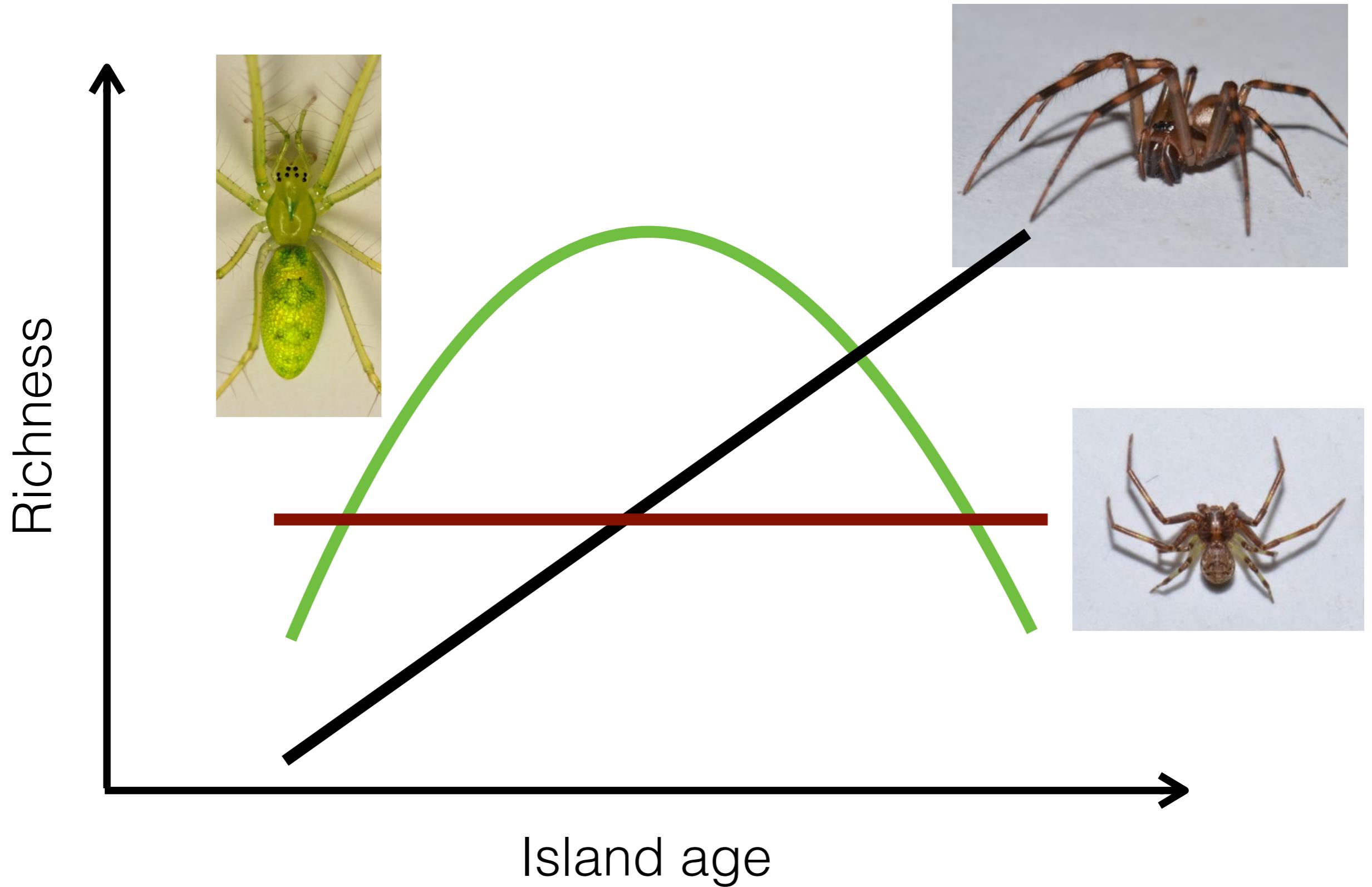
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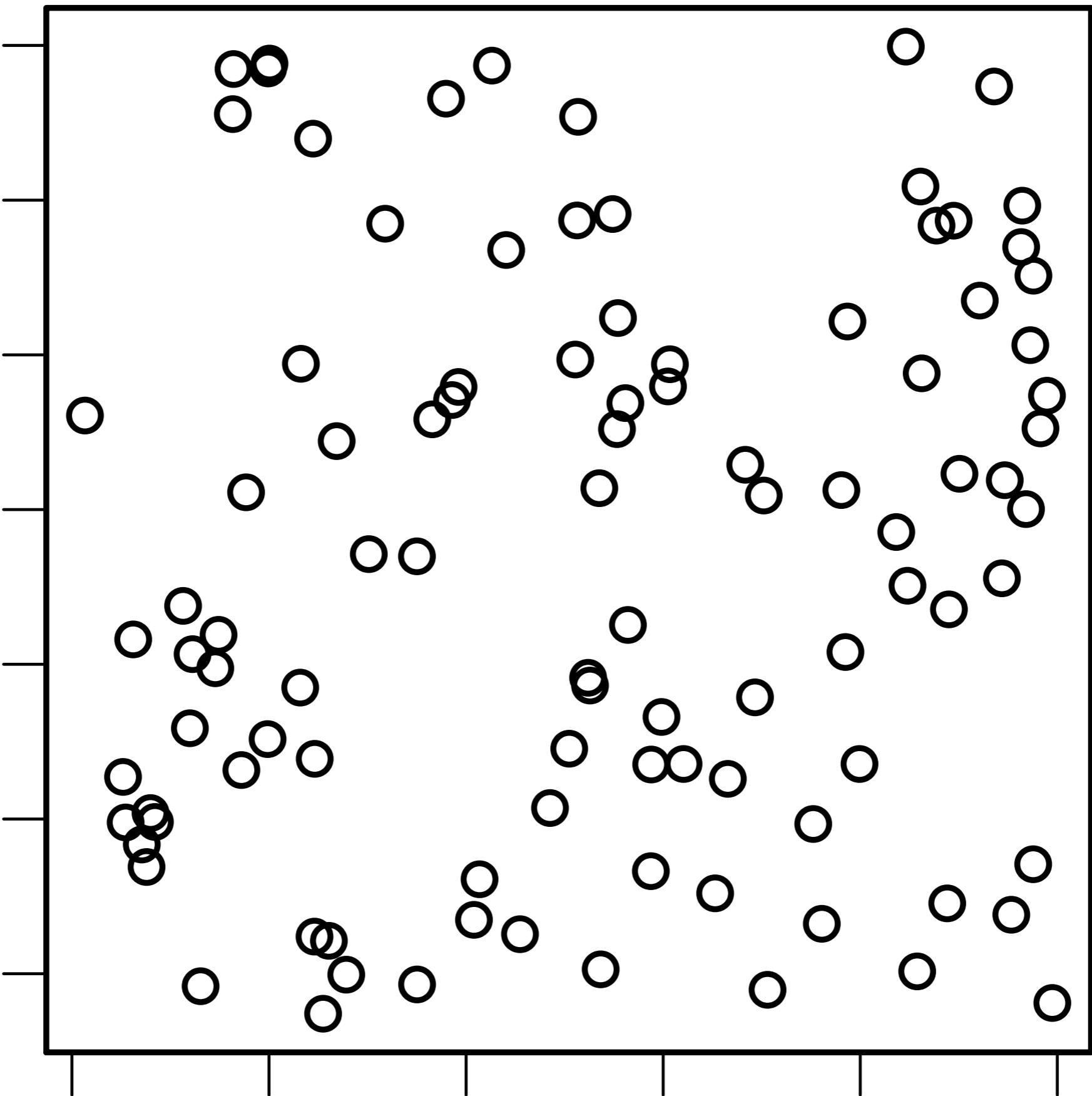
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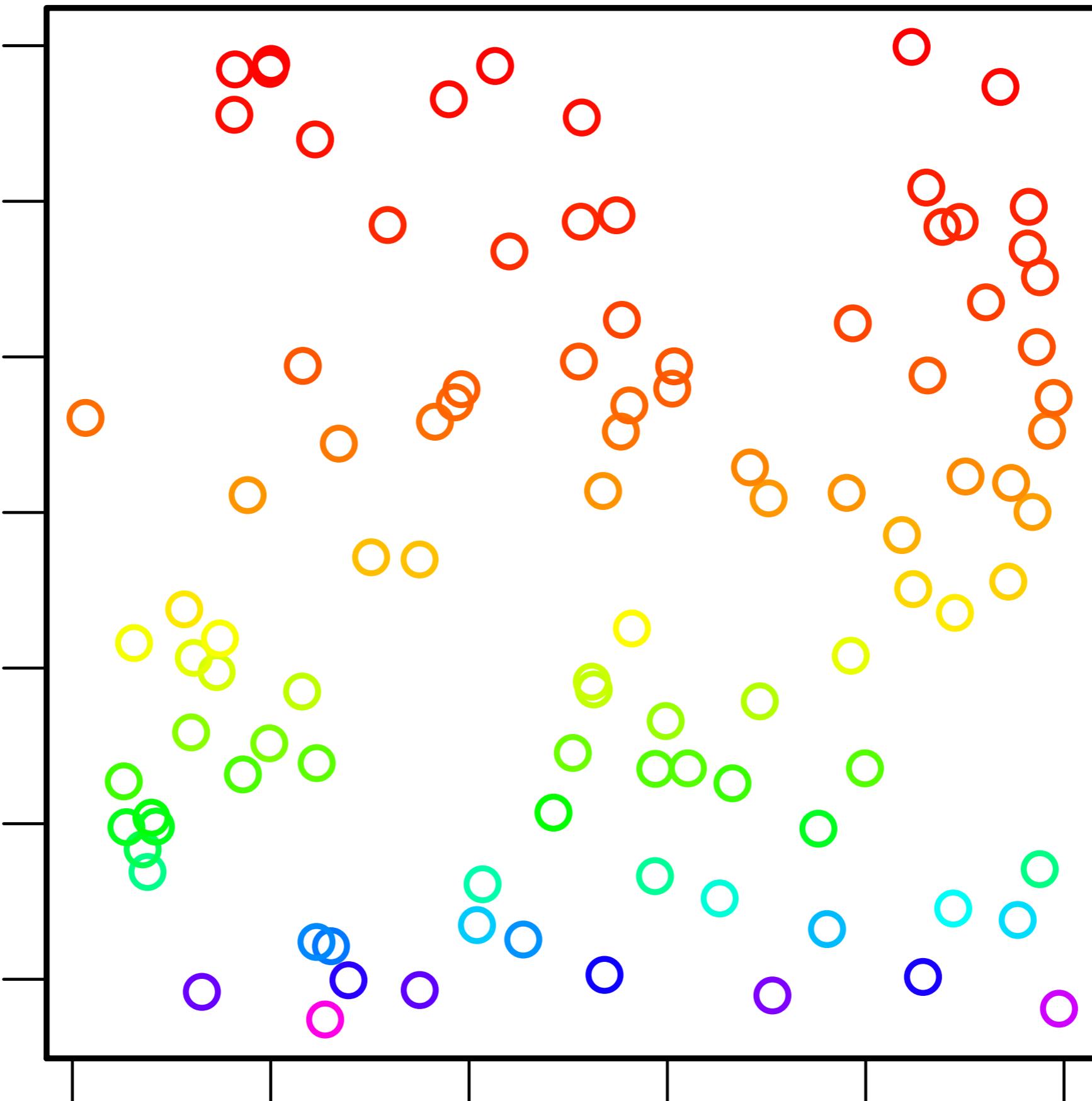


