



Learning from Trees (BIO 597)

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Introductions

- **Name**
- **Research interests** (your 30 second answer to “so, what do you do?”)
- **Two truths and a Lie**
 - Come up with three facts about you. One must be a lie.

Course overview

Course materials can be found at https://github.com/meireles/learning_from_trees

Course goals:

1. Learn how to build and use phylogenies to do cool biology
2. Get you to write a damn good paper and become famous



Course modules

- **Introduction**
 - trees, computation, file formats, visualization
- **Inferring trees (or stealing them)**
 - DNA alignment, models of DNA evolution, tree search, dating trees
- **Trait evolution**
 - Rates of evolution, selection, and convergence in continuous and categorical traits.
- **Ecology and Biodiversity**
 - Community Ecology, Biogeography, Diversification

Course dynamics

- **Wednesdays**
 - Lecture (I'll shoot for 30-40 min)
 - Paper discussion (remaining time).
 - **One student should lead the discussion each week.**
- **Fridays**
 - **Lab:** Hands on software tutorials, practice concepts we discussed in lecture, work on your own project.

Syllabus

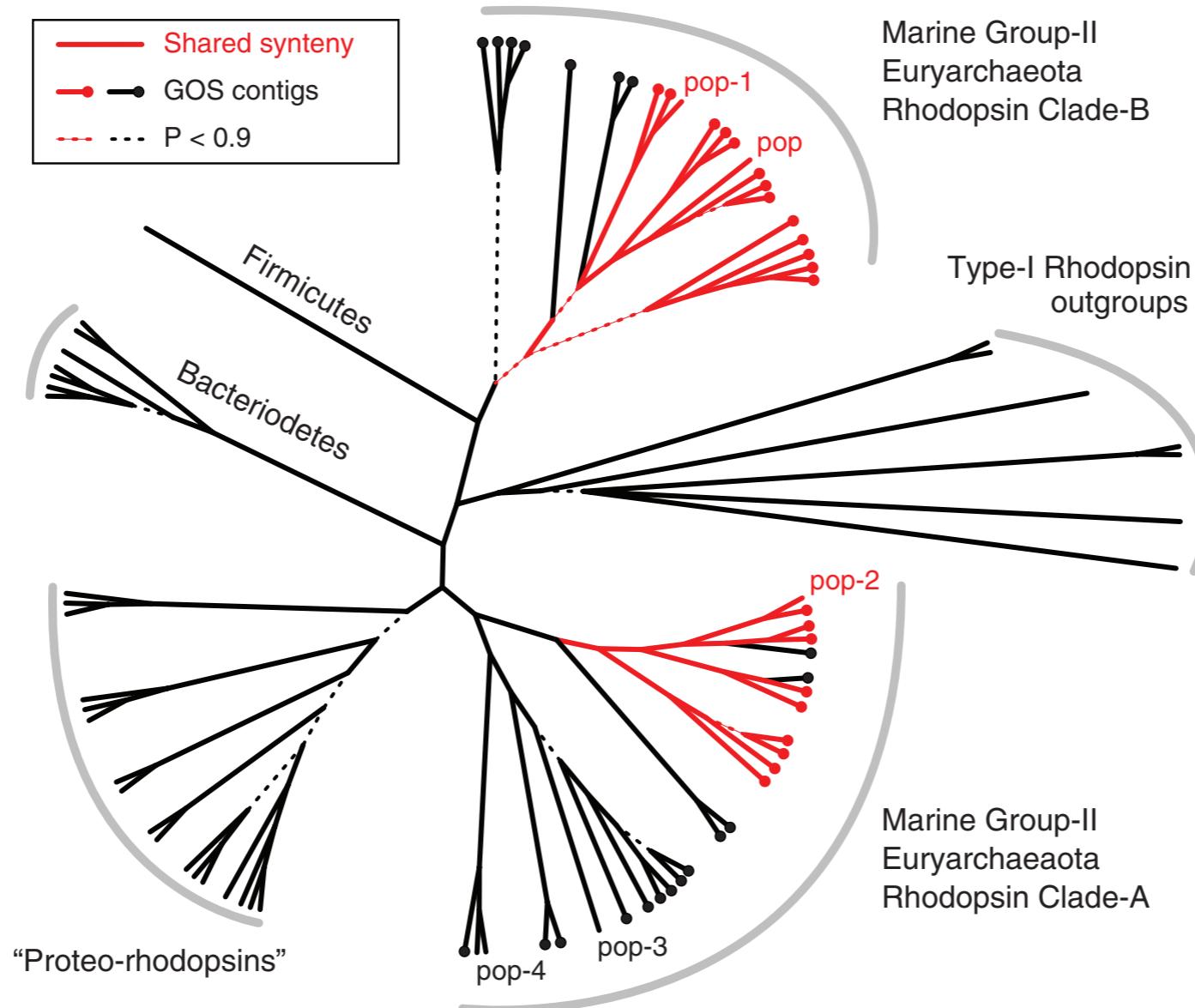
Check tentative schedule

What are phylogenies?

