"PRINCIPLES OF PHYLOGENETICS: ECOLOGY AND EVOLUTION"

*Integrative Biology 200* Spring 2014

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March 31st 2014**. Traits, plasticity and environment**

**Traits and plasticity**

• Organisms must be viewed in the context of the environments they occupy

• All traits are the outcome of an interaction between genotype and environment

genotype in this context usually refers to within species, heritable variation; can also refer to species

some are just more stable across environments, and some less

phenotypic plasticity = development of different phenotypes as a function of environment

• Observations of phenotypic variation in the field always have an unknown environmental component

• Traits as points on reaction-norm (or norm of reaction)

• If there is GxE interaction, then the degree of genotypic vs. environmental influence on phenotypic variation depends on the sampling of genotypes and environments!

• Genotype x environment covariance = different genotypes occupy different environments, so factors can't be clearly separated from available data (normal in the field)

• How does plasticity contribute to apparent interspecific variation in the field?

Co-gradient variation means plasticity enhances apparent differences, in the 'correct' direction

Counter-gradient variation masks and can in principle reverse differences that would be observed in common environment

• Within-species slopes generally < Across-species differences

**Habitats as characters**

• Habitat can be discrete or continuous

Weighted averages of discrete states makes sense if habitat types are properly ordered

• Observed habitats occupied by species in the field depends on what environments exist

• Jackson and Overpeck 2000 Paleobiology

*Realized environmental space*: distribution of environments that exist

*Fundamental niche*: distribution of environments over which species is capable of living

*Potential niche space* = intersection of realized space and fundamental niche

Peterson et al. 2011 suggested alternative term:

*Realized niche*: distribution of environments occupied in the face of competitors, and available within realized environmental space

• Characterization of 'climatic niche' from field distributions is based on realized niche

• Climatic niche as absolute distribution of occupied sites, or distribution relative to availability

**Taxon sampling and hypothesis testing**

A lot of attention given to model fitting, parametric vs. Bayesian, etc. for model testing

The domain of a hypothesis test is determined, implicitly or explicitly, but the sampling procedure

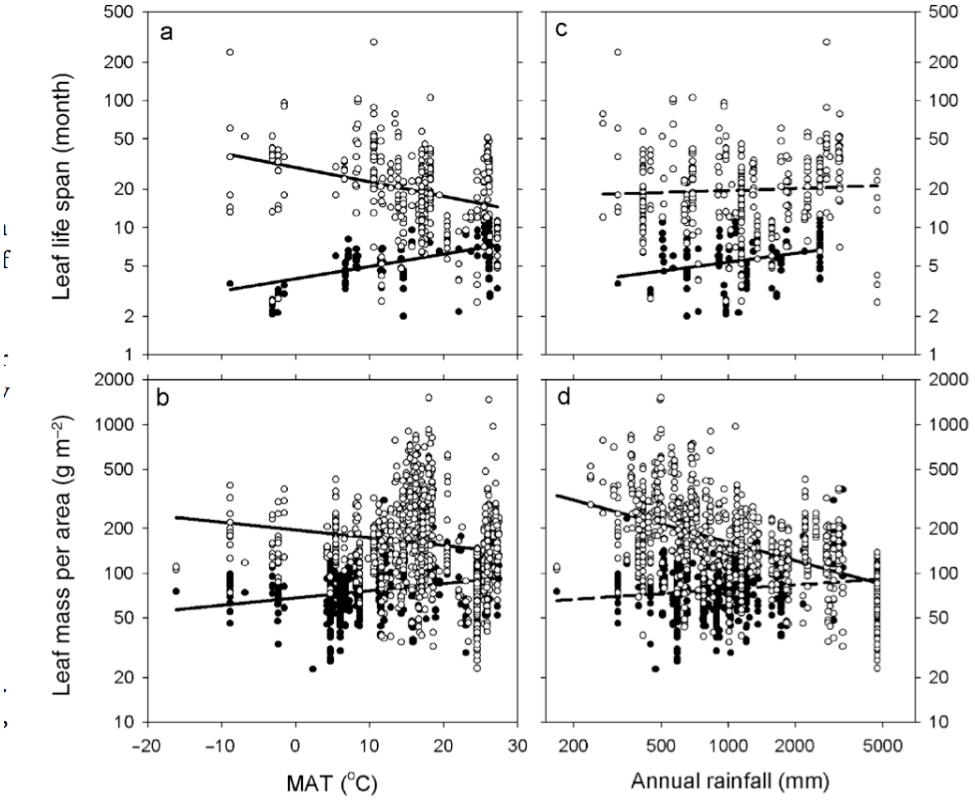
What does it mean to sample taxa randomly?