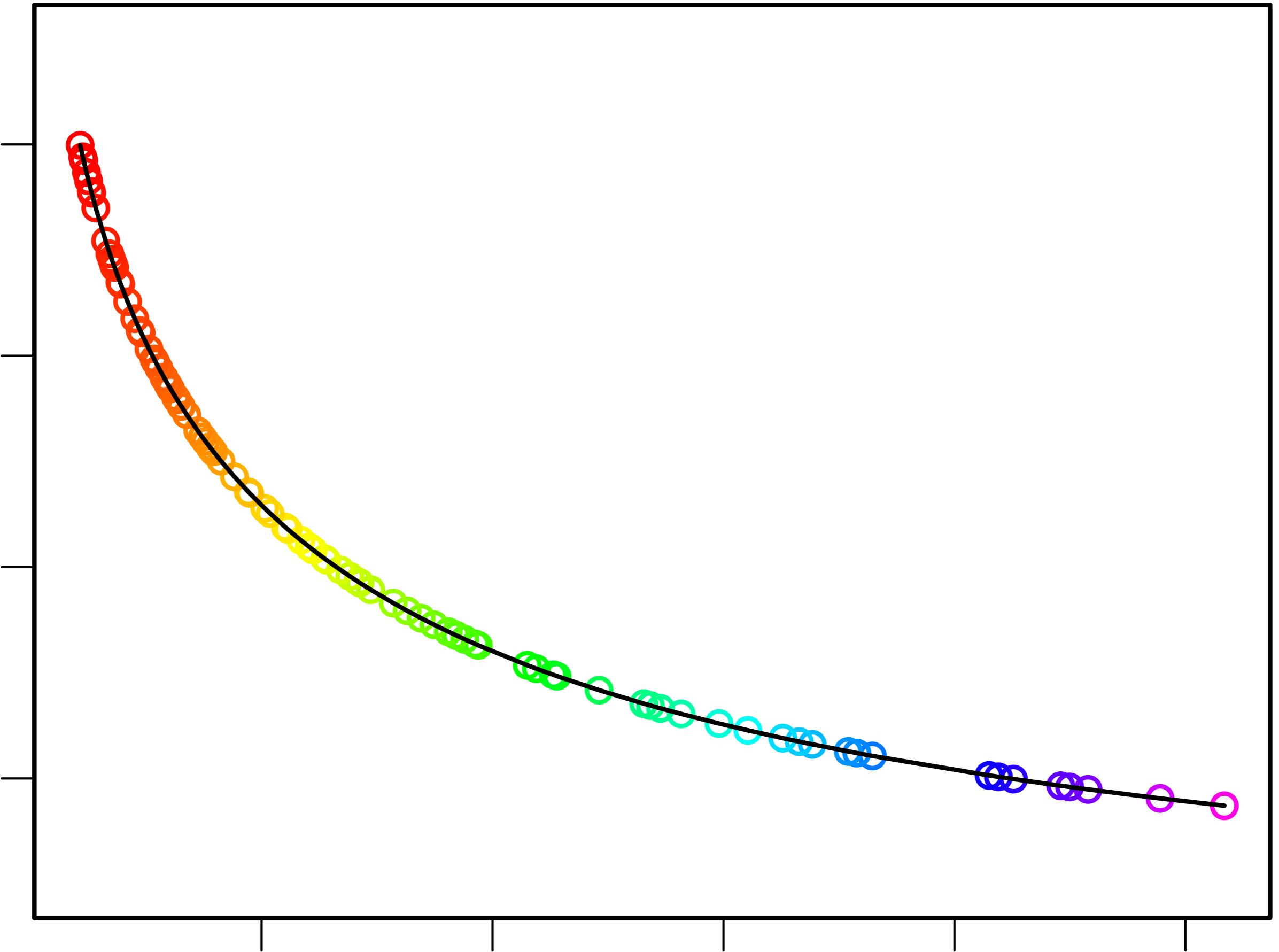
Insights from chronosequence

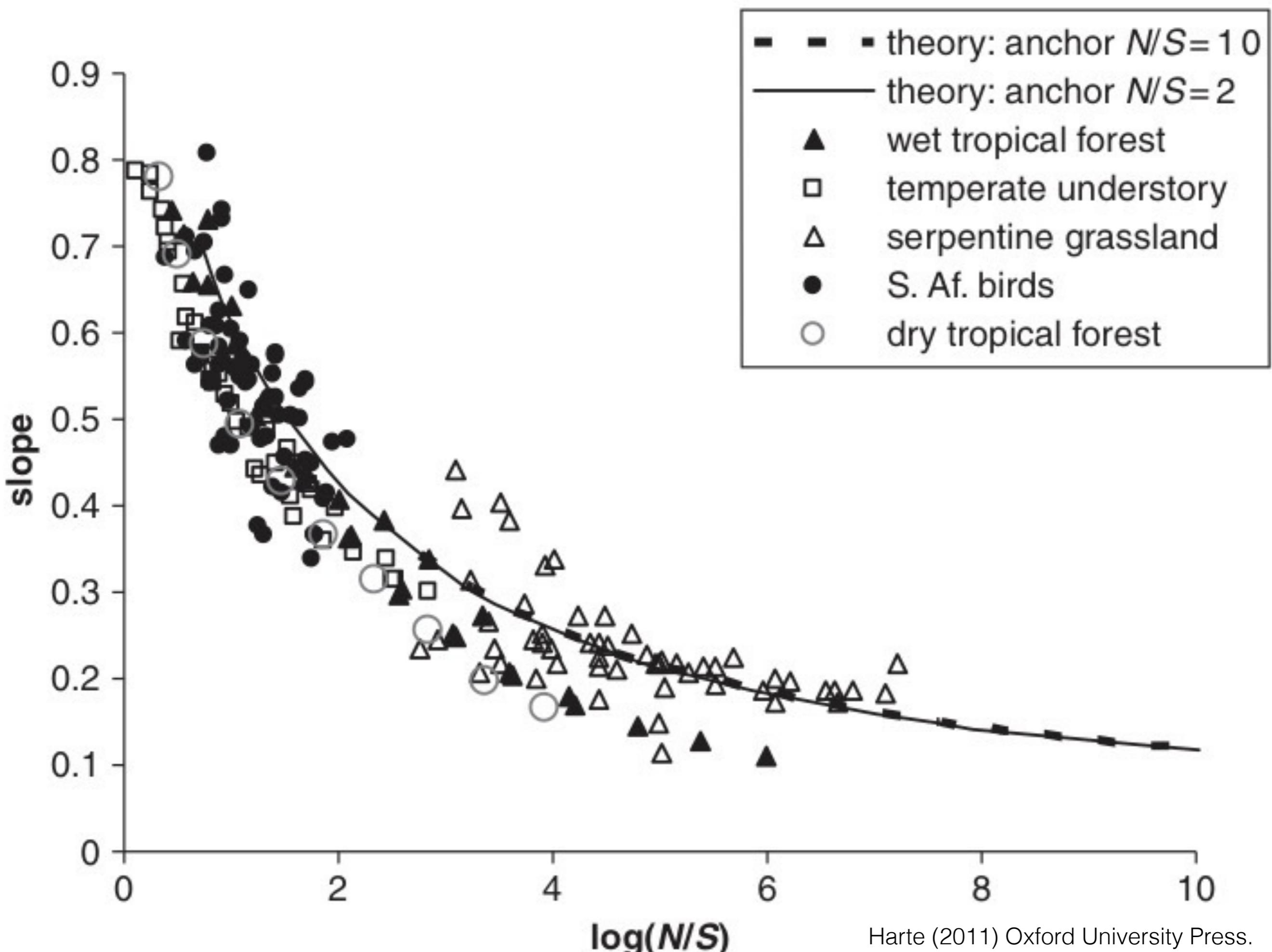


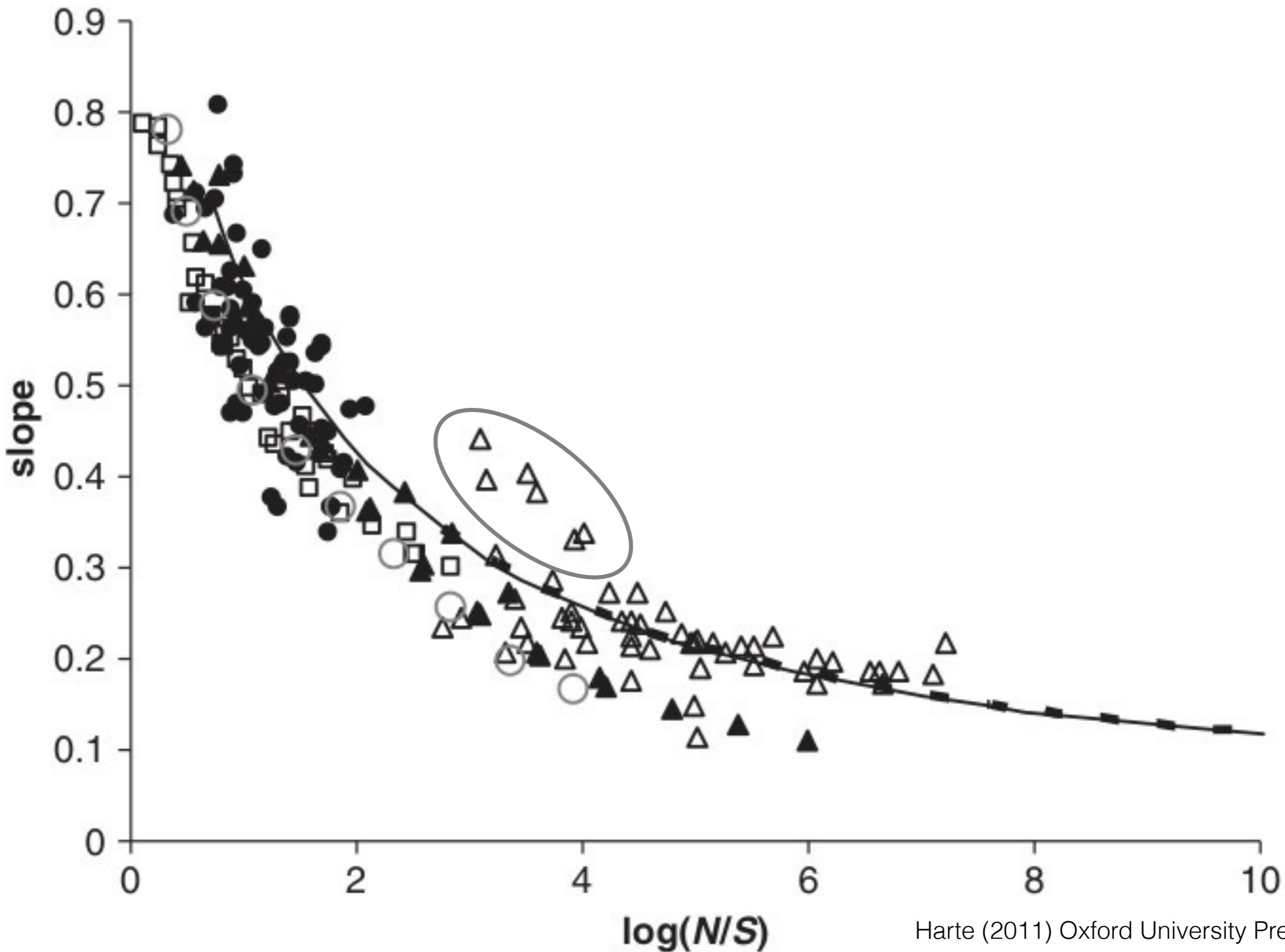
Theory to find pattern in noise

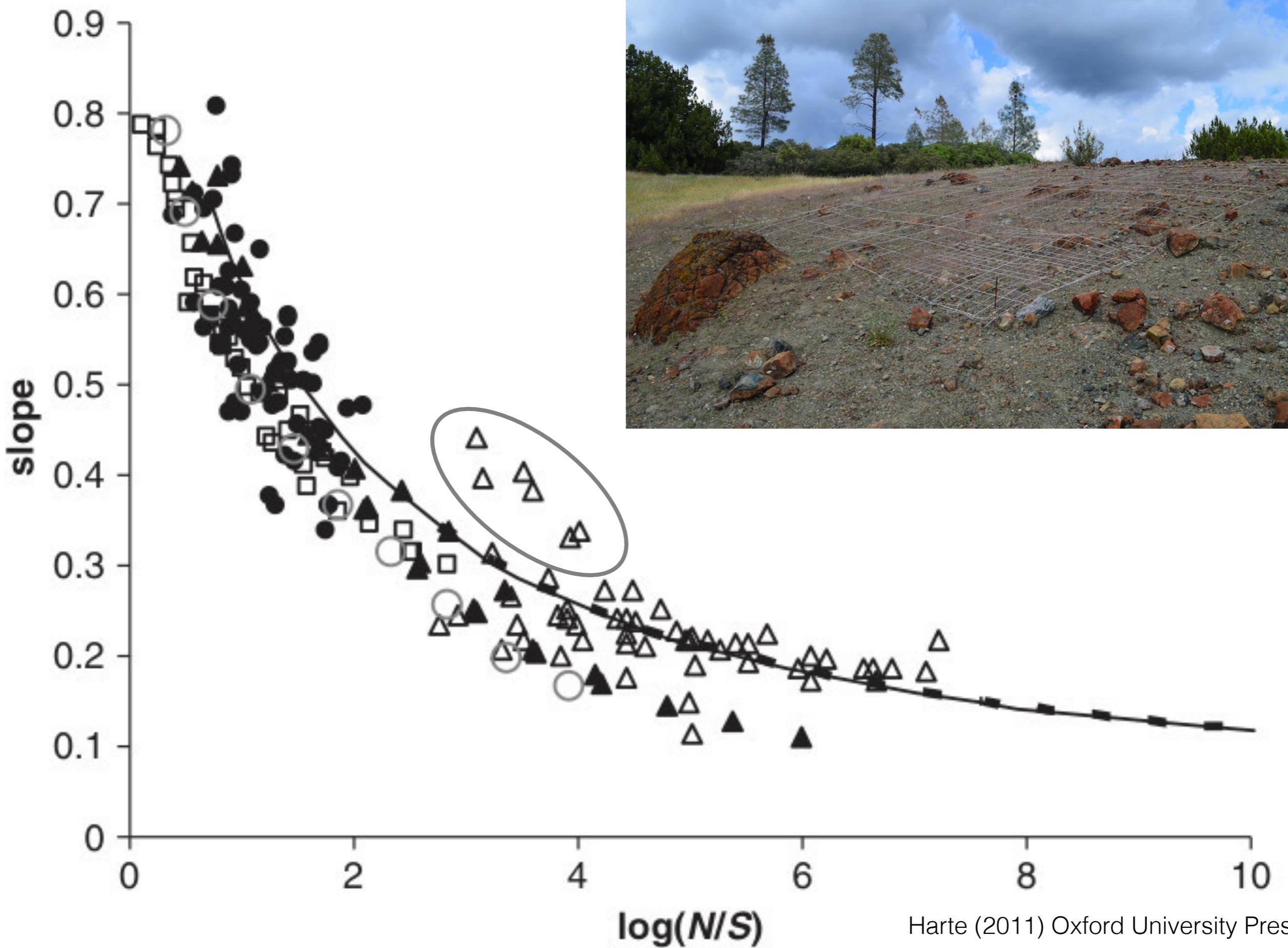






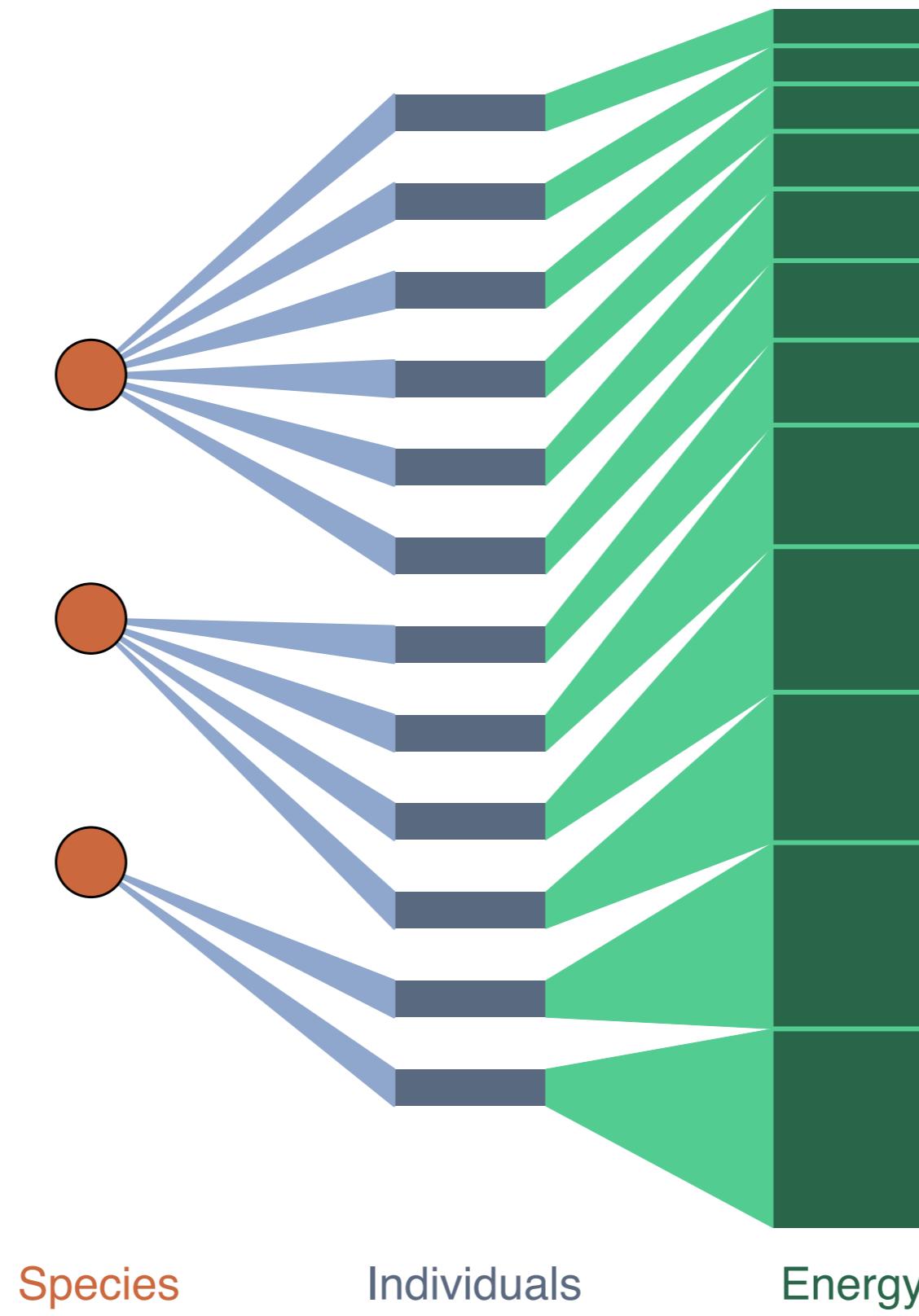


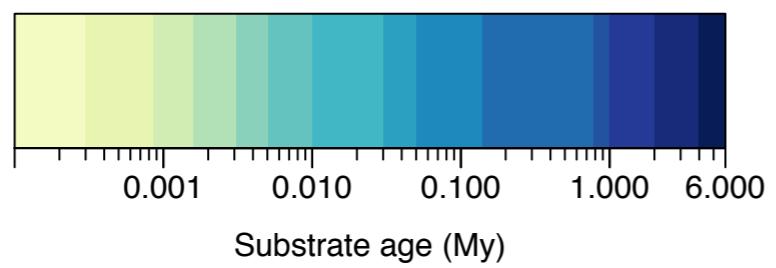
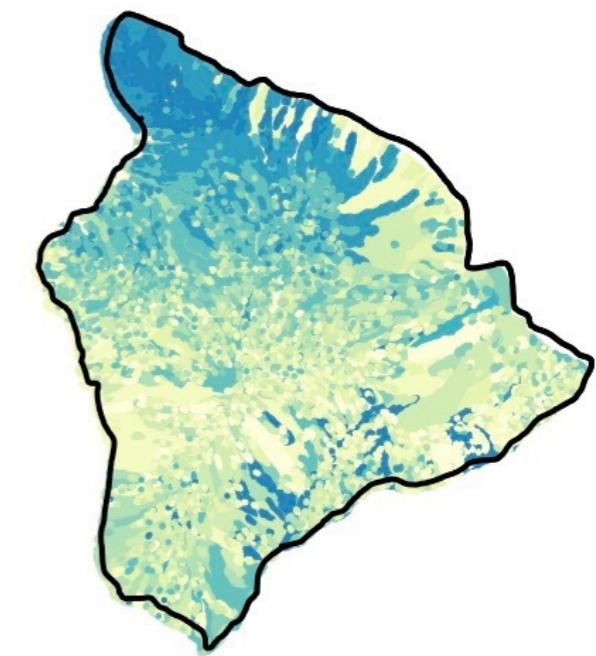
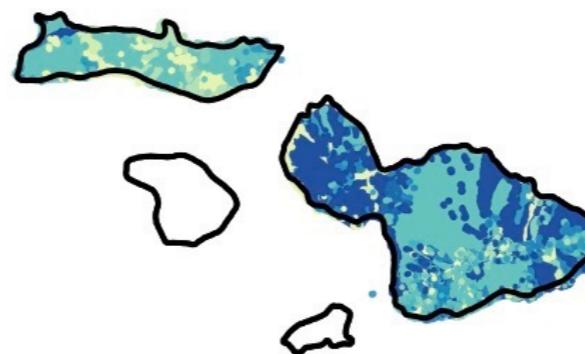
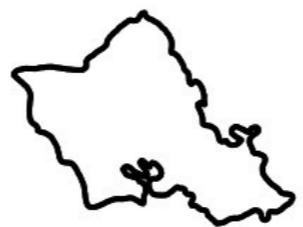
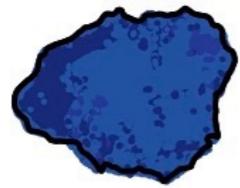


