

Understanding Maritime Chaparral

Using *Arctostaphylos* as the road to and from confusion

Maritime Chaparral

No real definition has stabilized for maritime chaparral. There is a continuum of chaparral types distributed along the coast of California.



Post-fire at Ft. Ord



Pfeiffer Rock

Summer fog is the one characteristic that links these chaparral types together.



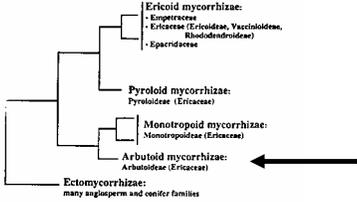
The recent *Arctostaphylos* (manzanitas) radiation in California has resulted in a confusing group for most people. As a principal dominant of maritime chaparral, one question is *where did all these manzanitas come from?*

Origin within the Ericaceae

- The Arbutoideae is a subfamily of the Ericaceae, a widespread and diverse family. The family itself dates beyond 100 MYBP, and some estimates place it older.



One theory proposed relationships within the family based upon their fungal root mutualists, or *mycorrhizae*. Suggesting single origins for the various mycorrhizal types within the family, the Arbutoideae comes out as one of the oldest lineages.



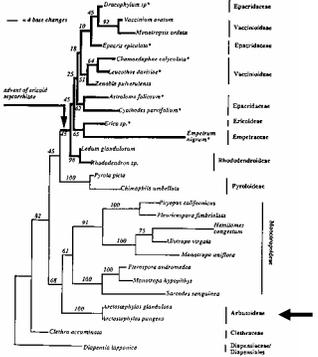
Ericoid mycorrhizae:
 • Empetraceae
 • Ericaceae (Ericoidae, Vaccioidae, Rhododendroideae)
 • Epacridaceae

Pyretoid mycorrhizae:
 Pyretoidae (Ericaceae)

Monotropoid mycorrhizae:
 Monotropoidae (Ericaceae)

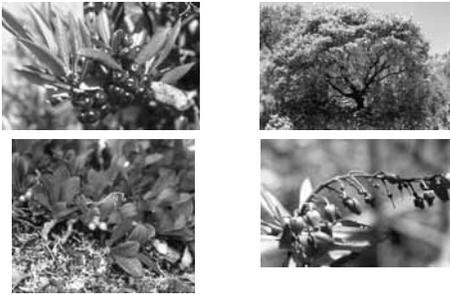
Arbutoid mycorrhizae:
 Arbutoidae (Ericaceae) ←

Ectomycorrhizae:
 many angiosperm and conifer families



Using molecular sequence data, these relationships within the Ericaceae were confirmed.

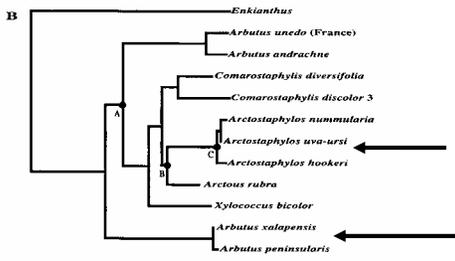
What are the relationships among the genera within the Arbutioideae?



The subfamily Arbutioideae contains 6 genera. These genera are found in the northern hemisphere, with most species confined to North America.

- *Arbutus* ~12 species
- *Arctostaphylos* ~60-90 species
- *Arctous* 2 species
- *Comarostaphylis* ~16 species
- *Ornithostaphylos* 1 species
- *Xylococcus* 1 species

Molecular sequences suggest *Arbutus* as the basal genus for the subfamily, and *Arctostaphylos* as the most derived.

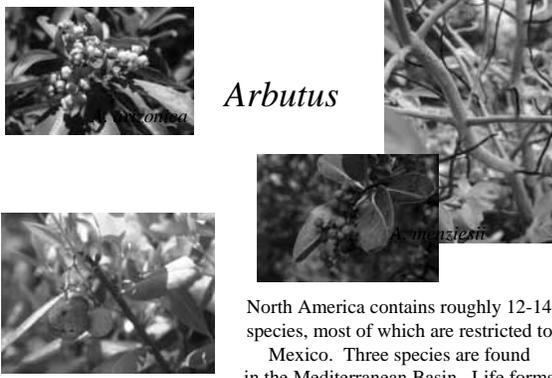


Arbutus

- As the oldest lineage within the subfamily, *Arbutus* fossils date back over 50 MYBP.
- *Arbutus* is divided into 2 clades, one found in western N. America including Mexico,
- ...and one in the Mediterranean Basin.



