Feb. 16th - Phylogenetic analysis 1.
Using characters, character states to estimate past history
   Cladistic analysis - example using six plants from class
   Outgroups, rooting. Why do we root trees?
   Direction of character-state change - ancestral vs. derived
      Synapomorphies vs. ancestral states, and definition of clades
   What is cladistic analysis?
   Principle of parsimony in cladistic analysis
   Informative vs. uninformative characters, autapomorphies
   Characters and conflicting relationships, homoplasy
   Choosing among alternate tree. Discard characters? Add more characters?

Feb. 18th - Phylogenetic analysis 2.
Summarizing information from multiple trees
   Many equally parsimonious trees
   Consensus trees
Weighting characters
   Should some characters be worth more than others in a cladistic analysis?
   Complex characters - parallel origins vs. parallel gains. Dollo's Law. E.g., eyes.
   Nucleotide changes; purine to purine, pyrimidine to pyrimidine, purine to pyrimidine, pyrimidine to
   purine. Transitions vs. transversions - weighting?
   Rapidly changing characters vs. slowly-changing characters - differential weighting?
   Morphological characters
   DNA characters
Methods using mathematical models that describe how characters (usually DNA characters) evolve
   Maximum likelihood
      Differences in character-state changes
      Rate differences among characters
      Rate differences among taxa
   Advantages and disadvantages of maximum-likelihood methods
Assessing the reliability of a tree
   Once we obtain a tree, how do we decide whether it is reliable
   Decay analysis
      Is a group found on trees only slightly longer than most-parsimonious tree?
      High decay index - more reliable group
      How high is high enough?
   Bootstrap analysis
      Simulates having additional data sets by resampling
      Analysis of all resampled data sets - how frequently does group appear?
      High bootstrap - more reliable group
      How high is high enough?
Multiple data sets
   Congruence among different data sets
   Conflict among data sets
   Combining multiple data sets
Mapping characters on a tree
   Reading assignment no pp. 31–33. Evolution of Ericaceae corolla - fused vs. free.
   Taxon sampling and direction of character evolution
   You are responsible for reading this, and being ready to answer a question about it.
March 1st and March 3rd - Genetic diversity within species 1 and 2.

Conservation of genetic diversity - relevance

   Variation within species, and species performance within its range
   Variation with populations, and their persistence into the future

Are performance and persistence tied to genetic diversity?

Performance within it range - genetic diversity within species and habitat range

   Ecotypes - genetic variants?

   First type of experiment - measure genetic diversity in widespread vs. narrowly-distributed species
   Some show correlation, others do not
   What do the compiled allozyme data say about total variation?
   variation among populations?
   Variation among populations and breeding system

   Second type of experiment - transplants - confirm that ecotypes are genetic variants

Diversity with populations, and persistence into the future

Microhabitat differentiation

   Heterogeneity within a single site
   Does genetic diversity allow occupation of more microhabitats?

Transplant experiments

   Genetic diversity → use of more habitats → increases population's chance of persisting

Stochastic events

   Temporal fluctuation
   Example: seedling survival; different genotypes are superior at different times
   Genetic variation → better survival through temporal variation

Pathogens, herbivores

   Genotypes differ in susceptibility to pathogens, herbivores
   Range of genotypes → some might survive an attack → population might persist

Inbreeding and genetic diversity

   Increase in homozygosity. Inbreeding depression.
   Populations with little variation may show inbreeding depression
   Maximize genetic diversity → minimize inbreeding depression → increase chance of persistence

Founder events

   Population from a small number of individuals
   Low diversity

   Loss of diversity due to initial sampling effect
   Further loss due to genetic drift

   Low genetic diversity:
   Less able to cope with microhabitat variation
   Less able to cope with stochastic events
   More susceptible to inbreeding depression

Conservation relevance?

   Management strategies, sizes of managed populations

Seven recommendations for sampling and conservation of rare species - you are responsible for reading this part and being ready to carefully describe two of them.
March 15th - Speciation.

Speciation - severing of population systems so that migrants from one system would be at a disadvantage when entering another.

Differences may arise through:

Adaptive change - selection
- Divergence due to selection in different environments
- Selection can lead to divergence among populations in very similar habitats

Random change - genetic drift
- Independent of selection
- Magnitude of genetic drift is related to population size

Modes of speciation

Allopatric speciation
- Geographic separation
- Gradual divergence between separated population systems
- Problem: is gene flow a homogenizing force across a large species?

Local speciation (peripheral isolation)
- Small population on the edge of the species range
- Small population - genetic drift
- Edge of range - extreme conditions may promote change through adaptation

Sympatric speciation
- No geographic separation
- Controversial:
  - If the new potential species can interbreed with parental species, how will it diverge?
  - If it can't interbreed, how will it reproduce?

*Stephanomeria* - a self-fertilizing variant within a non-selfing population

Hybridization among species can lead to

- Reinforcement of post-zygotic mating barriers
- A hybrid swarm
- Fusion of the species
- Introduction of new genes into one or both species
- Evolution of a new hybrid species

Boxes 6B, 6D - You are responsible for reading these, and being prepared to answer a question on one.

Polyploidy - an instantaneous reproductive barrier

- Frequency varies among plant groups
- Production of gametes without chromosome reduction. Fusion of unreduced gametes → polyploid.
- Autopolyploid vs. allopolyploid
- Autopolyploid is a type of hybrid individual, often more stable than a diploid hybrid
- Polyploid X diploid → sterile offspring

*Tragopogon* in western North America - a well-documented speciation event