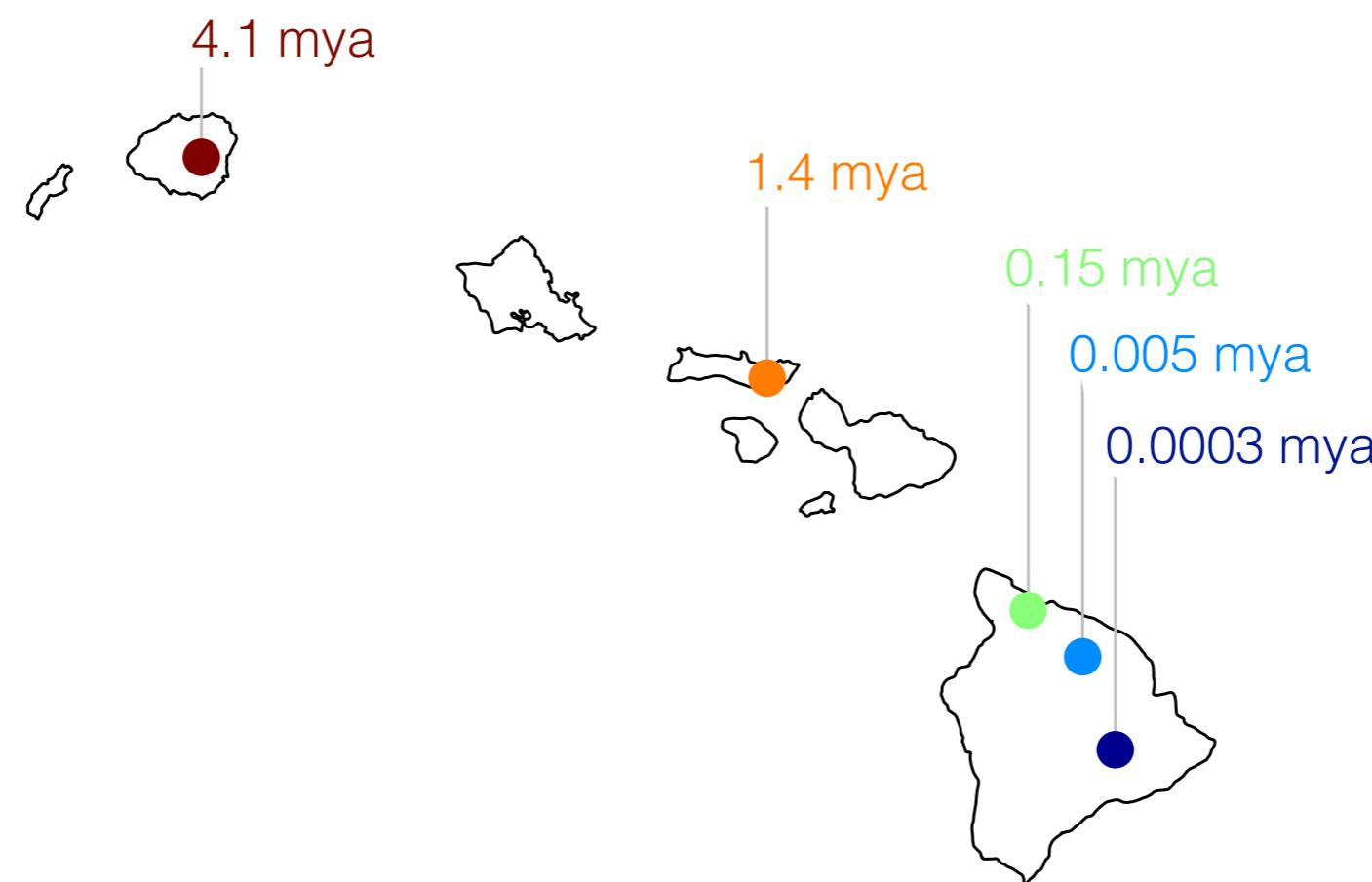
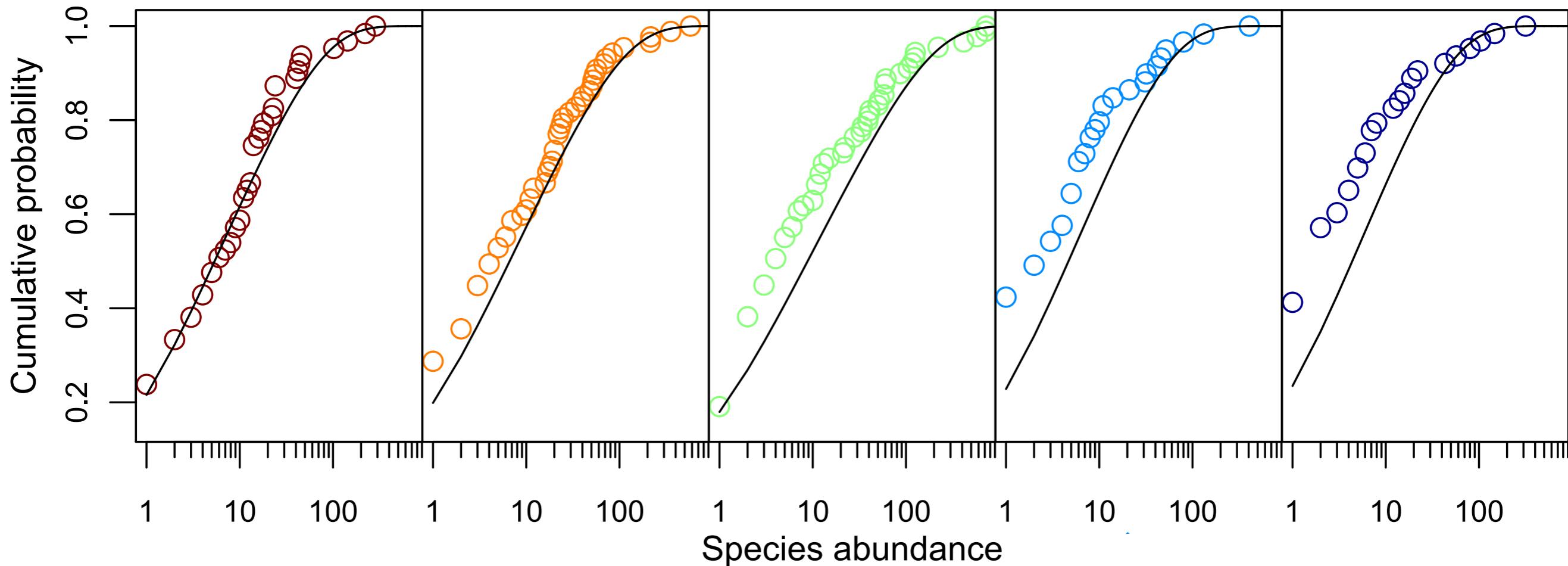


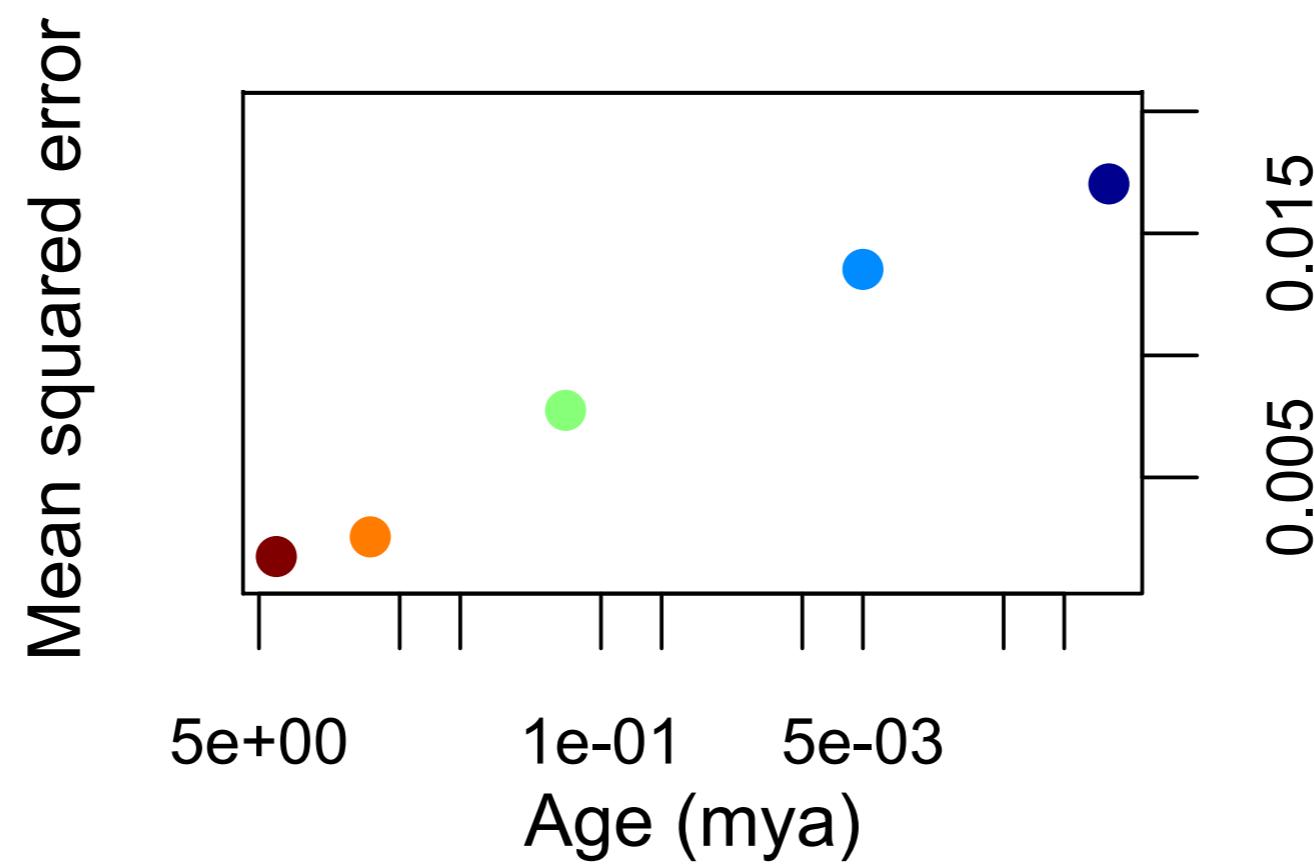
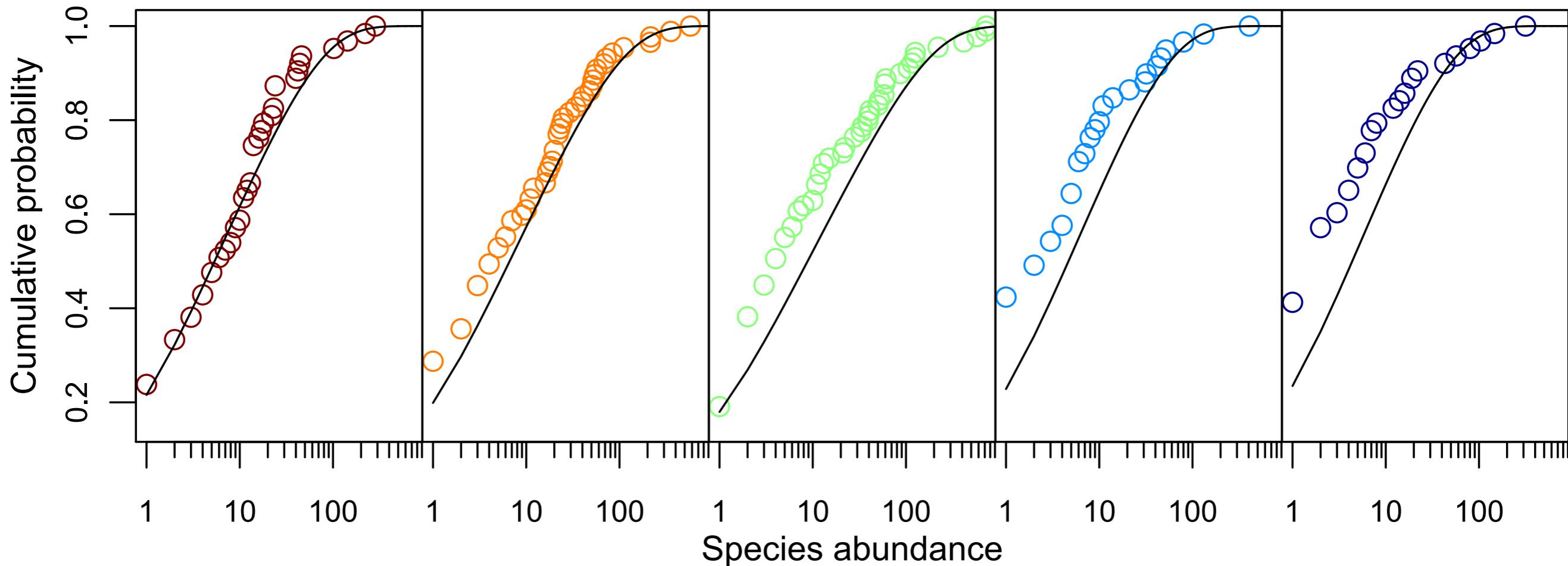
Harte (2011) Oxford University Press.