Arbutus

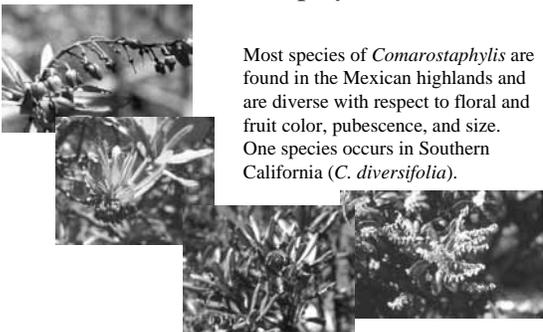


North America contains roughly 12-14 species, most of which are restricted to Mexico. Three species are found in the Mediterranean Basin. Life forms range from shrubs to trees.

A. unedo

Comarostaphylis

Most species of *Comarostaphylis* are found in the Mexican highlands and are diverse with respect to floral and fruit color, pubescence, and size. One species occurs in Southern California (*C. diversifolia*).

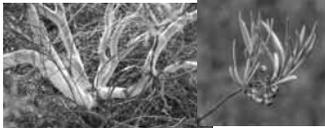


Xylococcus

- *Xylococcus* is a monotypic genus.
- Restricted to S. California and northern Baja, *X. bicolor* was originally placed in *Arctostaphylos*.



Ornithostaphylos



Ornithostaphylos is a monotypic genus. It is restricted to northern Baja and just crosses into S. California.

Arctous

- *Arctous rubra* is found in boreal forest areas of North America.



Swedish tundra with *Arctous*



Alaskan tundra

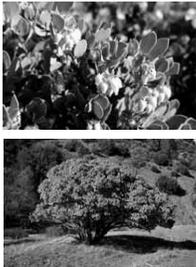


- *Arctous alpina* is found circumarctic in tundra, boreal forest and alpine habitats,.



Arctostaphylos

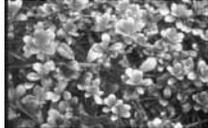
- *Arctostaphylos* is the most diverse genus in the Arbutioideae.
- Life forms range from prostrate plants to small trees.
- All are evergreen.



Arctostaphylos



Arctostaphylos
(ca. 1900-1900)

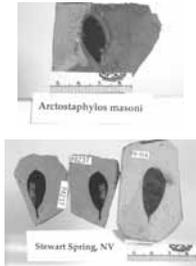


A. uva-ursi

- One species, *A. uva-ursi*, is found across the northern hemisphere, in subalpine, north temperate forests, and the California coast.
- All other species are entirely or partially found in California.

Arctostaphylos

- Fossils date back just over 15 MYBP.
- Most are relatively recent, less than 1-3 MYBP.
- The majority of species are believed to have originated later in the Pleistocene.



Where do we find manzanitas?



Worldwide in the Northern Hemisphere



- Arctic tundra
- Boreal forests
- Subalpine forests
- N. Temperate forests
- W. N. Am. Mountains
- California chaparral
- Coastal bluffs, sandy mesas and dunes

What do these places have in common?