Actually a two step problem:

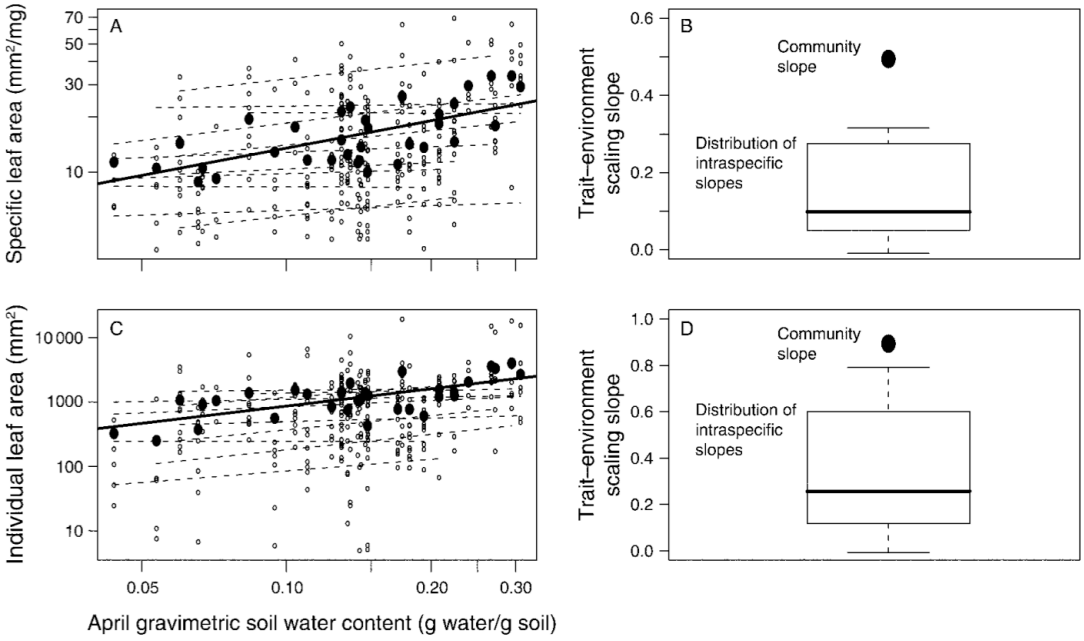
first decide on the clade or community to study

then almost always have to sample taxa within that clade or community

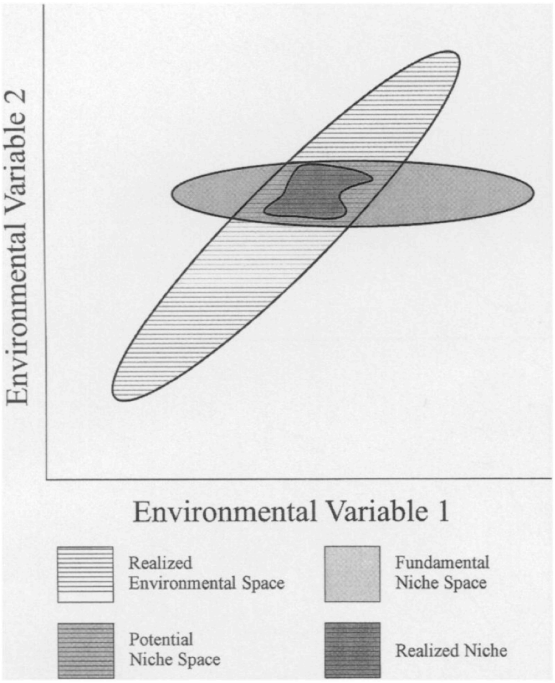
sampling procedures are usually better defined for step 2



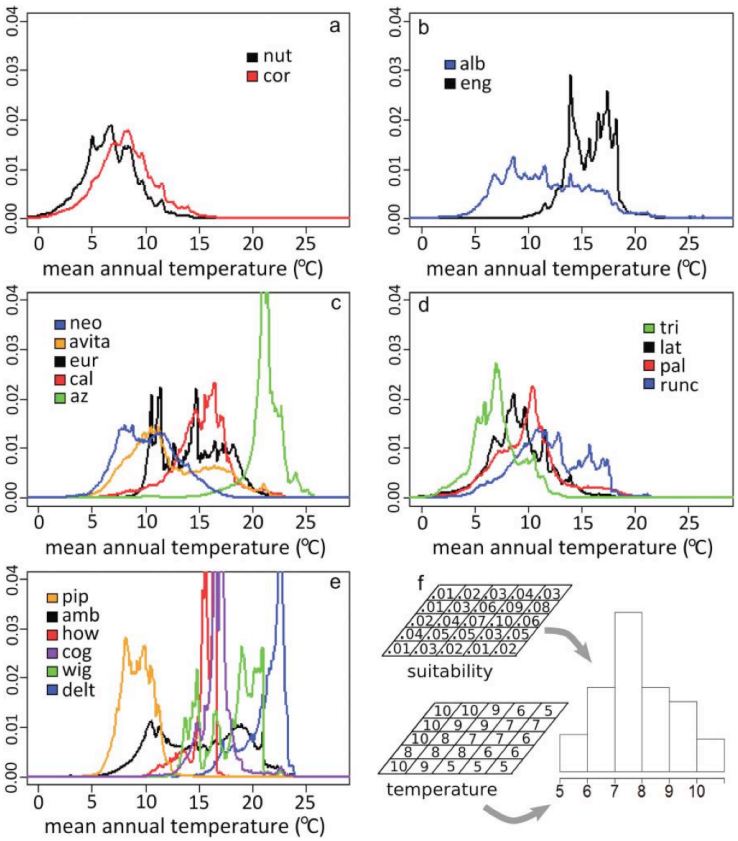

Wright et al. 2005 Glob Ecol. Biogeography




Ackerly and Cornwell 2009 Ecol. Monogr.




Jackson and Overpeck 2000 Paleobiology




Evans et al. 2009 American Naturalist