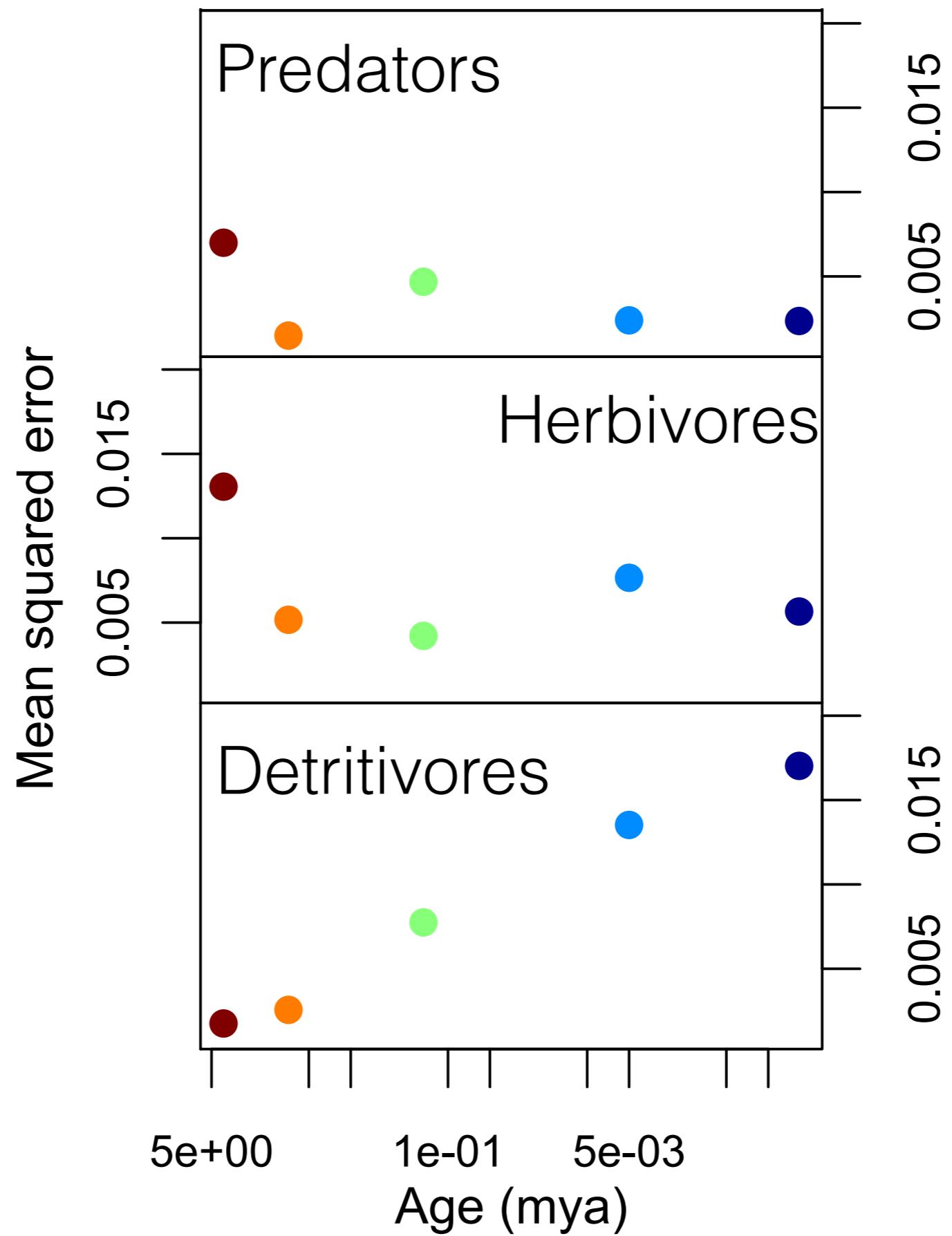
Maximum Entropy Theory of Ecology



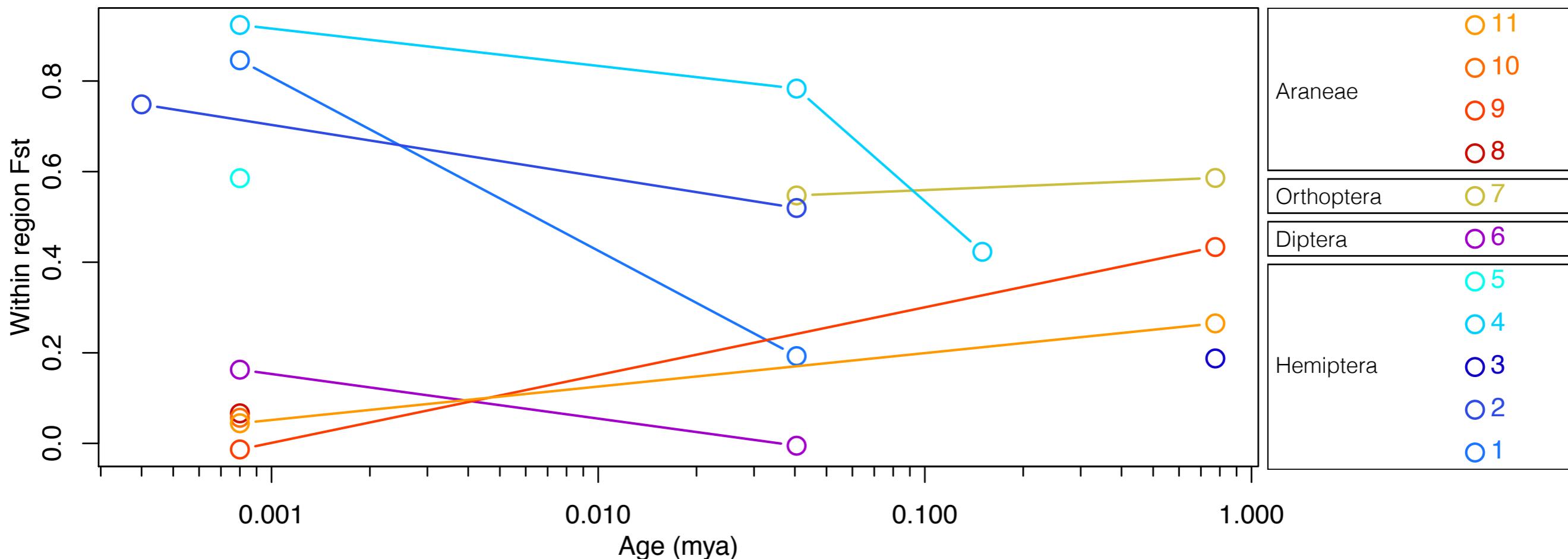


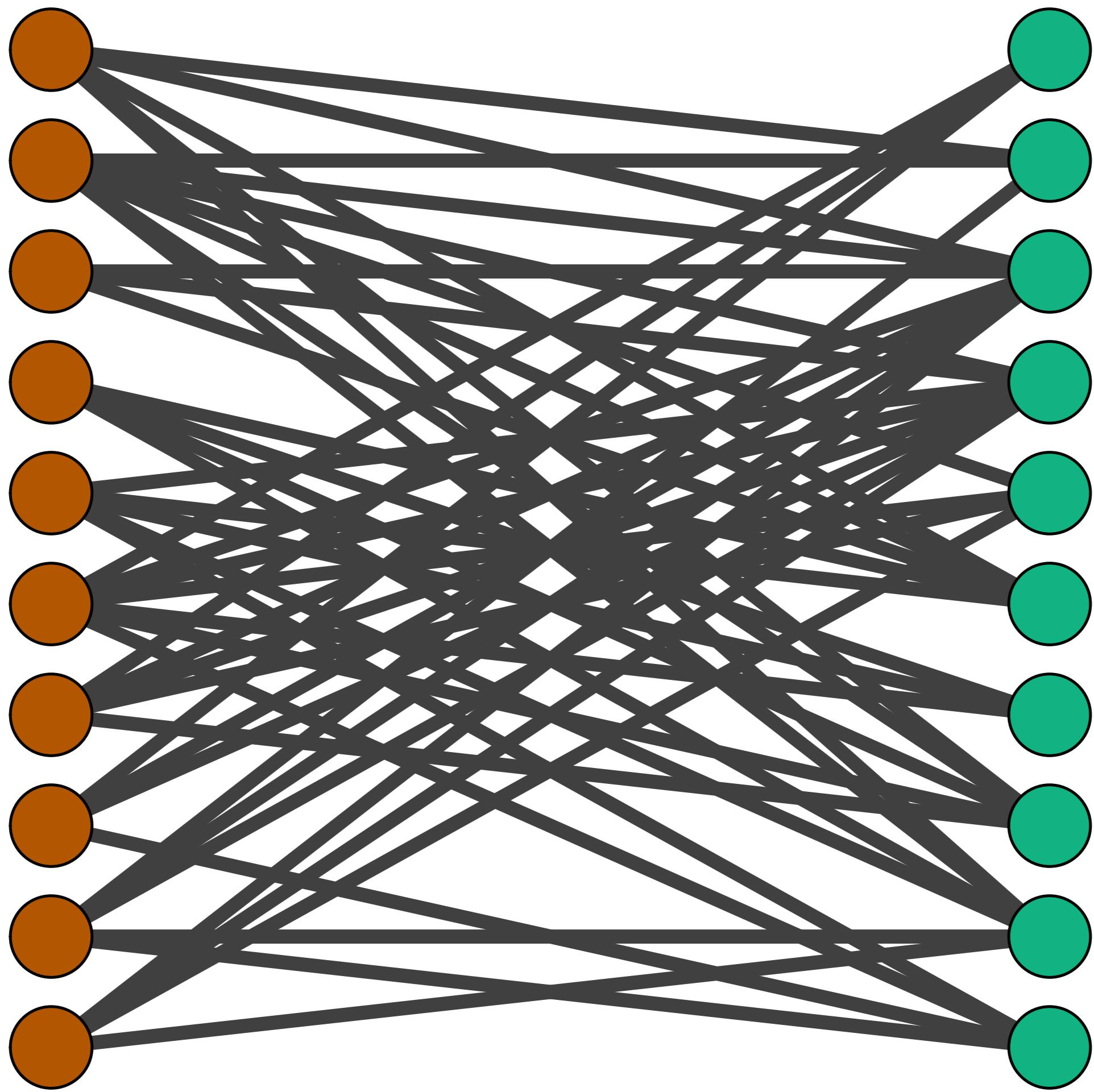


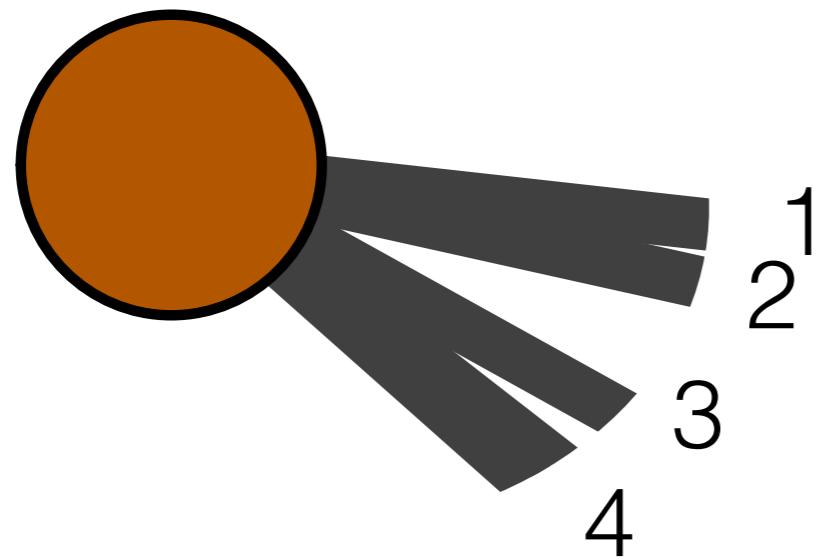


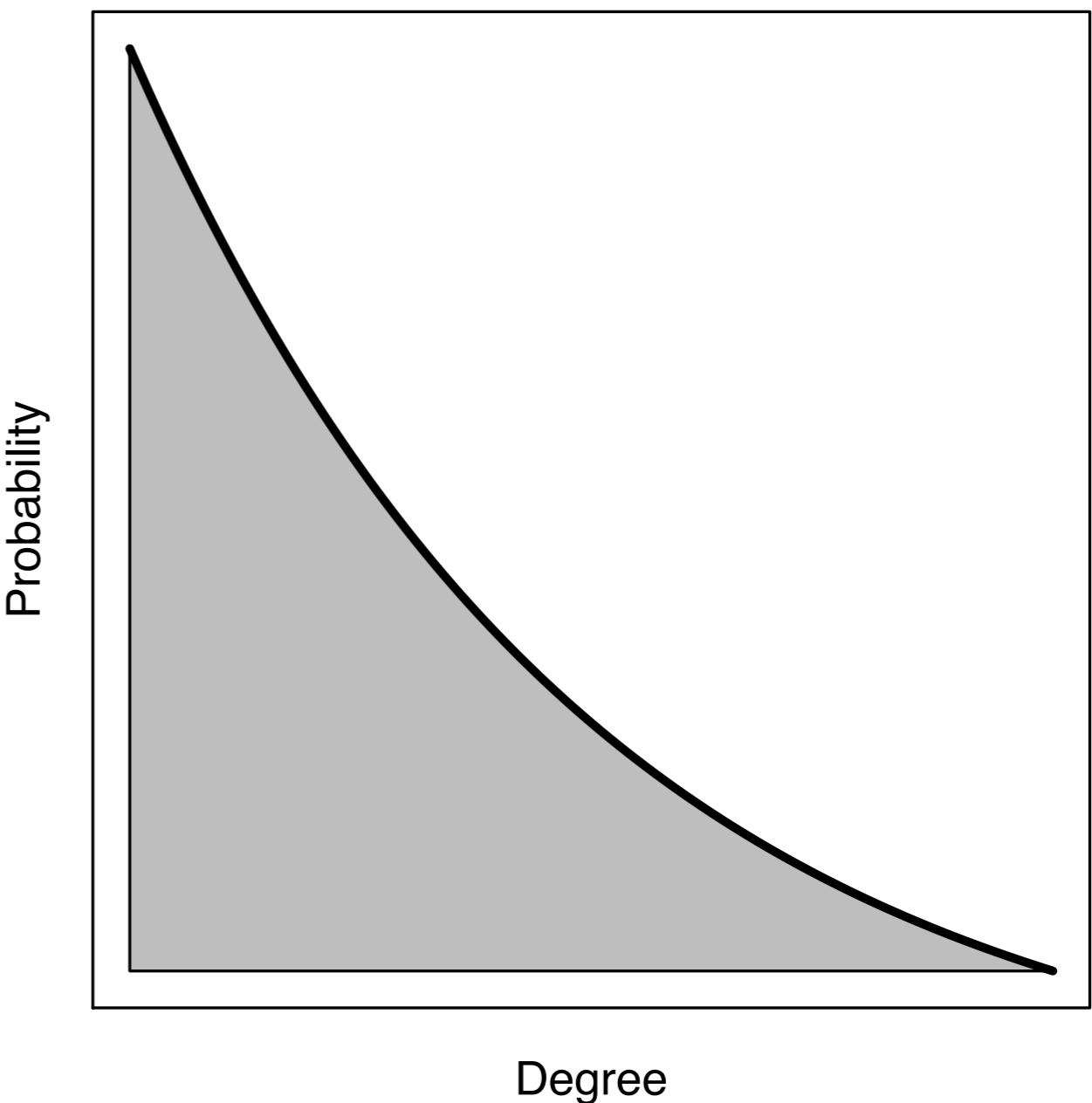
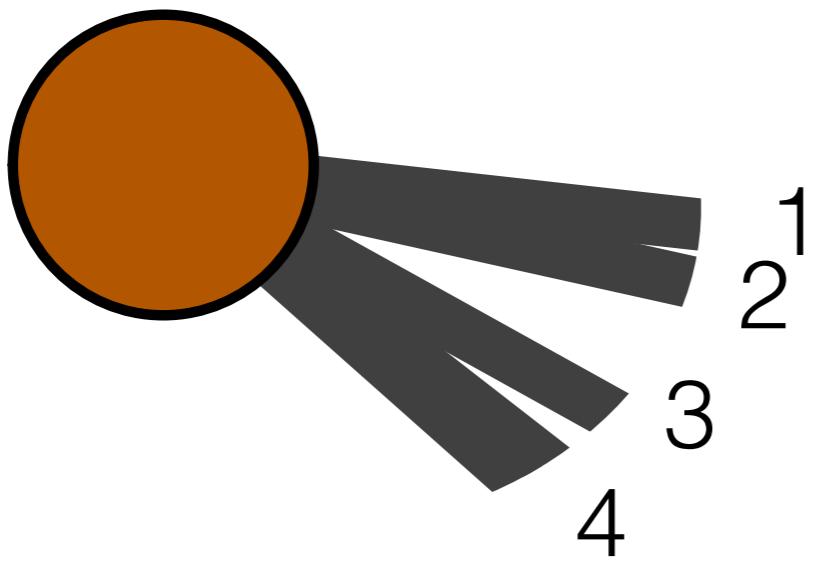