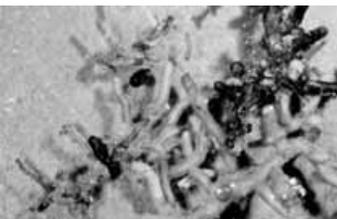


Nutrient Poor and Acidic Soils



Disturbance by Fire

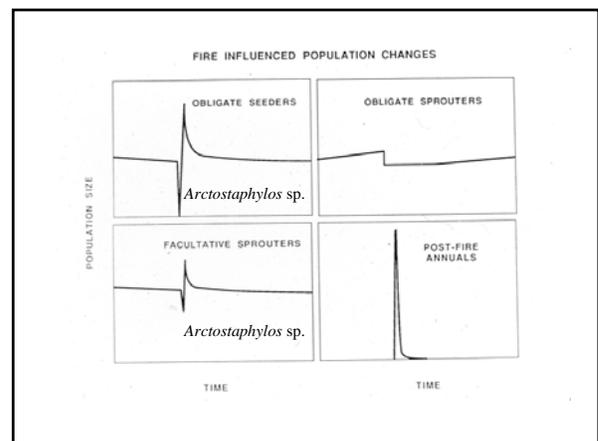
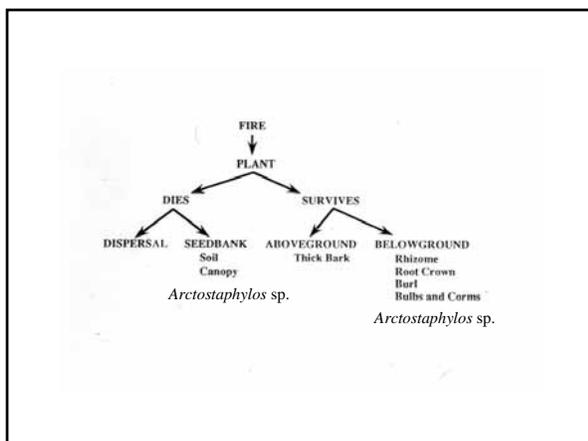
How do manzanitas tolerate acidic, nutrient poor soils?