**Why do we care about
them?**

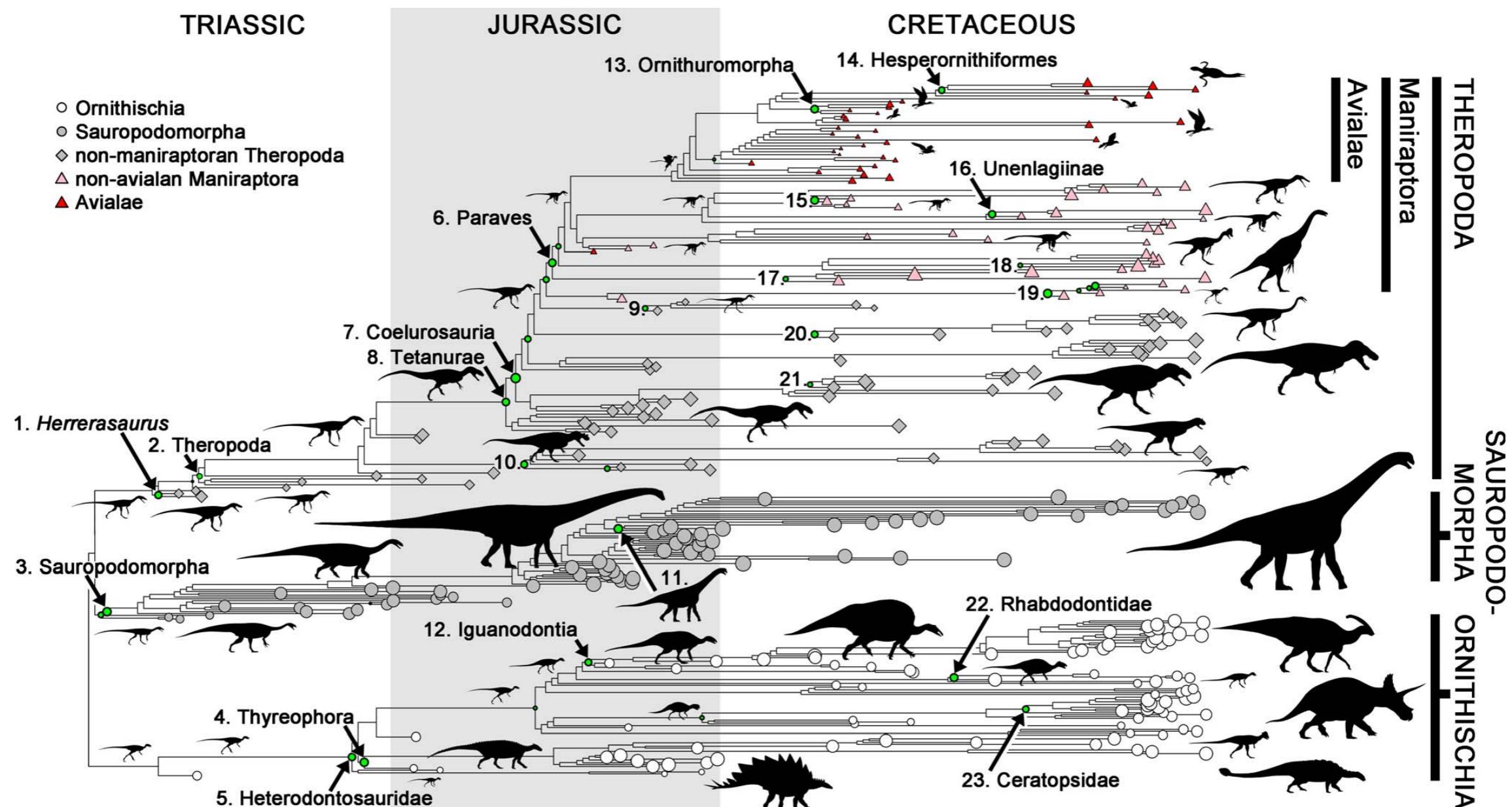
**What happens if we ignore
evolutionary trees?**