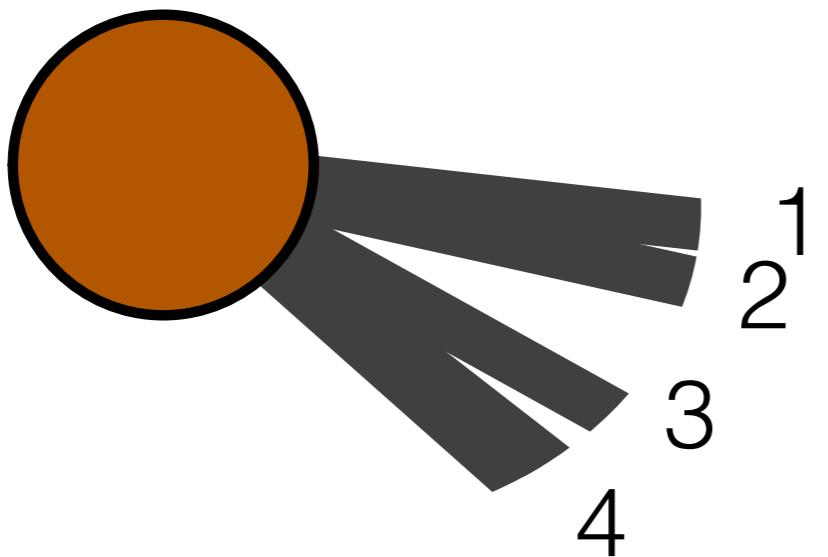
Synthesis across published pop gen





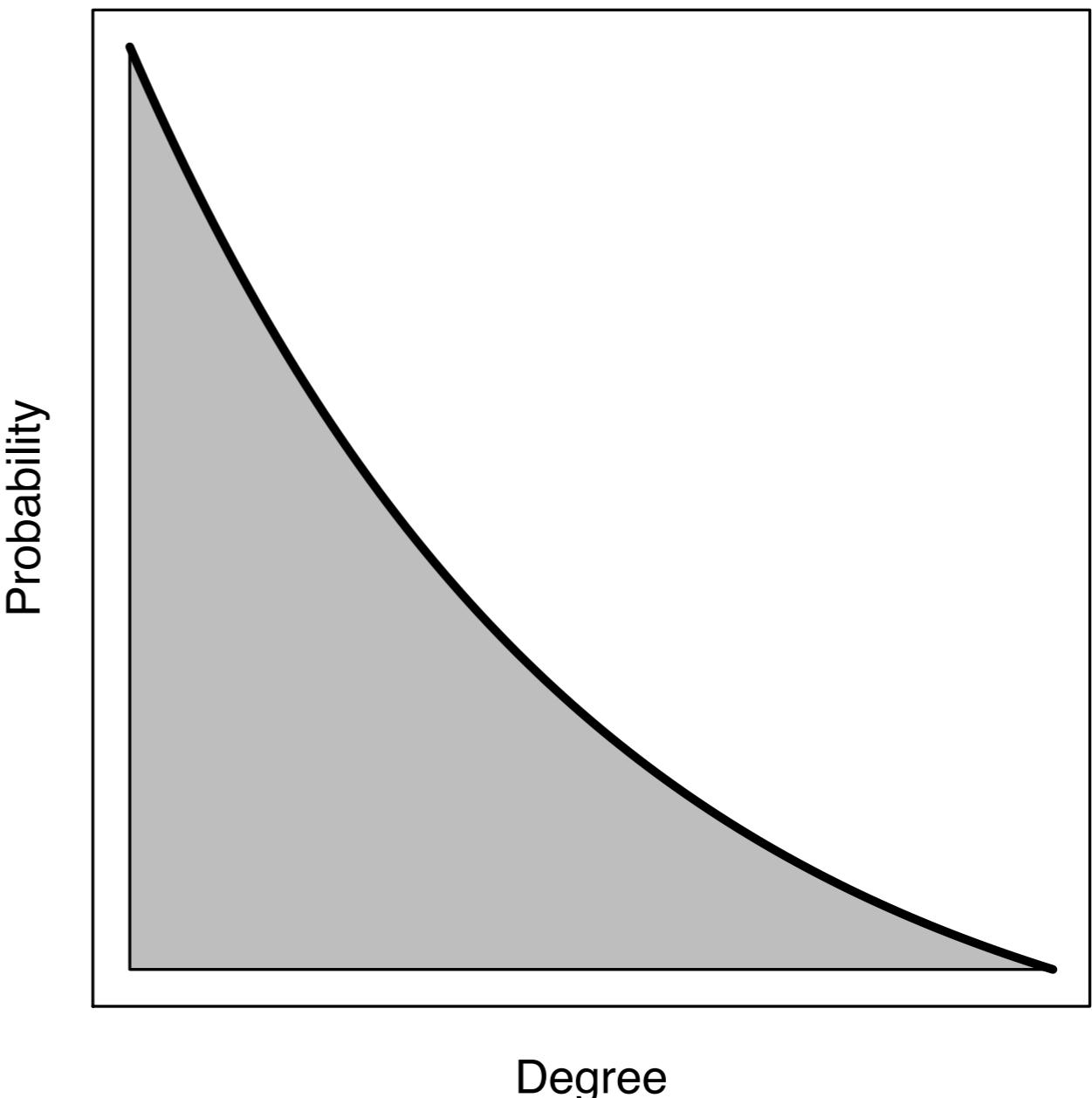


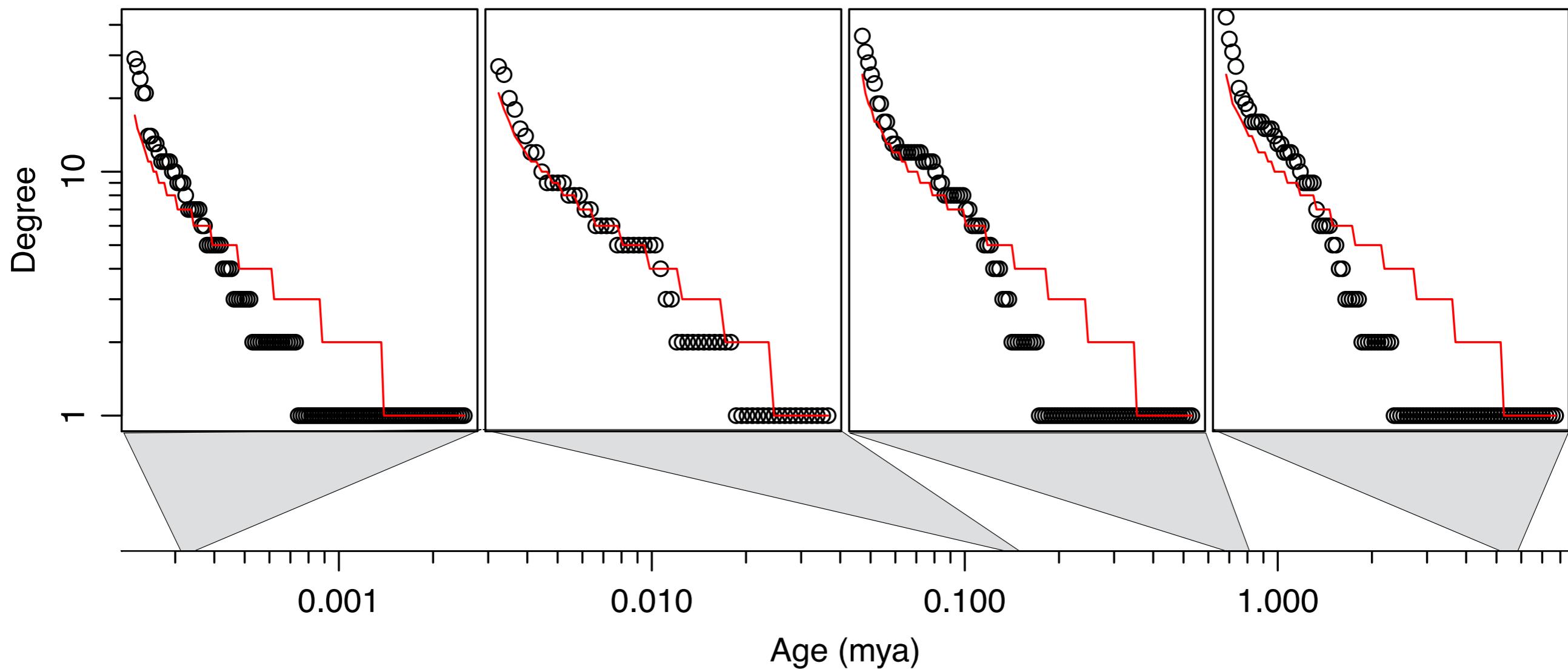


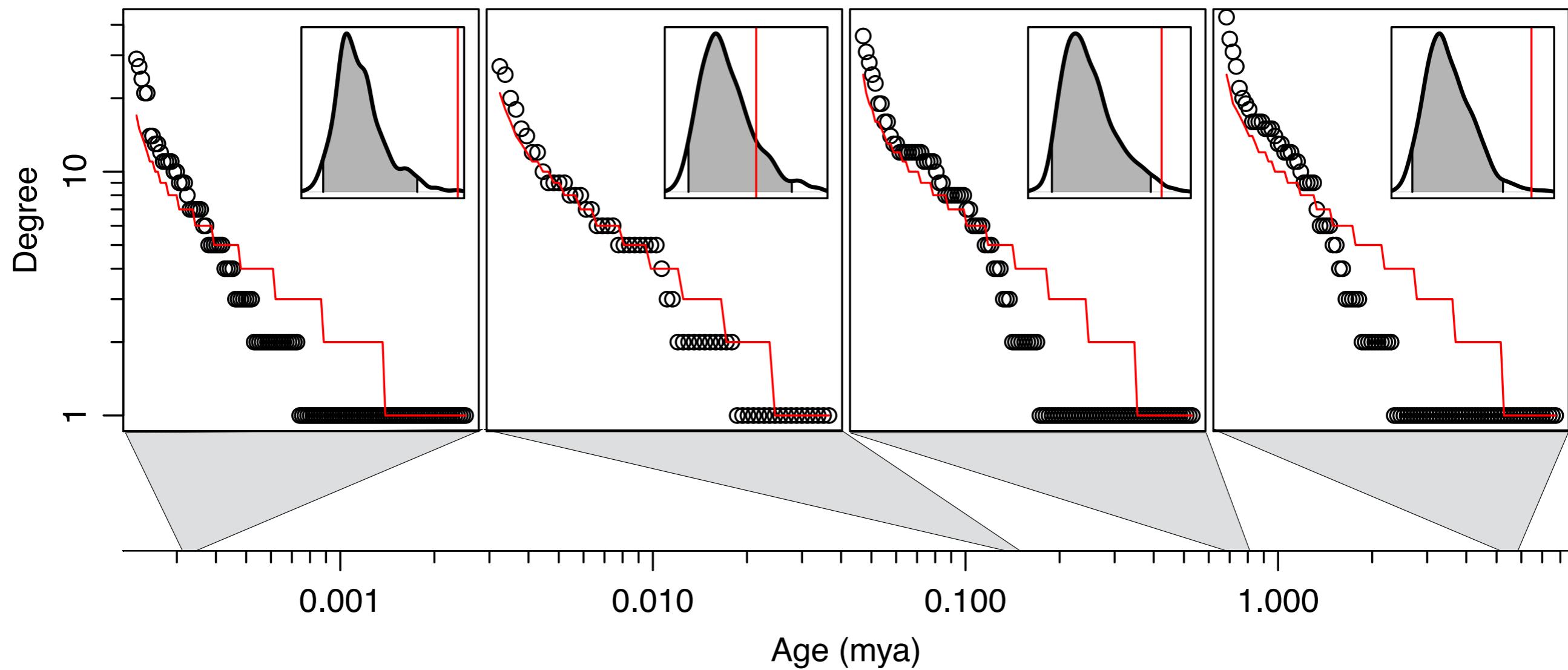


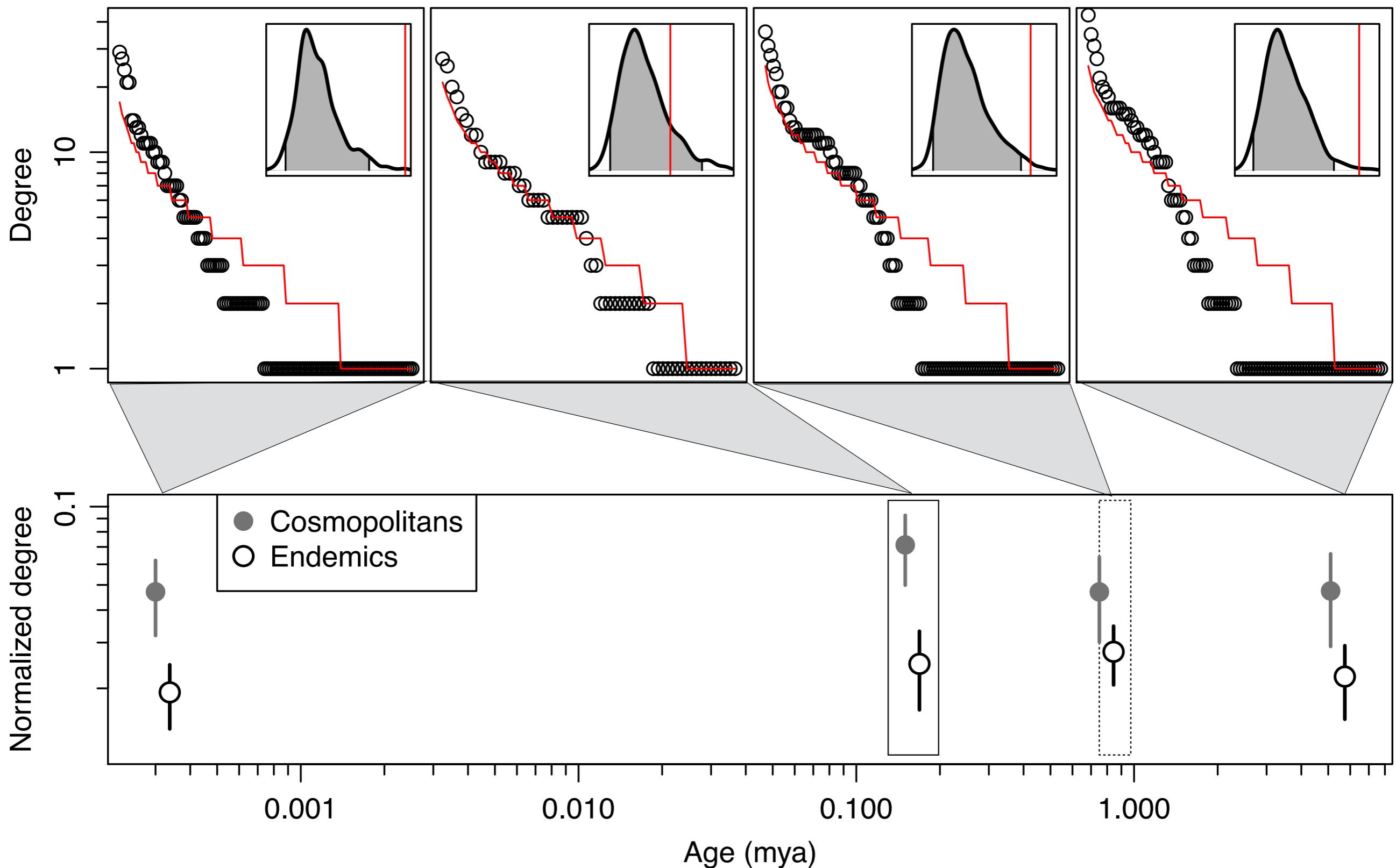
Principle maximum
information entropy

Williams & Martinez (2000) *Nature*
Harte (2011) Cambridge Press



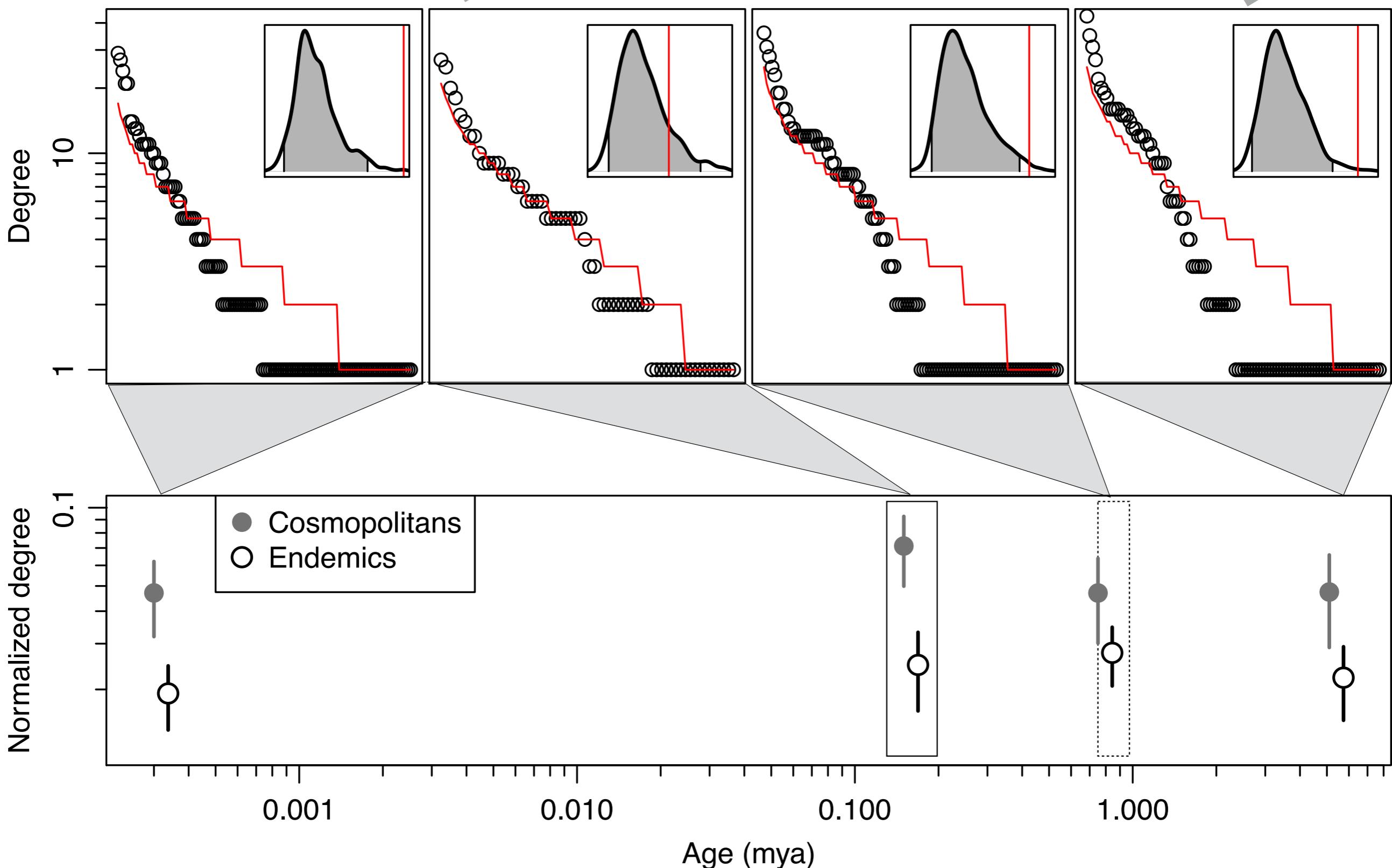


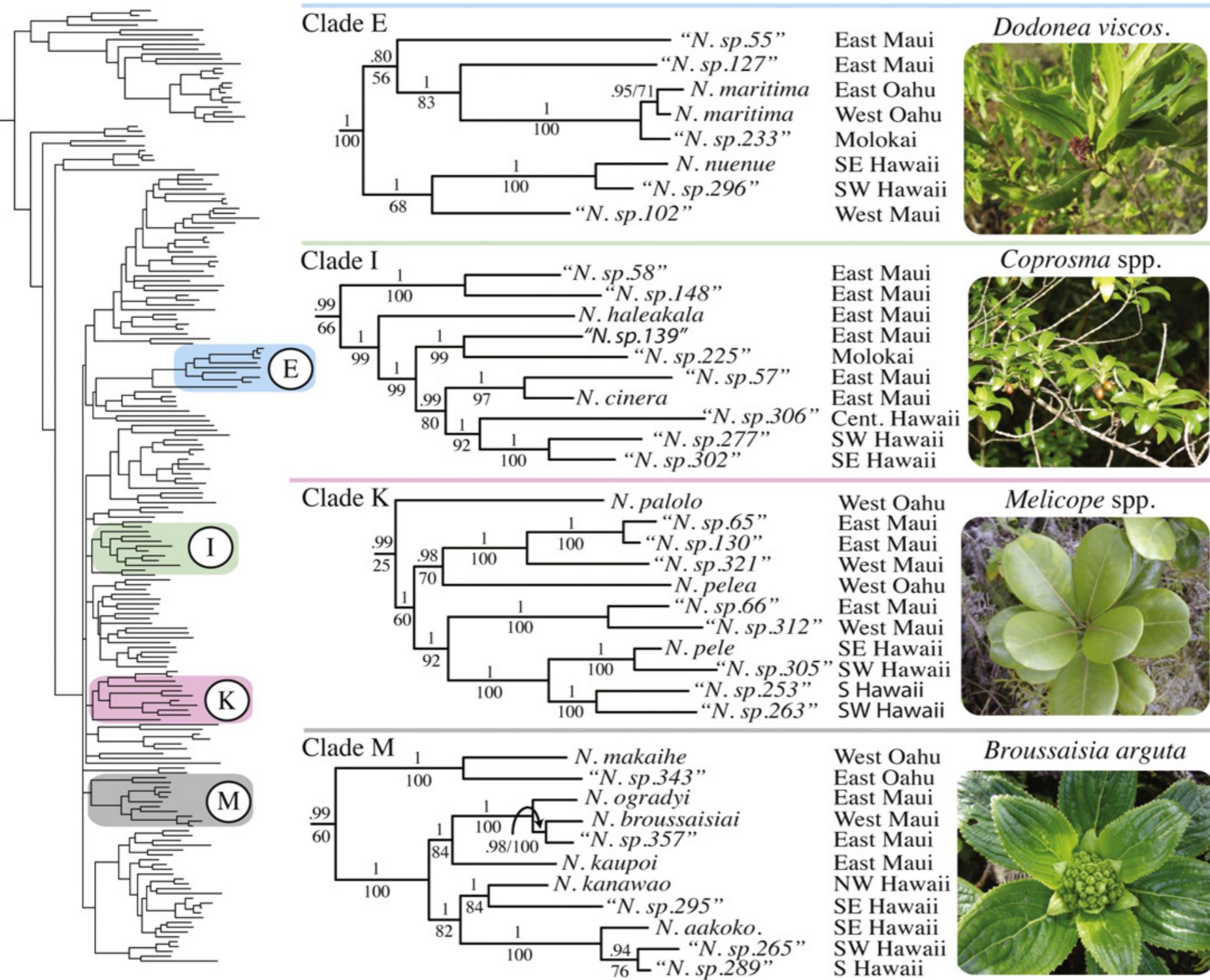




Primary succession

Niche exploration





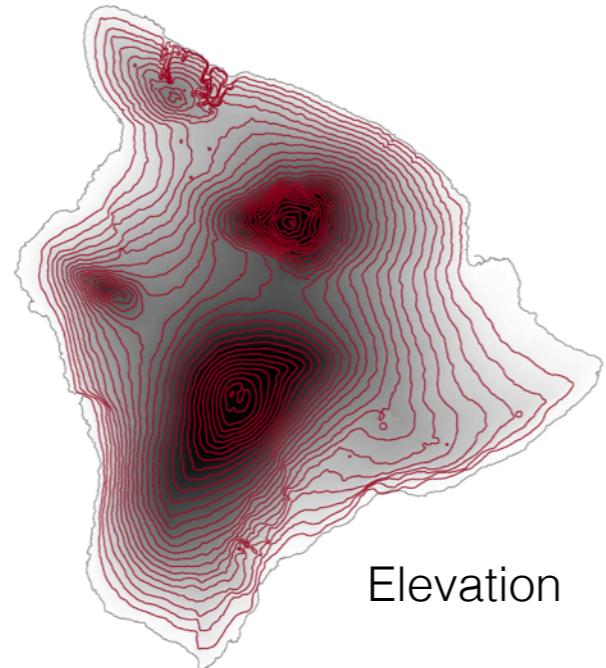
Across the chronosequence we've found:

- Different arthropod groups perceive, colonize and diverge across evolving landscapes differently
- Deviation from statistical steady state varies across groups and substrate ages
- Interaction of ecological strategies and opportunity afforded by new environments likely interact to produce patterns