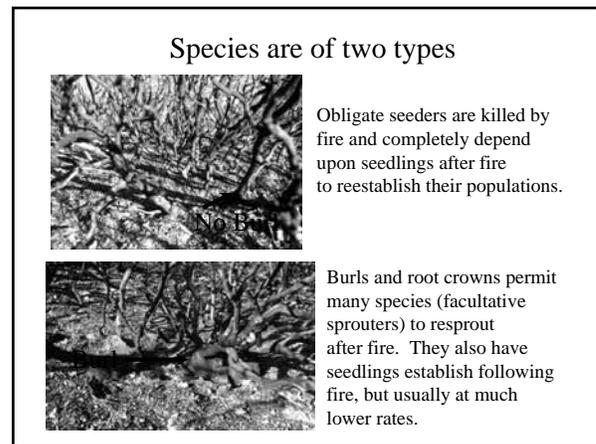
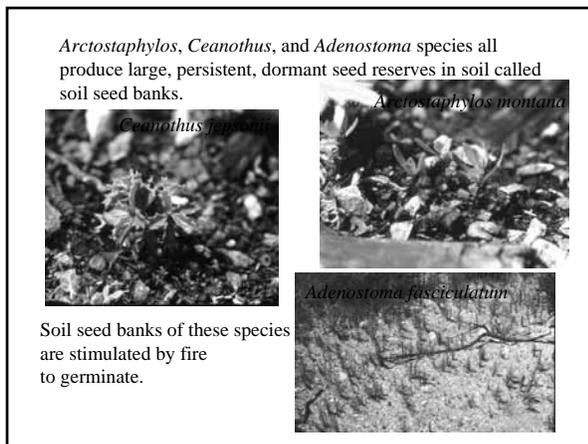
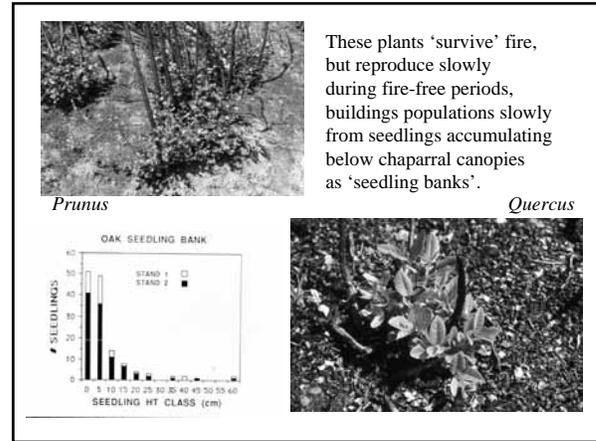
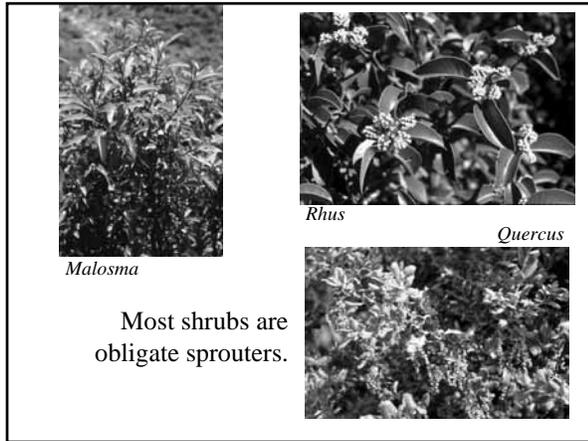
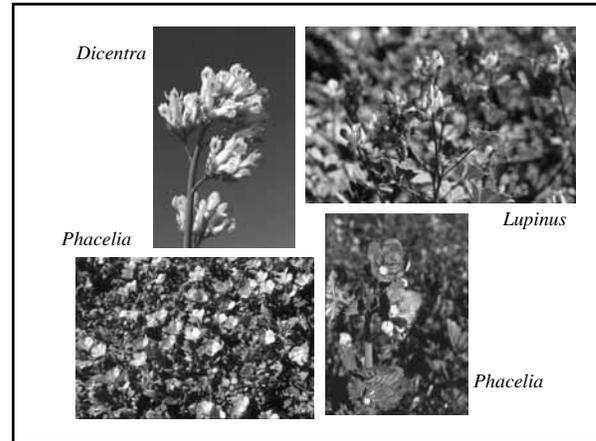
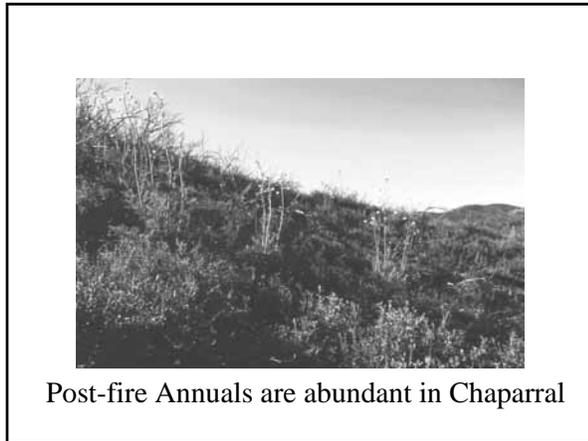


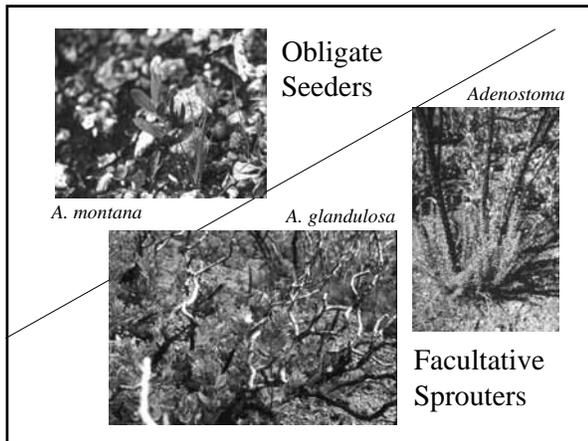
Manzanitas have a mutualistic relationship with fungi.

Together they form mycorrhizal roots.

How do manzanitas survive fires?