Discovery of new Branches of the Tree of Life



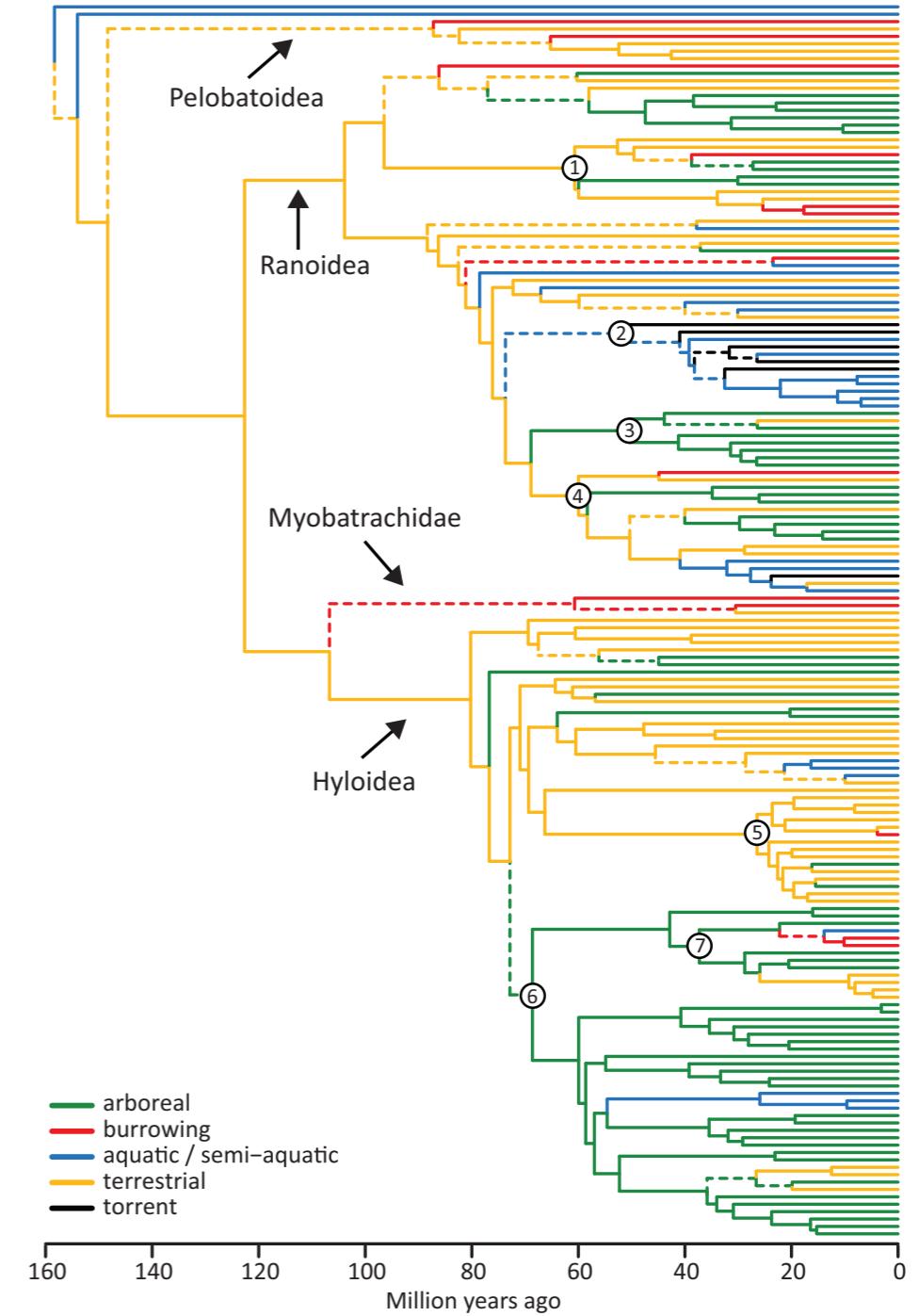
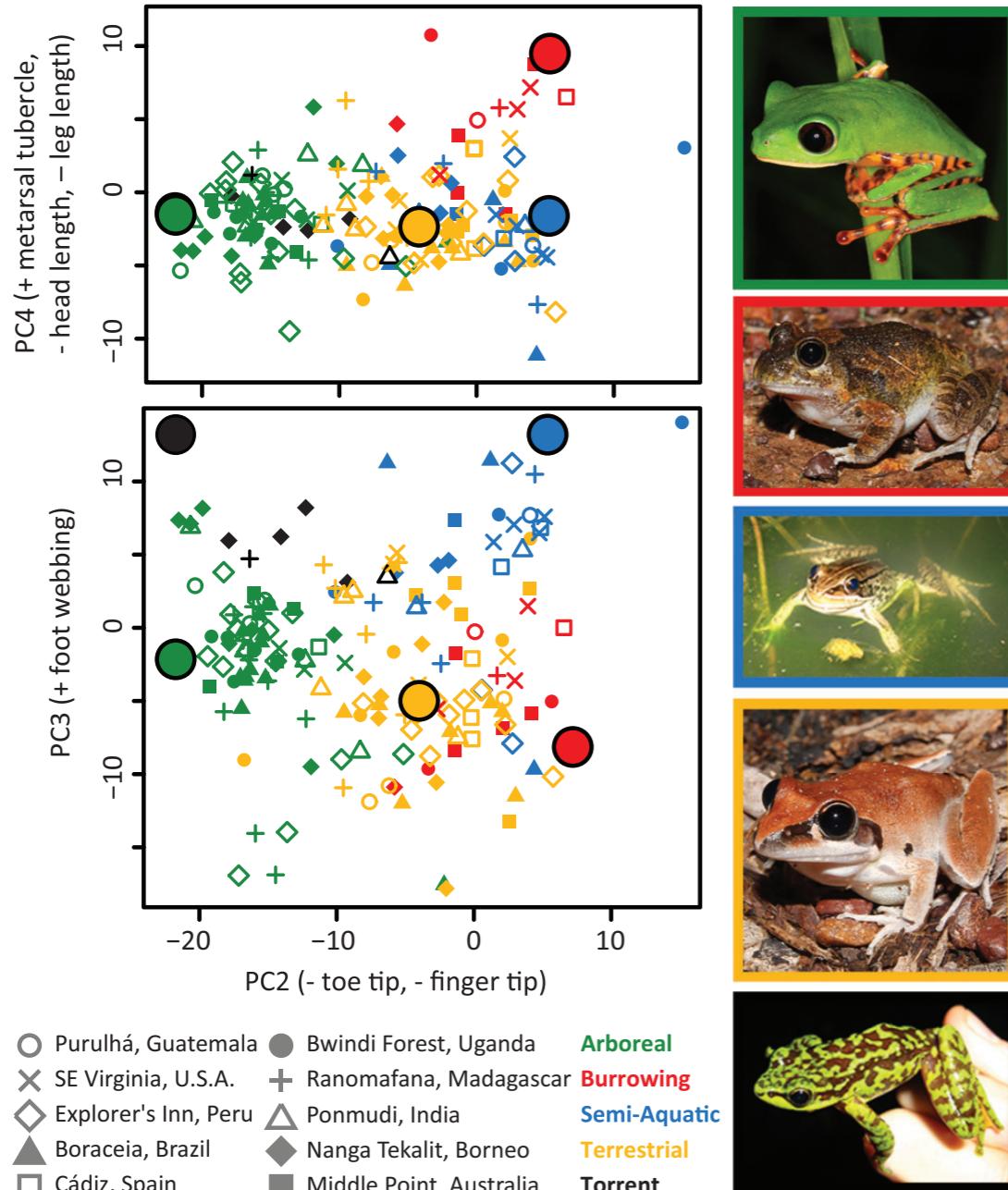
Iverson et al. 2012. Untangling Genomes from Metagenomes: Revealing an Uncultured Class of Marine Euryarchaeota