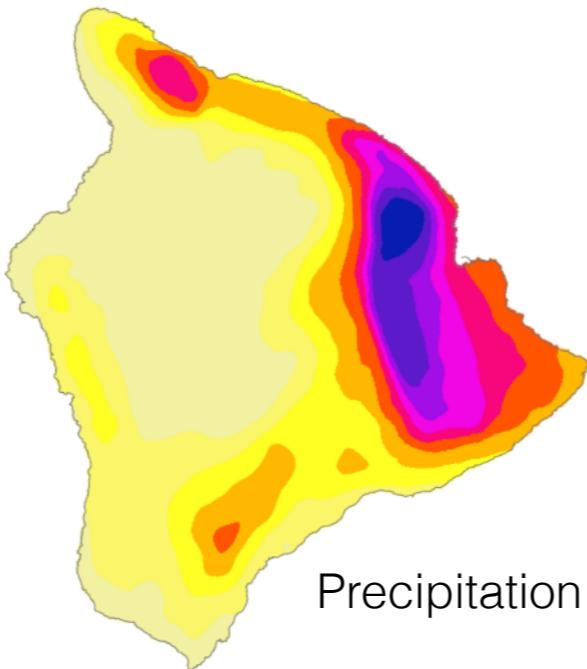
Across the chronosequence we've found:

- Different arthropod groups perceive, colonize and diverge across evolving landscapes differently **WHY?**
- Deviation from statistical steady state varies across groups and substrate ages **WHY?**
- Interaction of ecological strategies and opportunity afforded by new environments likely interact to produce patterns **WHICH STRATEGIES?**

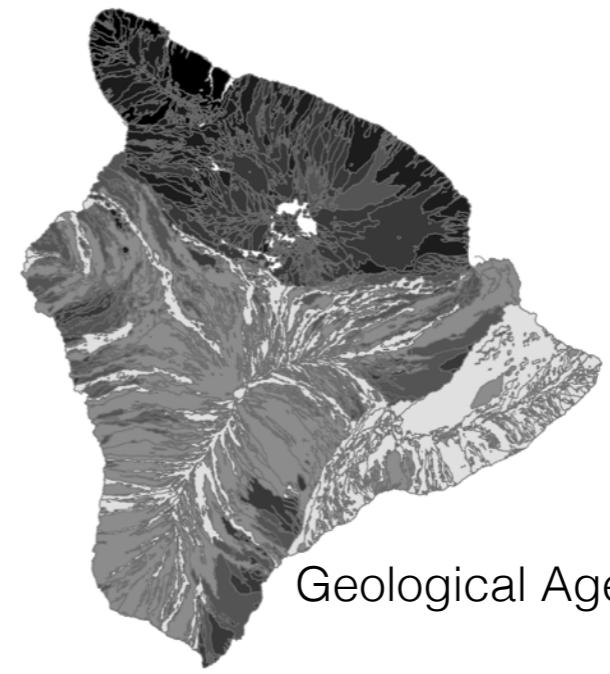
Work underway



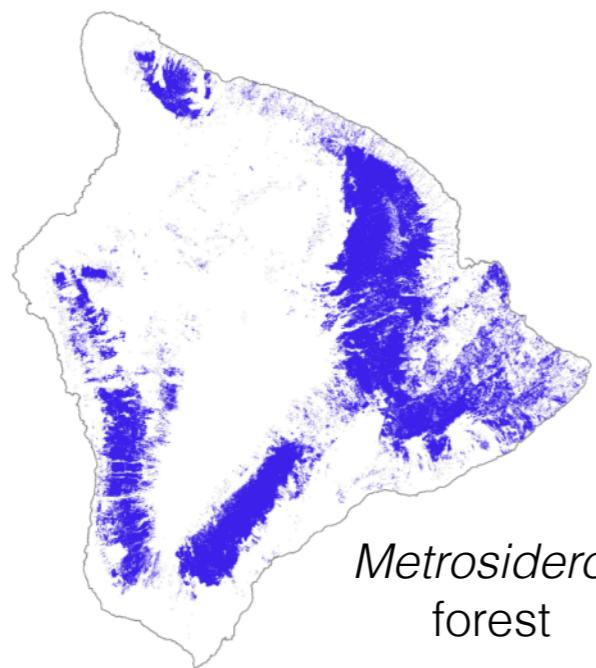
Elevation



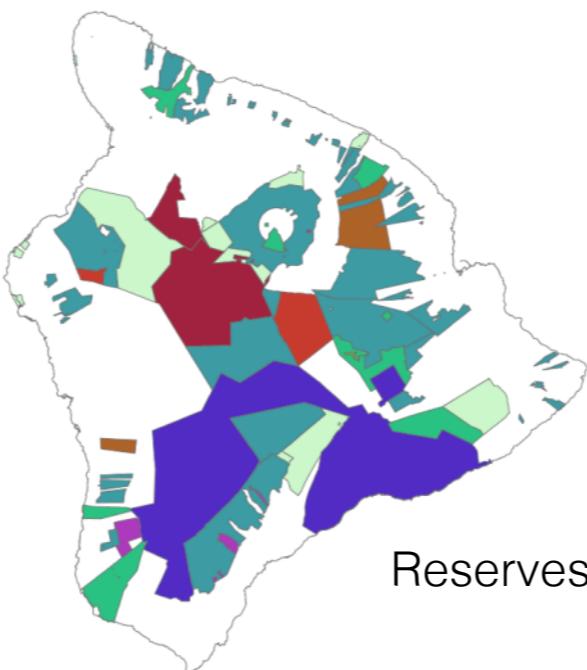
Precipitation



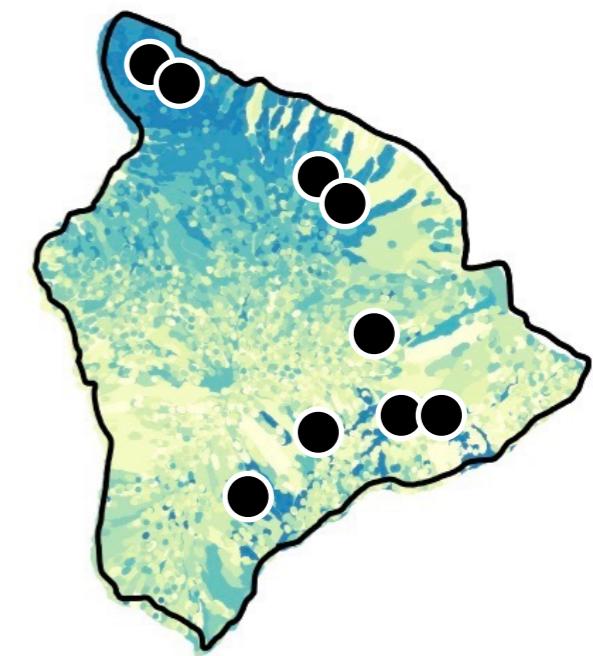
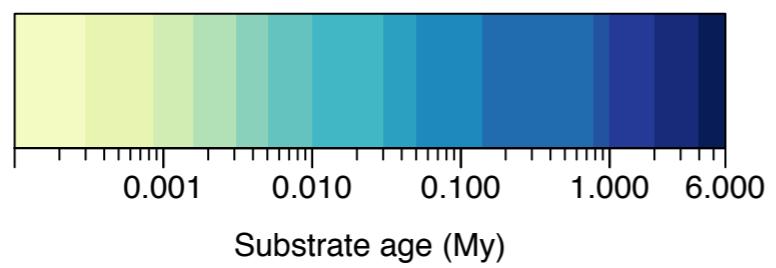
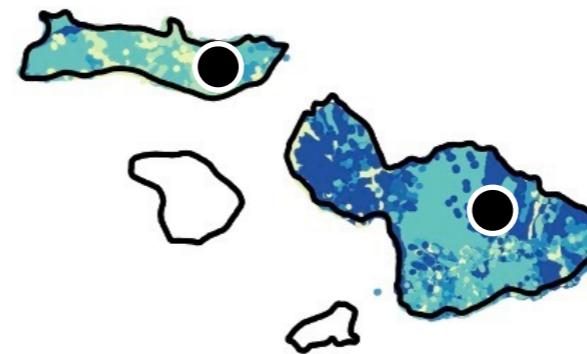
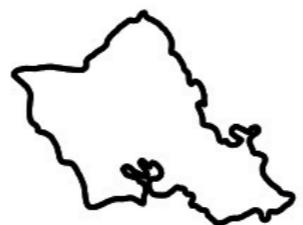
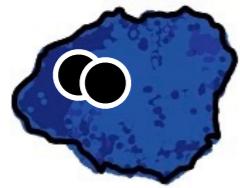
Geological Age



