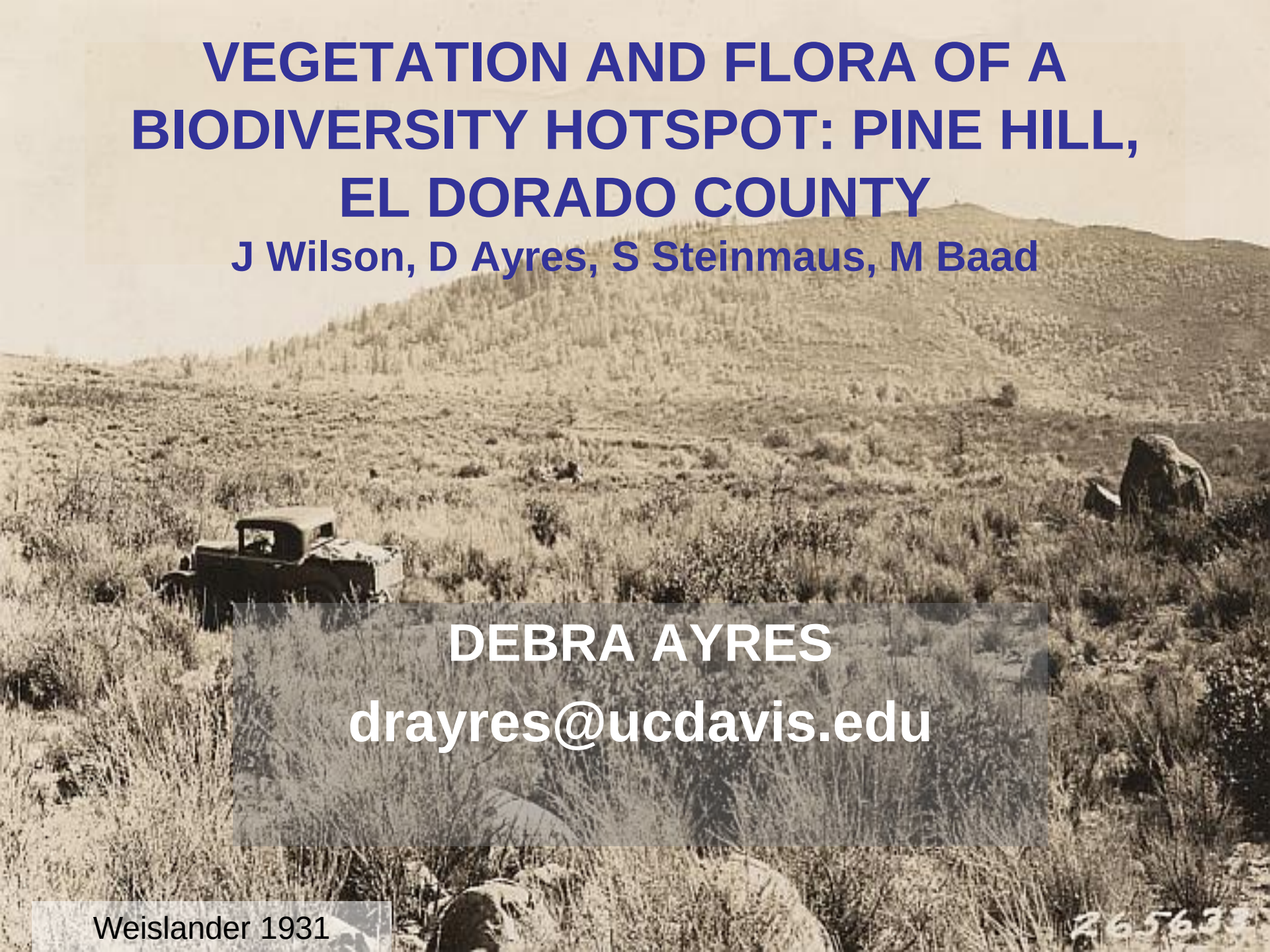
VEGETATION AND FLORA OF A BIODIVERSITY HOTSPOT: PINE HILL, EL DORADO COUNTY