Relationships and rates of evolution



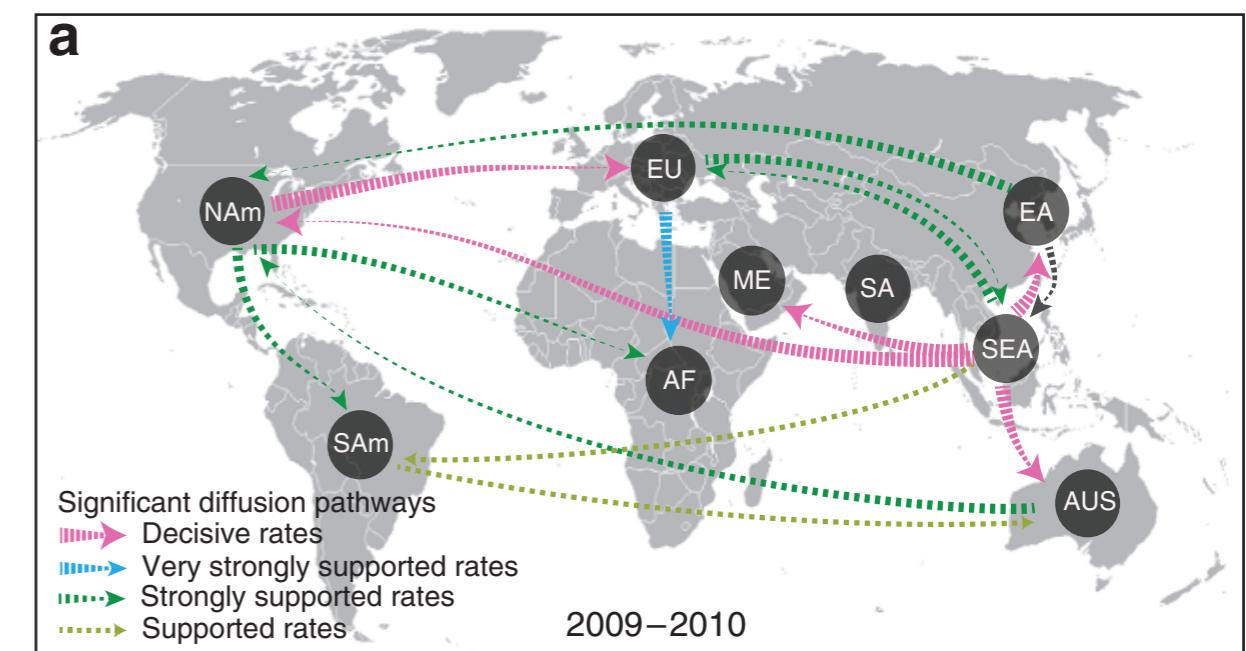
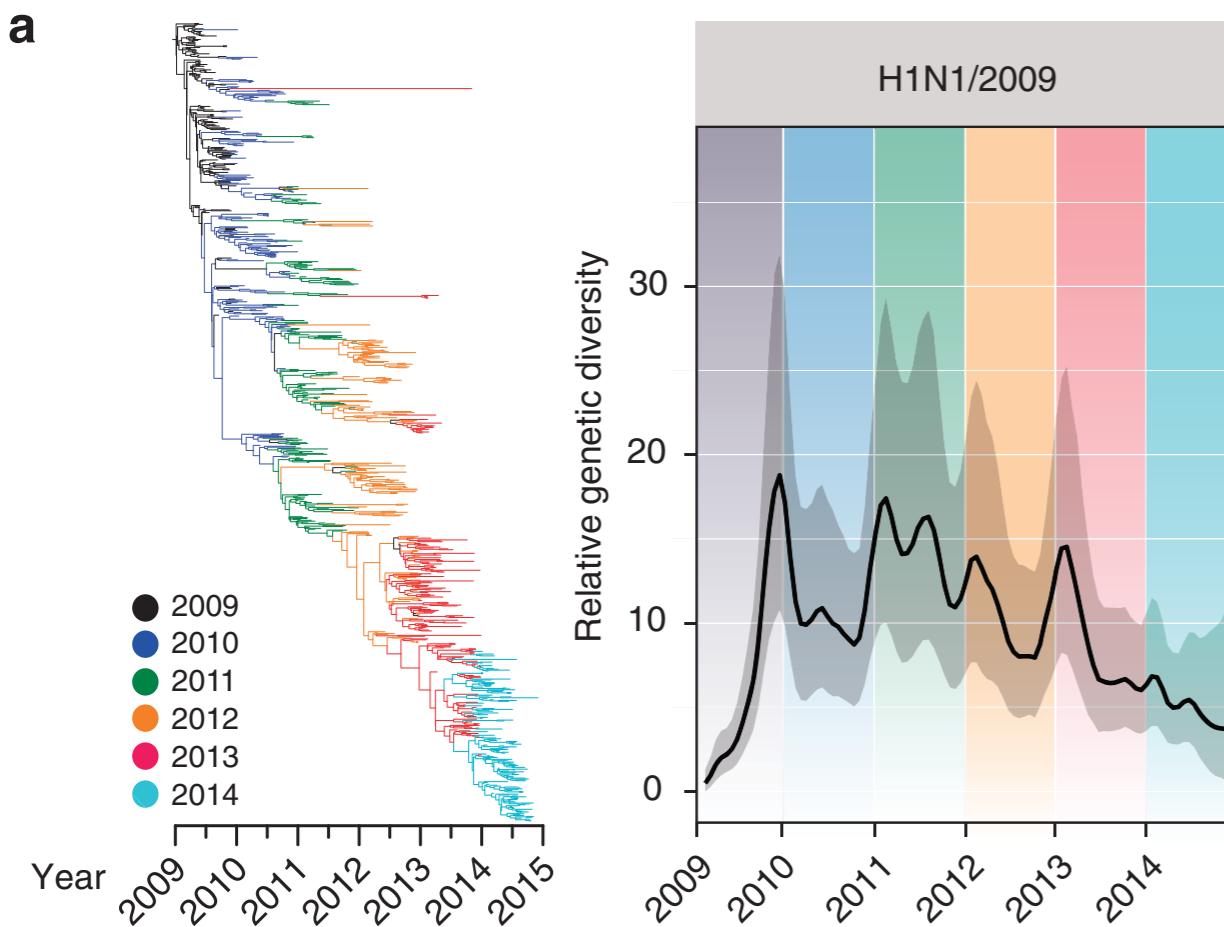
Benson et al. 2014. Rates of Dinosaur Body Mass Evolution Indicate 170 Million Years of Sustained Ecological Innovation on the Avian Stem Lineage