Metrosideros
forest



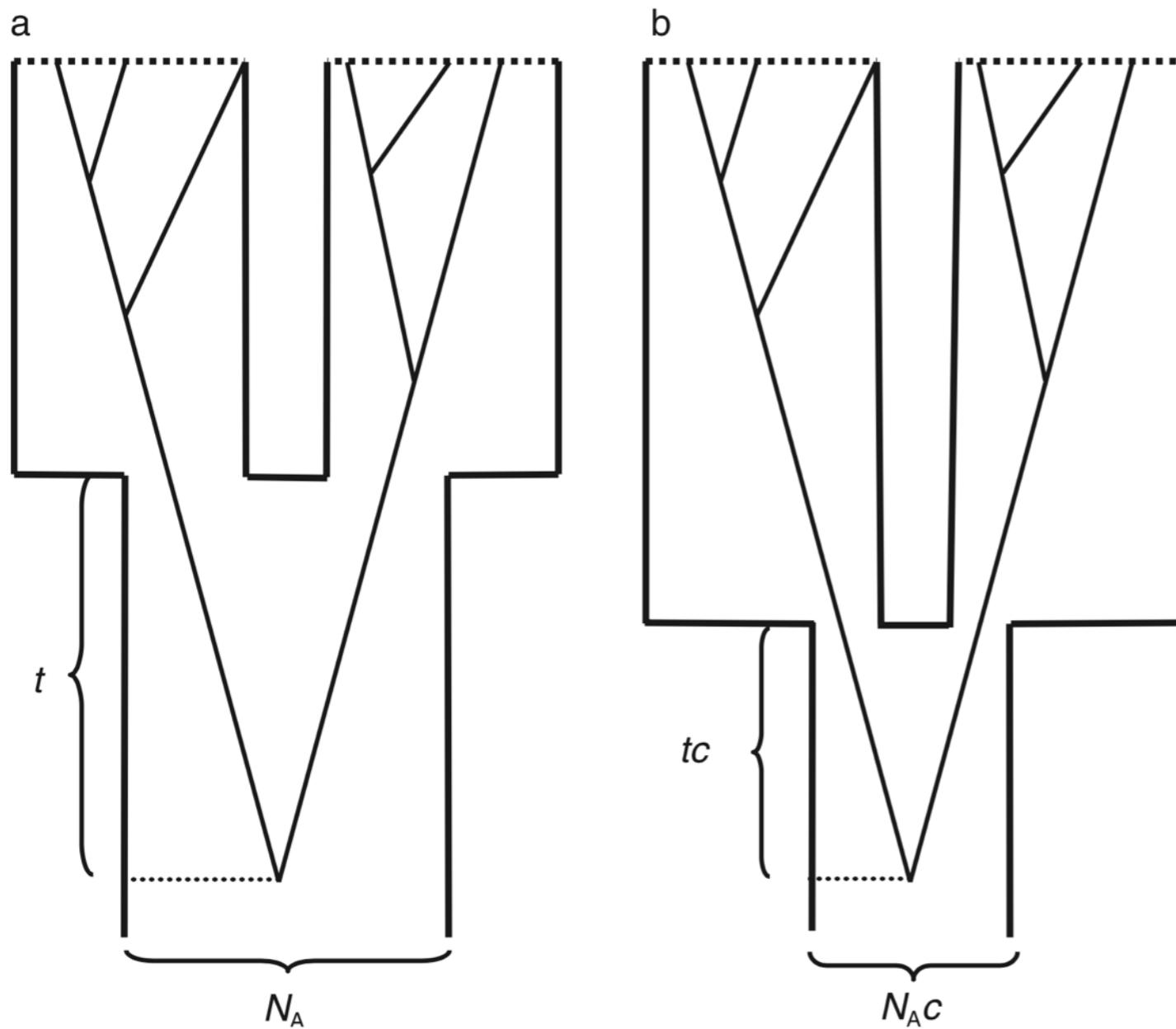
Reserves



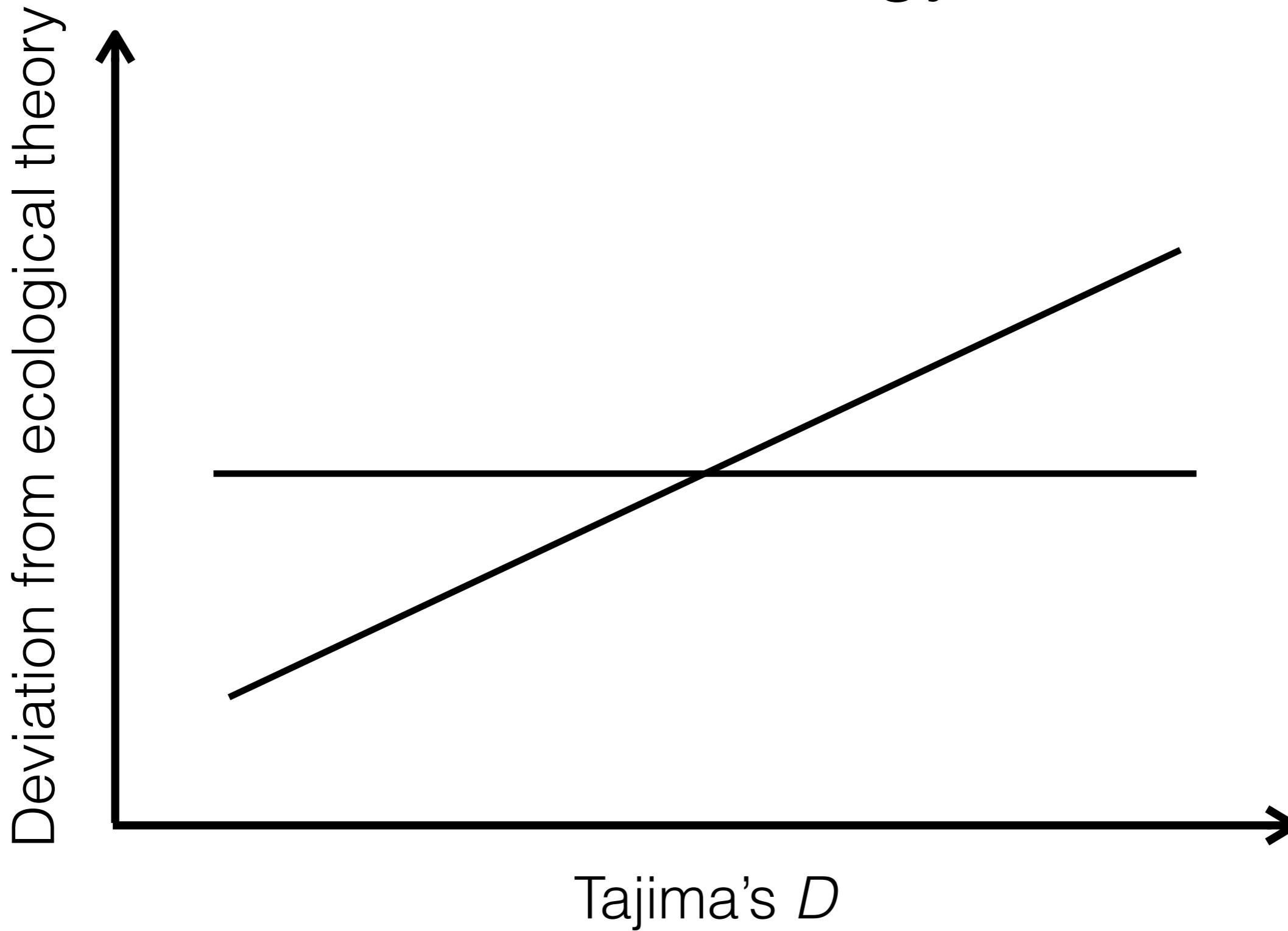
Intensive ecological sampling



NextGen sequencing and statistical phylogeography

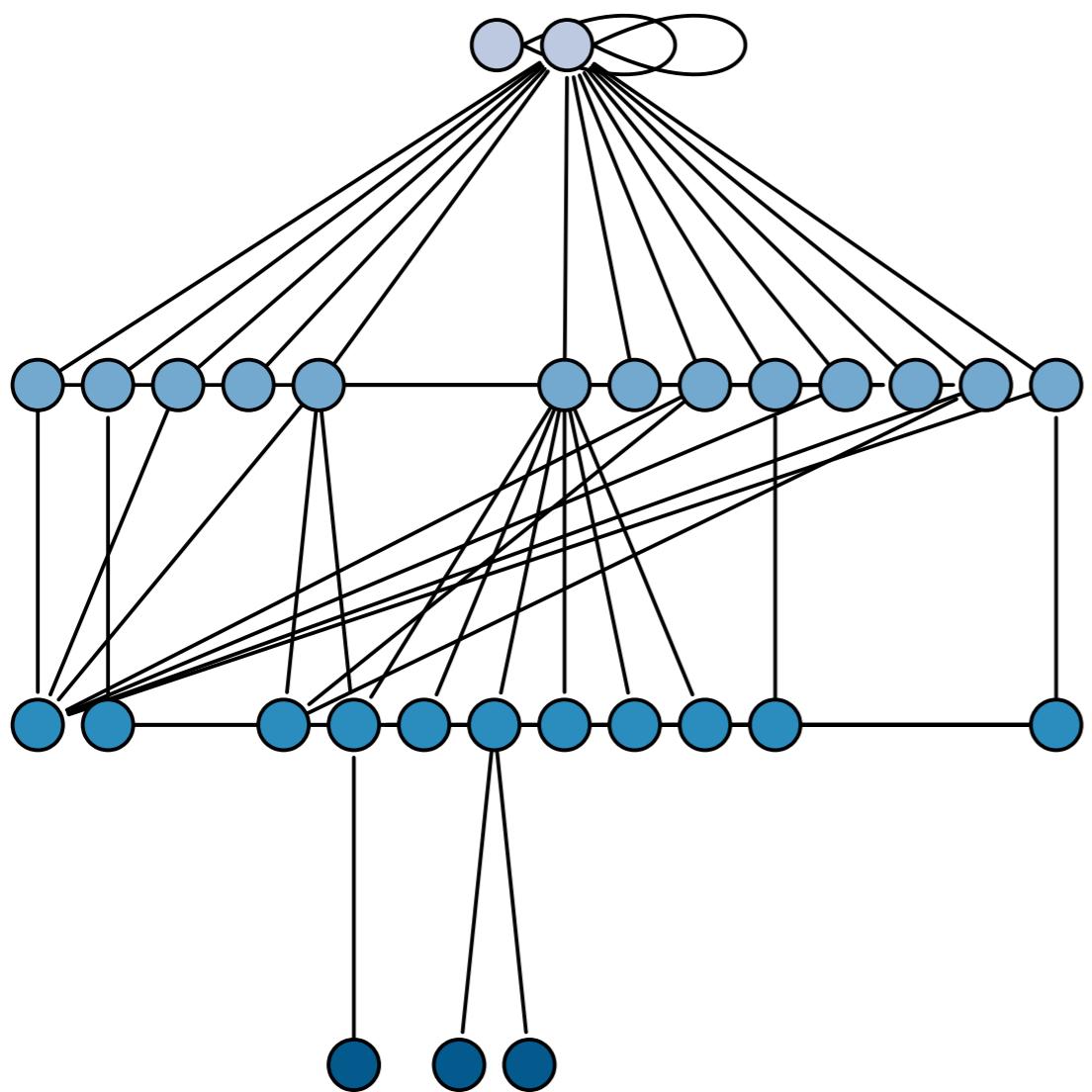


Connection microevolution and macroecology



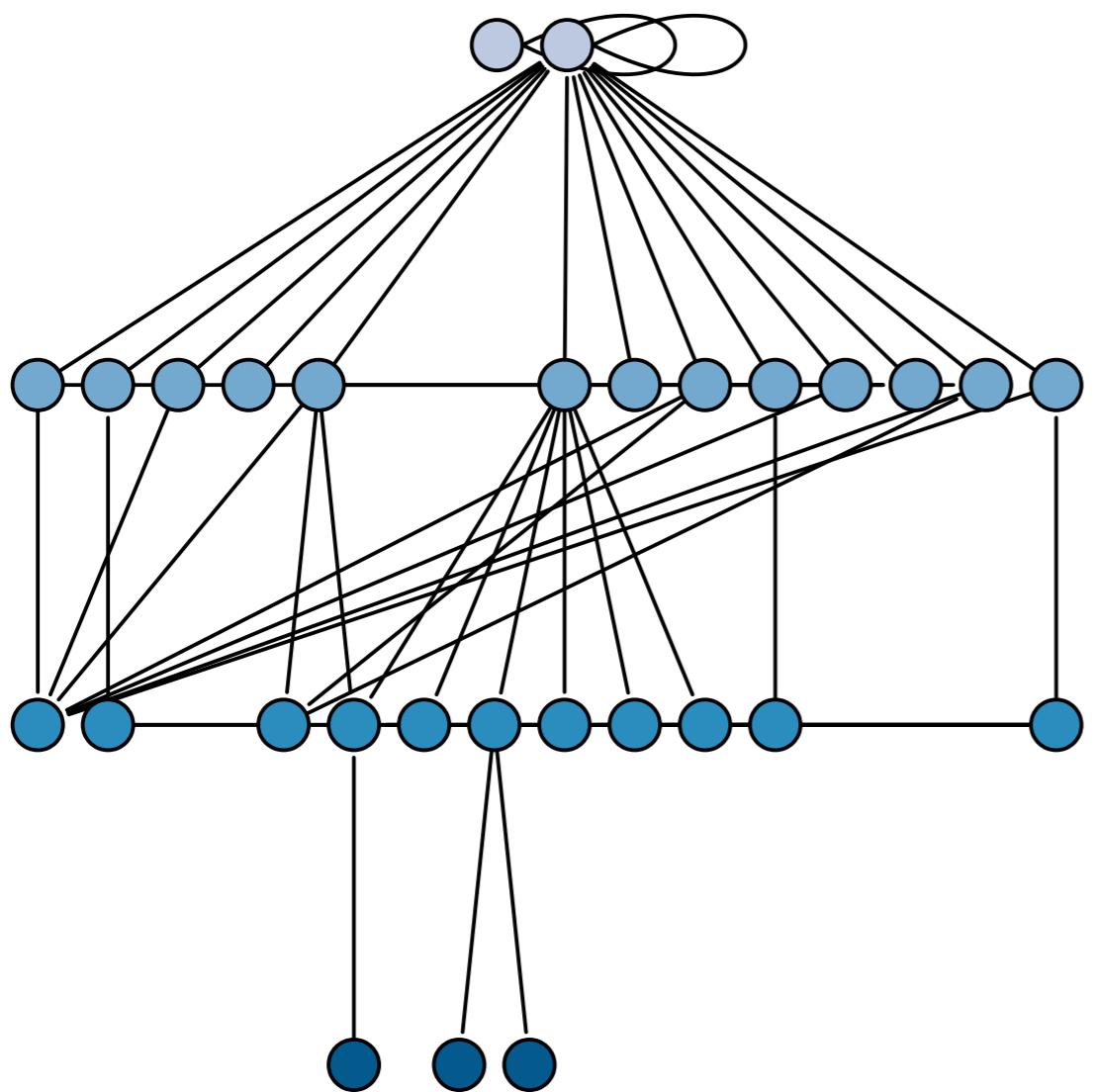
Metagenomics and hidden dimensions

Gut content
foodwebs

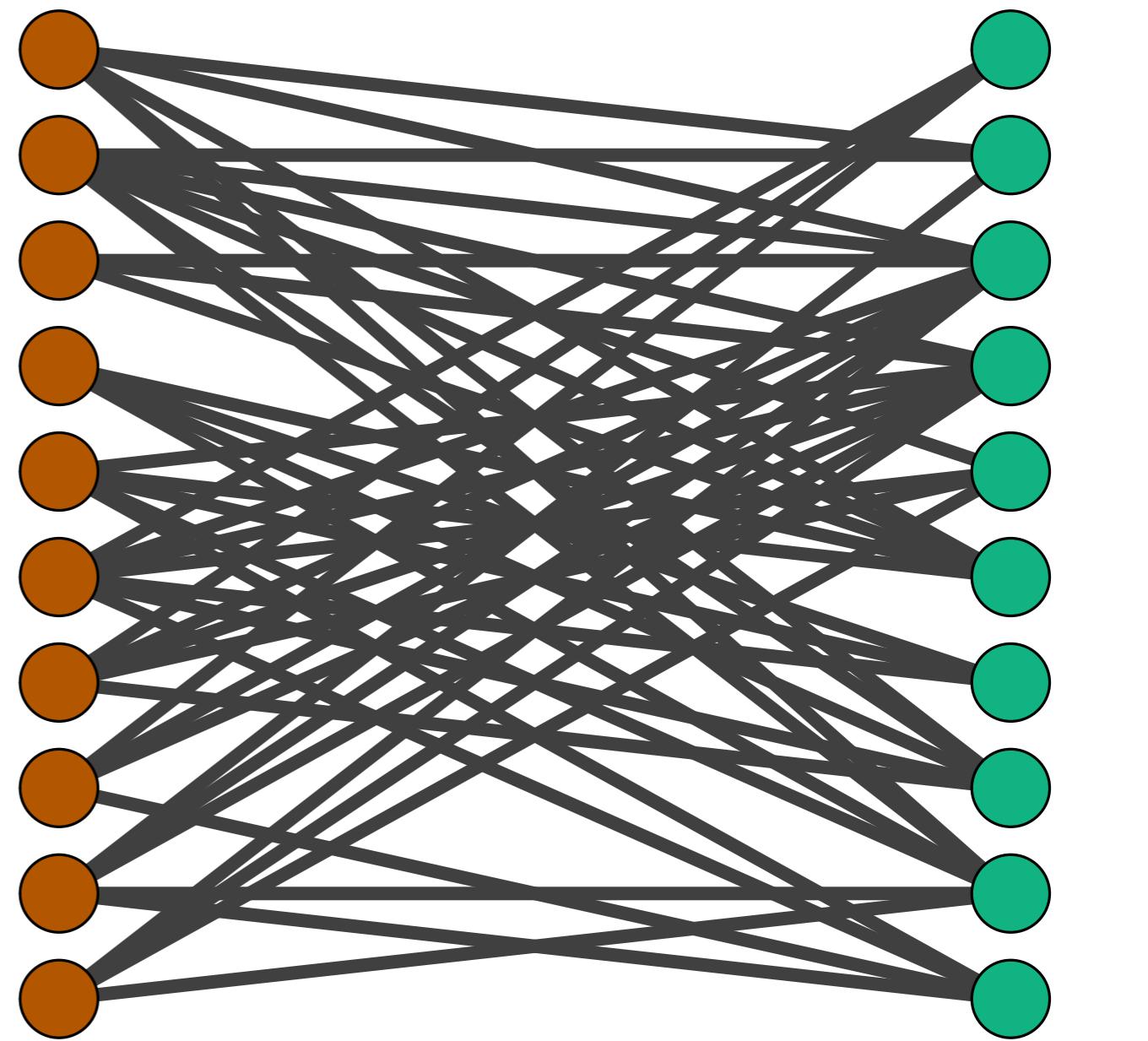


Metagenomics and hidden dimensions

Gut content
foodwebs



Host

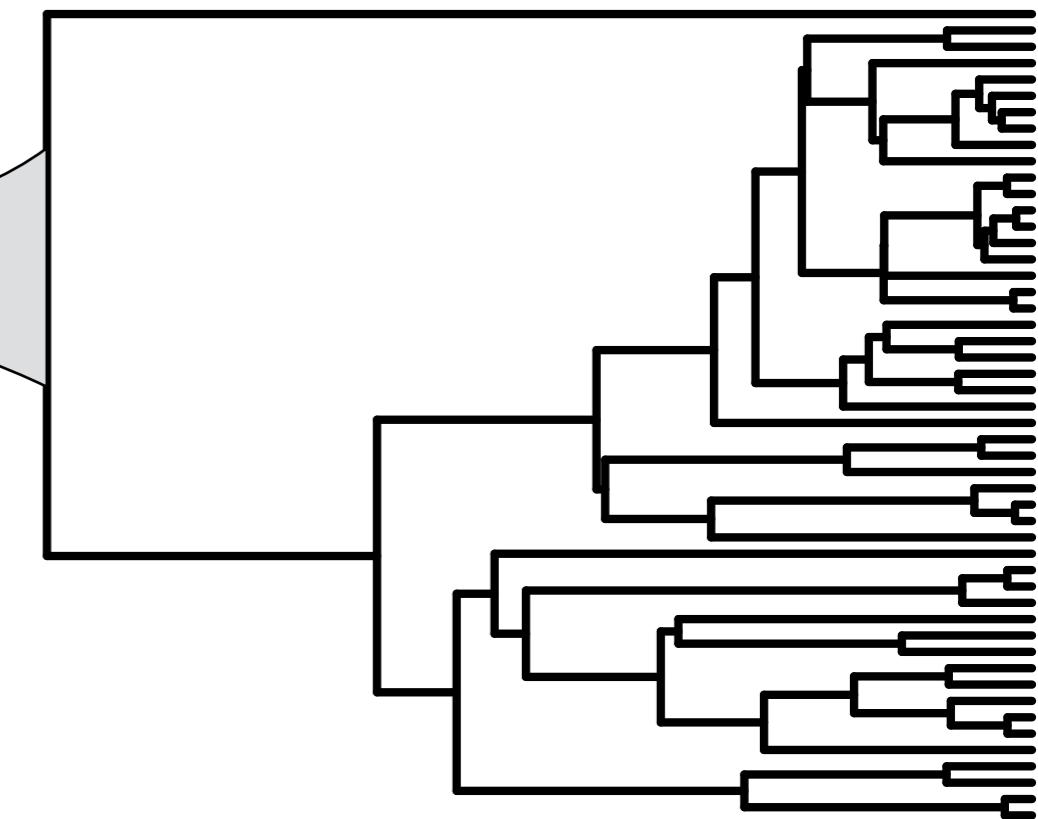


Microbes

Simultaneous assessment of the macrobiome and microbiome in a bulk sample of tropical arthropods through DNA metasystematics