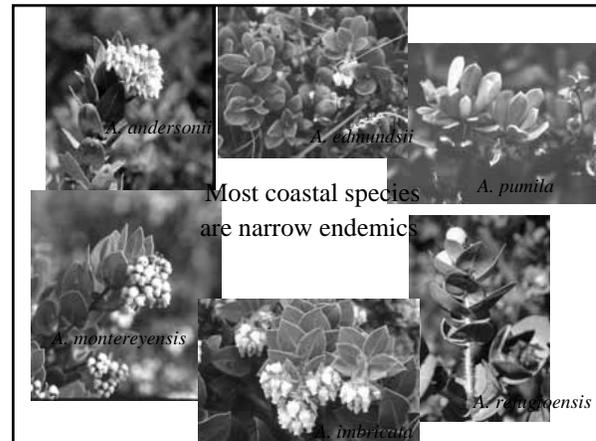
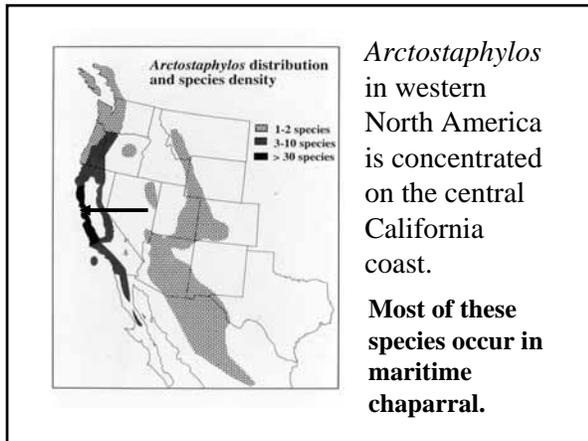







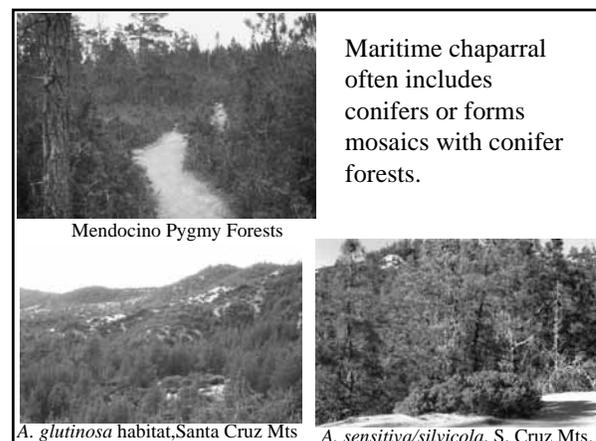
Species Richness in Maritime Chaparral

- High Species Richness for the region
- Comparing one site to another, stands have similar genera, but different species
- The richness in diversity is among sites



Richness of *Arctostaphylos* endemism

- 18 taxa are found in Monterey County
- 10 taxa are found in Santa Cruz County
- 24 total different taxa for these two counties
- 8 taxa are in San Mateo Co, increasing the total to 28 different taxa
- 20 taxa are in San Luis Obispo Co, adding 12 new taxa, totalling 40 for the 4 central coast counties

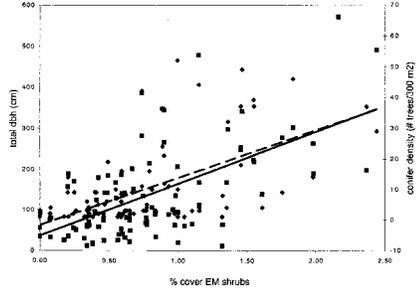


This association between manzanitas and conifers should remind you that they can share mutualistic fungi.



This can facilitate each other's establishment and dominance.

We tested this model, randomly sampling chaparral stands associated with 6 randomly chosen coastal conifer species. Stands with invading trees were assessed. Only EM shrub cover was significant for explaining conifer density or basal area in a linear model test



Maritime Chaparral

- Poor Acidic Soils
- Canopy fire adaptations (most obl. seeders)
- Variety of types (mesas and dunes, bluffs, forest edges, poor soil outcrops)
- Moderated climate with summer fog
- High species endemism
- Mycorrhizal mutualists shared with conifers

Implications for management

Fire Regime

← Frequency →

← Intensity →

← Season →

← Area →

Too frequent, obligate seeders can not form seed banks. Too infrequent, conifers can invade many sites. Off season, wrong intensity, too small an area, all of these can impact the recovery of the chaparral stands.