Convergent Evolution



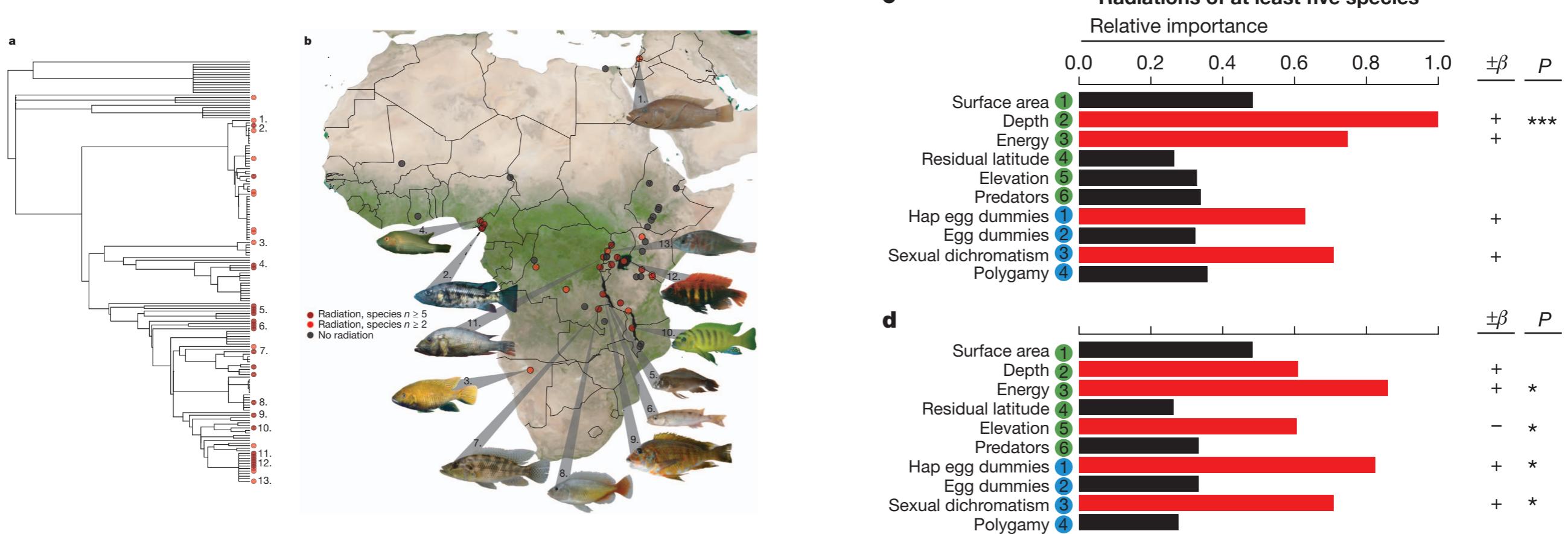
Mohen et al. 2015. Testing Convergence Versus History: Convergence Dominates Phenotypic Evolution for over 150 Million Years in Frogs