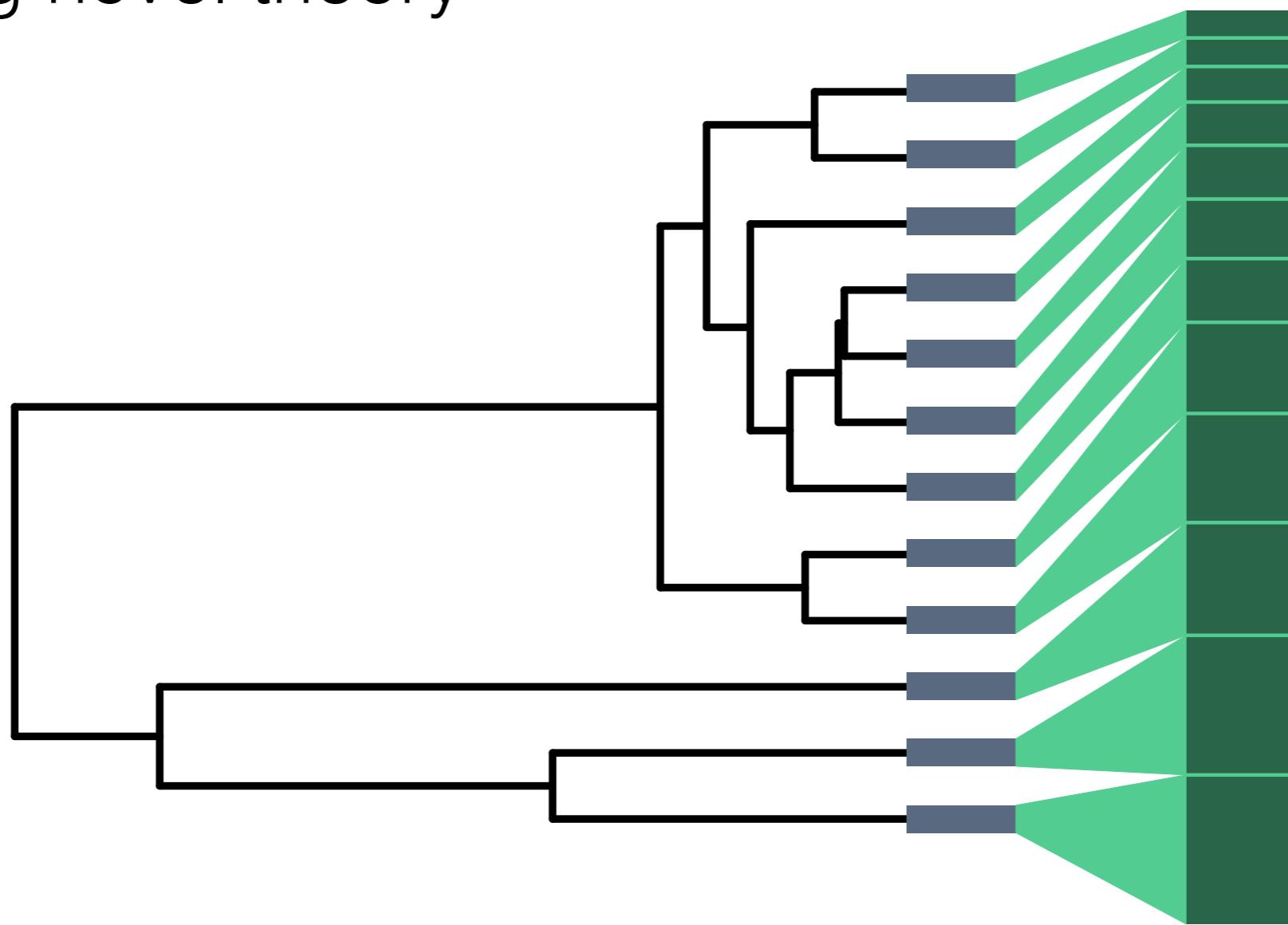
Joel Gibson^a, Shadi Shokralla^{a,b}, Teresita M. Porter^c, Ian King^a, Steven van Konynenburg^a, Daniel H. Janzen^{d,1}, Winnie Hallwachs^d, and Mehrdad Hajibabaei^{a,1}

^aDepartment of Integrative Biology and Biodiversity Institute of Ontario, University of Guelph, Guelph, ON, Canada N1G 2W1; ^bDepartment of Microbiology, Mansoura University, Mansoura, Egypt 35516; ^cDepartment of Biology, McMaster University, Hamilton, ON, Canada L8S 4K1; and ^dDepartment of Biology, University of Pennsylvania, Philadelphia, PA 19104

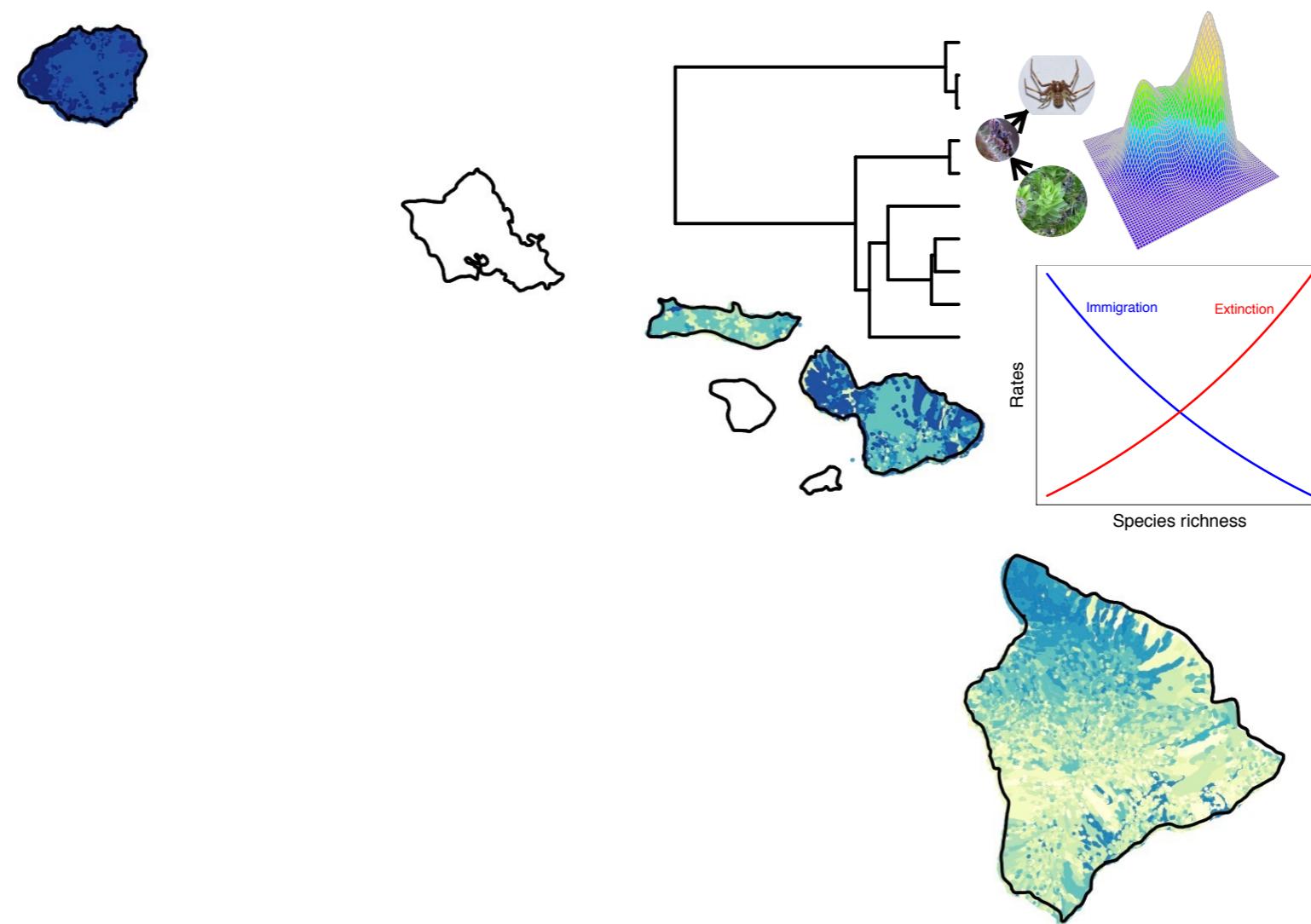


- Community-wide genetic divergence across space, environment and time (chronosequence)

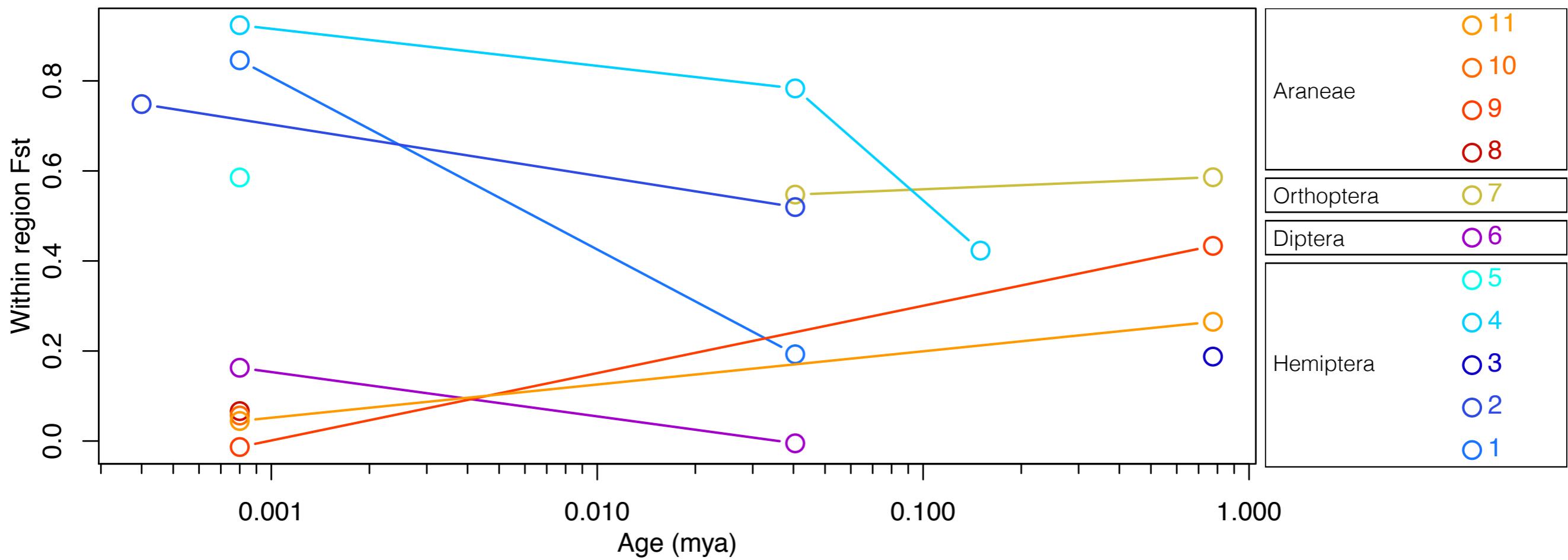
- Community-wide genetic divergence across space, environment and time (chronosequence)
- Testing novel theory



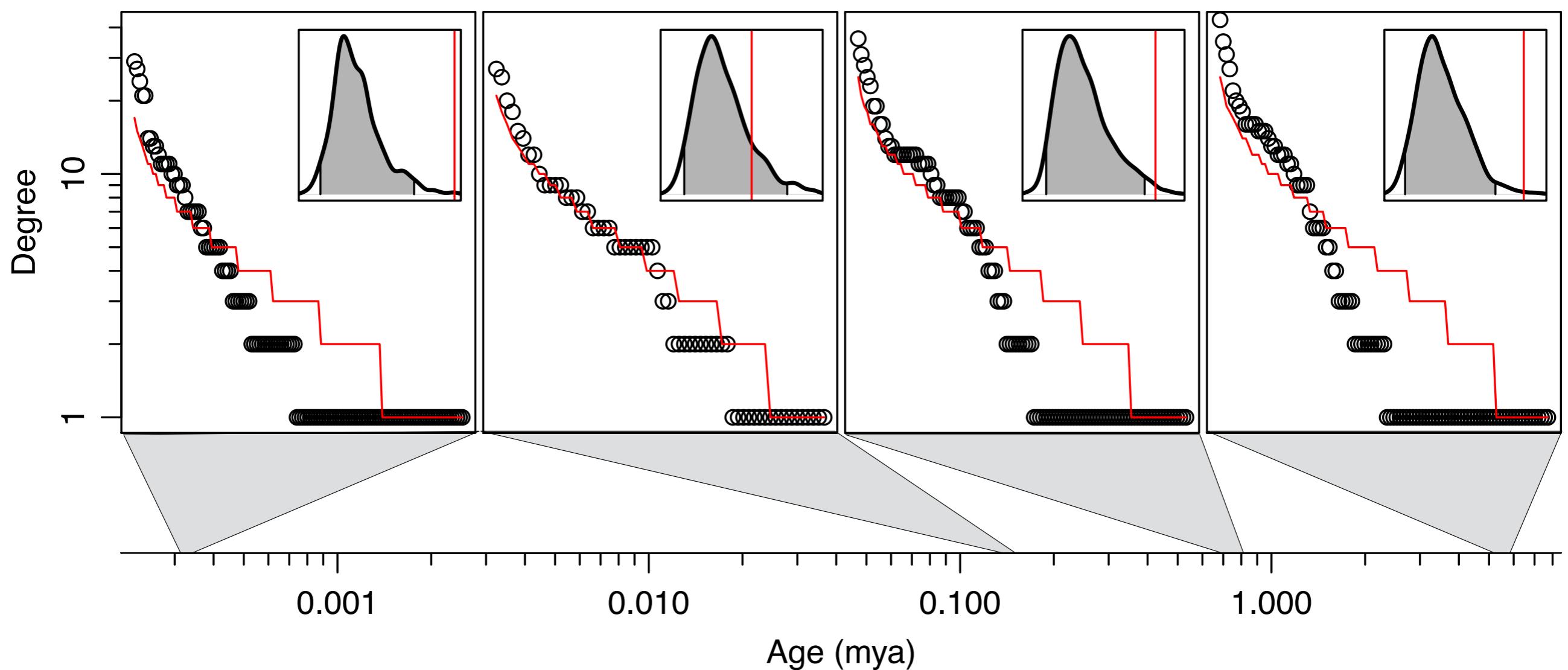
- Chronosequence offers snapshots in assembly



- chronosequence offers snapshots in assembly
- genetic methods illuminate how different groups perceive this chronosequence



- chronosequence offers snapshots in assembly
- genetic methods illuminate how different groups perceive this chronosequence
- ecological theory can give us a guide as to what's novel



looking to the future:

- ecological basis of speciation and decline
- history drives divergence from theory by how specifically?
- ecology-evolution feedback is circular, how do we break the cycle to infer causation?

Mahalo! Obrigado!

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