Disease dynamics



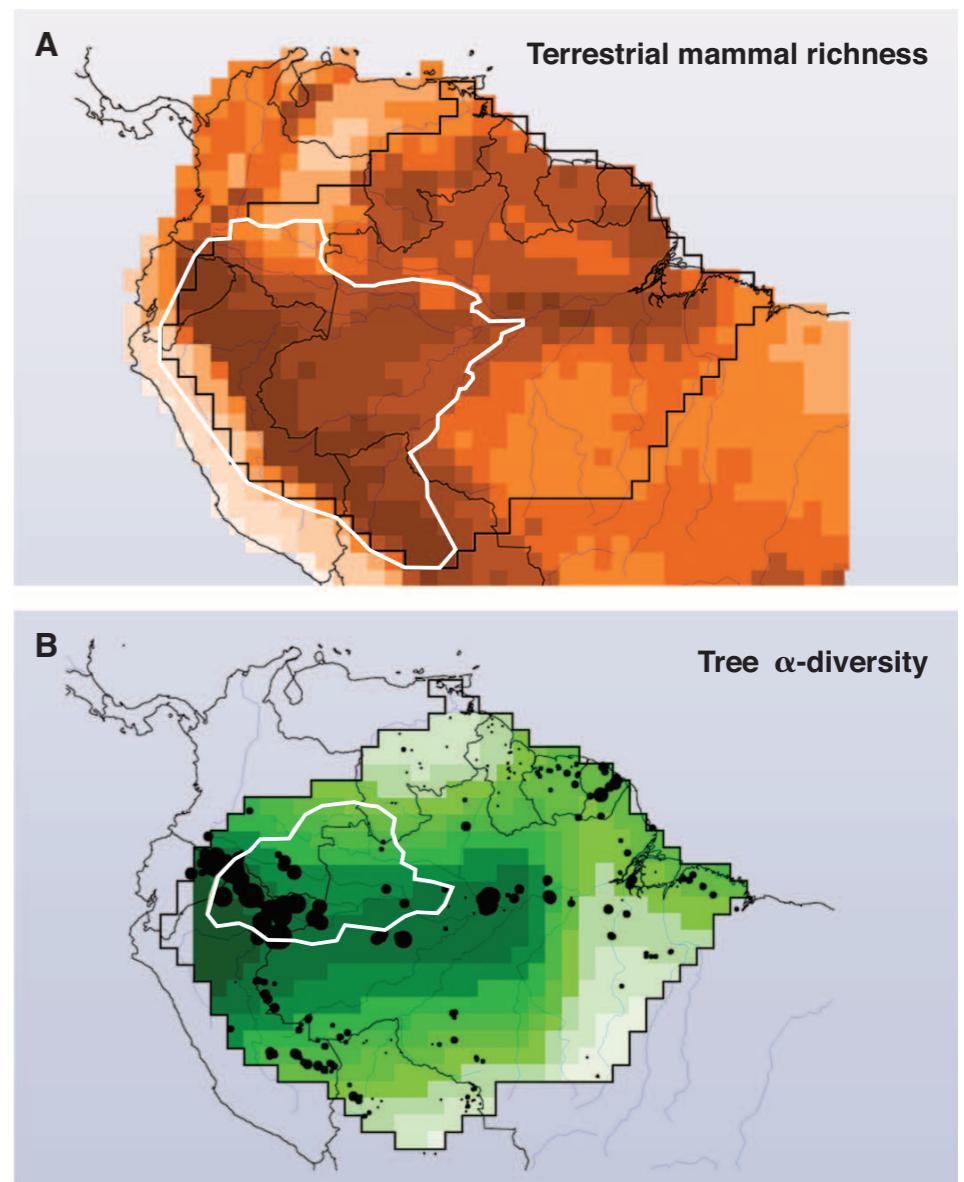
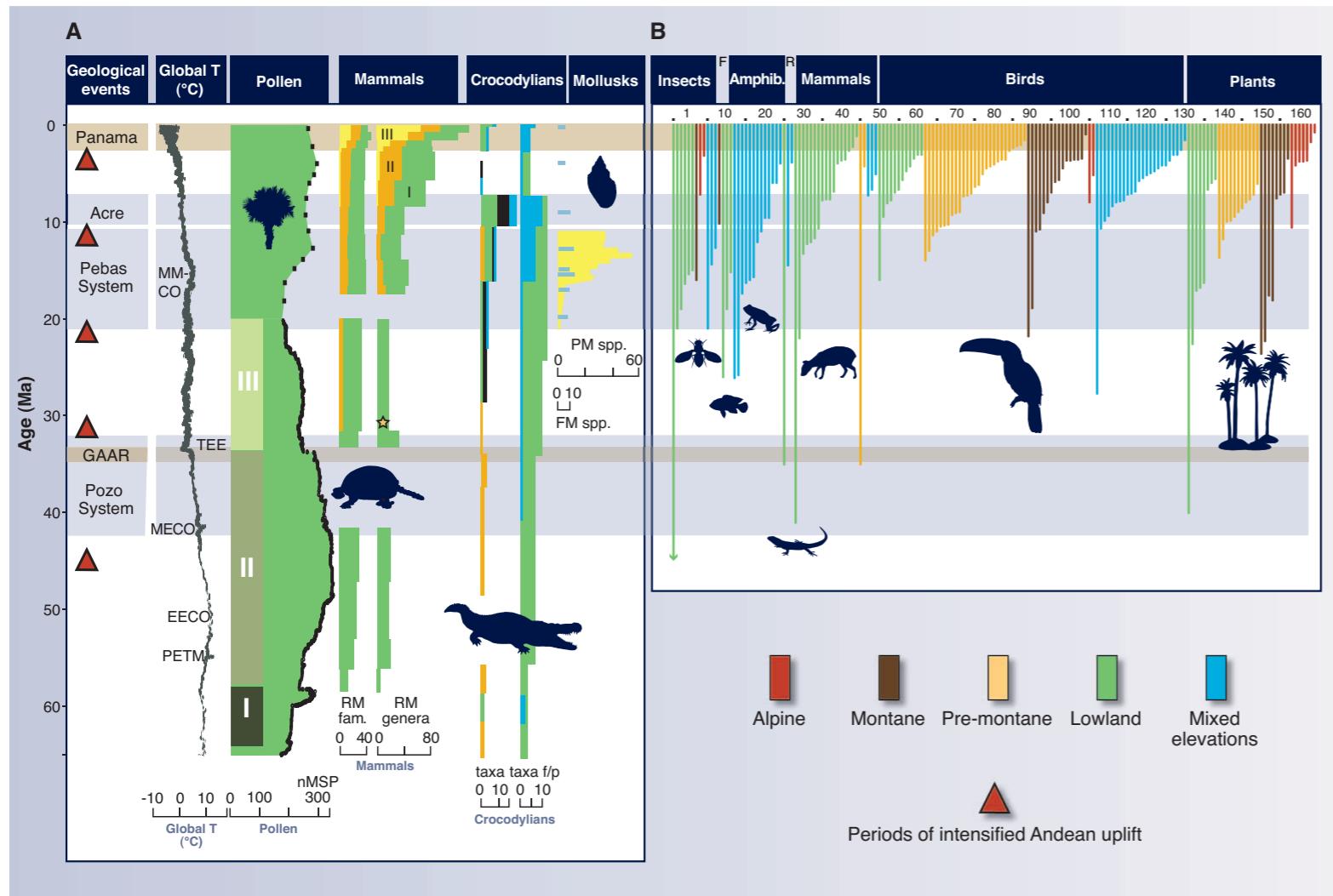
Su et al. 2015. Phylodynamics of H1N1/2009 influenza reveals the transition from host adaptation to immune-driven selection.

Biology driving diversification



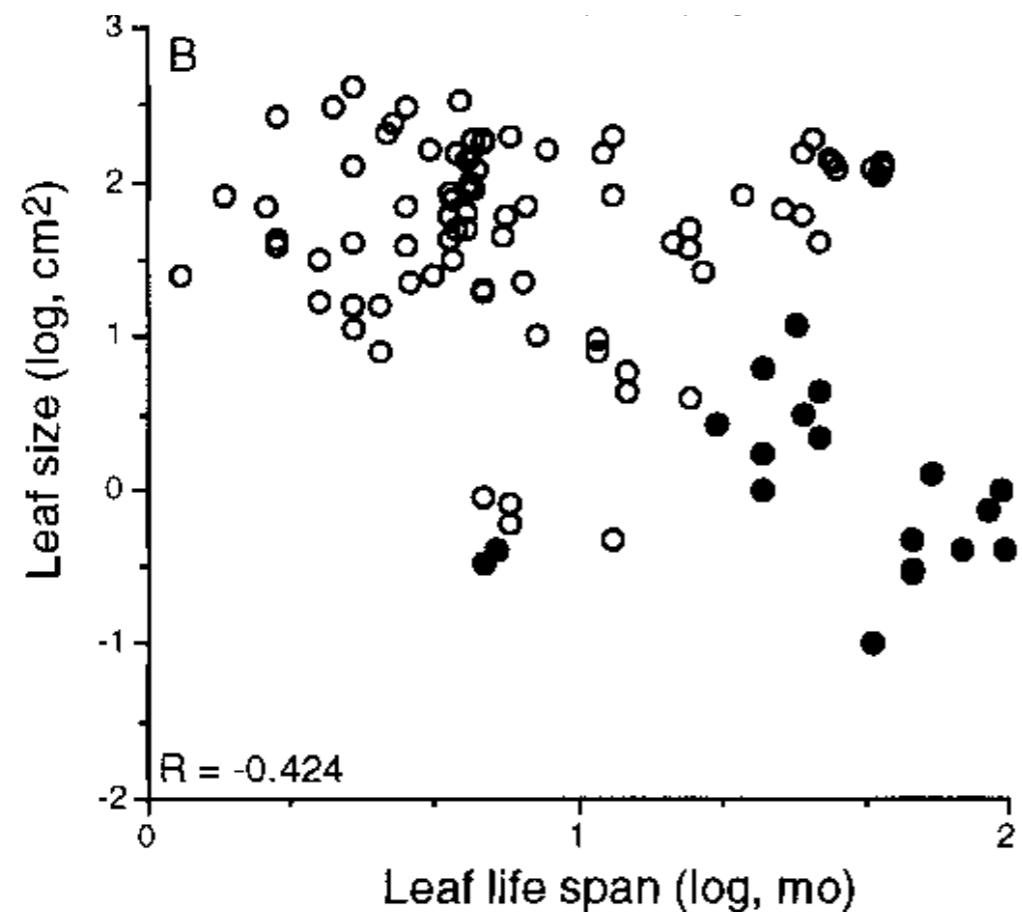
Wagner et al. 2012. Ecological opportunity and sexual selection together predict adaptive radiation

Origin of continental scale Diversity



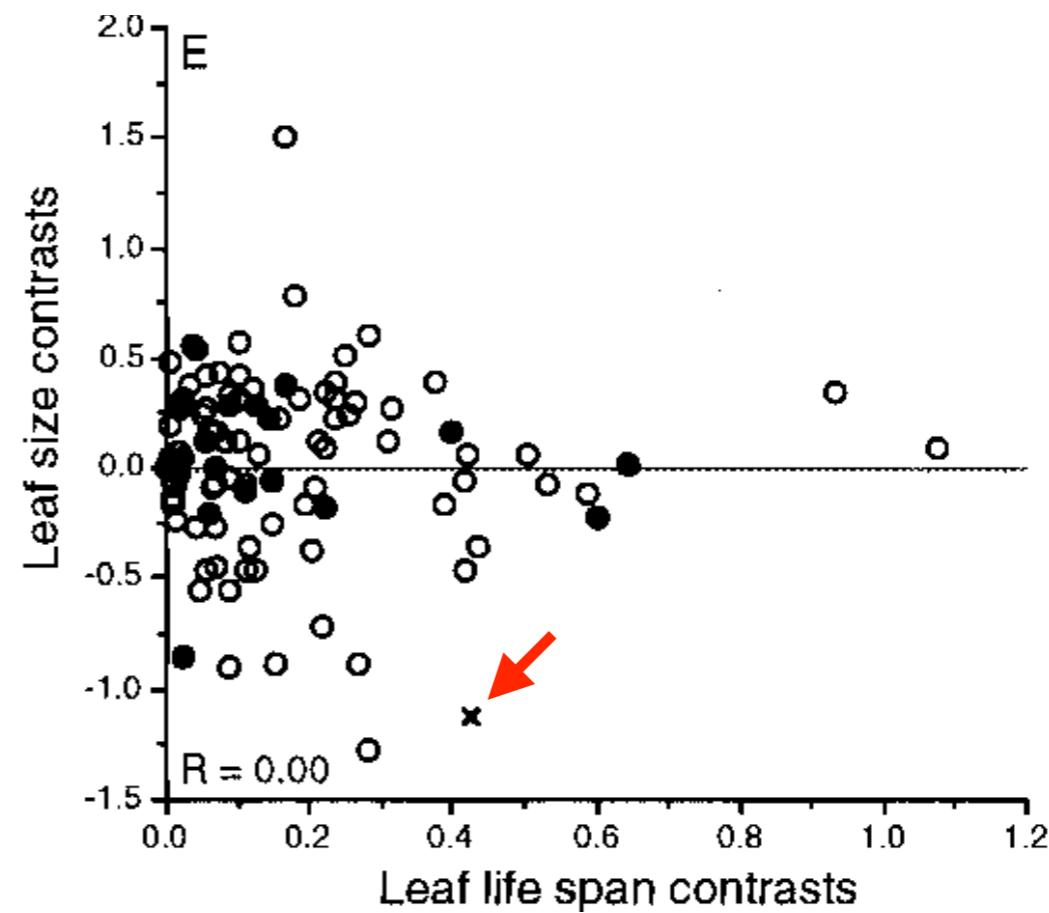
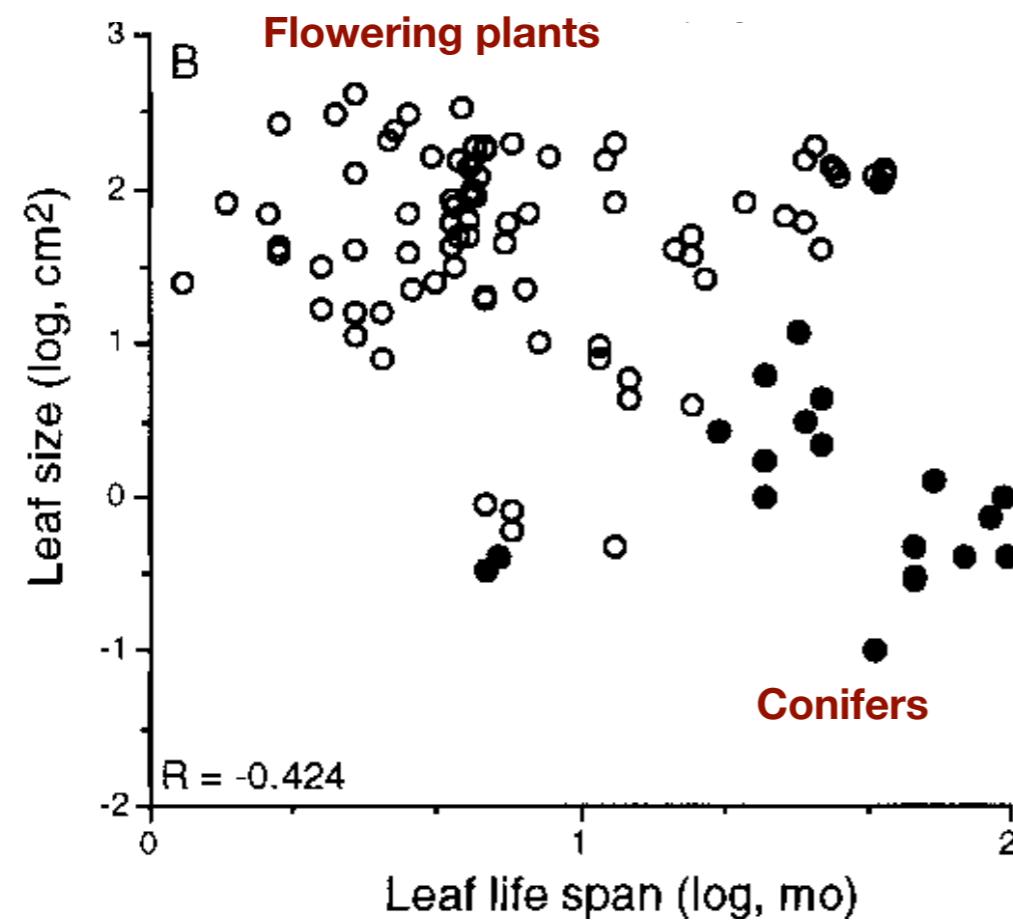
Horn et al. 2010. *Amazonia Through Time: Andean Uplift, Climate Change, Landscape Evolution, and Biodiversity*

Cost of ignoring trees



Ackerly and Reich 1999. Convergence and correlations among leaf size and function in seed plants.

Cost of ignoring trees



Ackerly and Reich 1999. Convergence and correlations among leaf size and function in seed plants.

Next time:
**Intro to computation
and reproducibility**