J Wilson, D Ayres, S Steinmaus, M Baad



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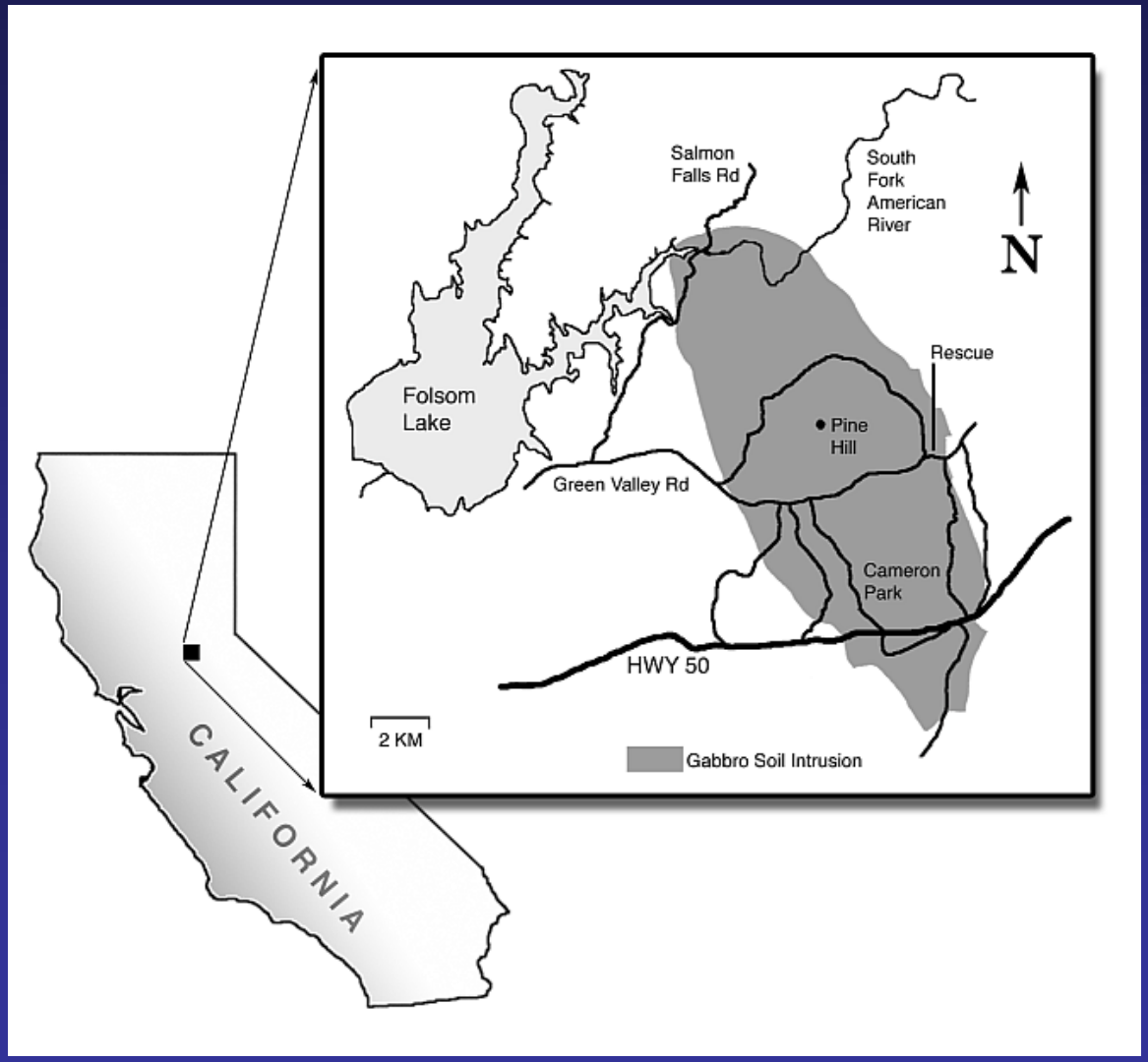
Weislander 1931

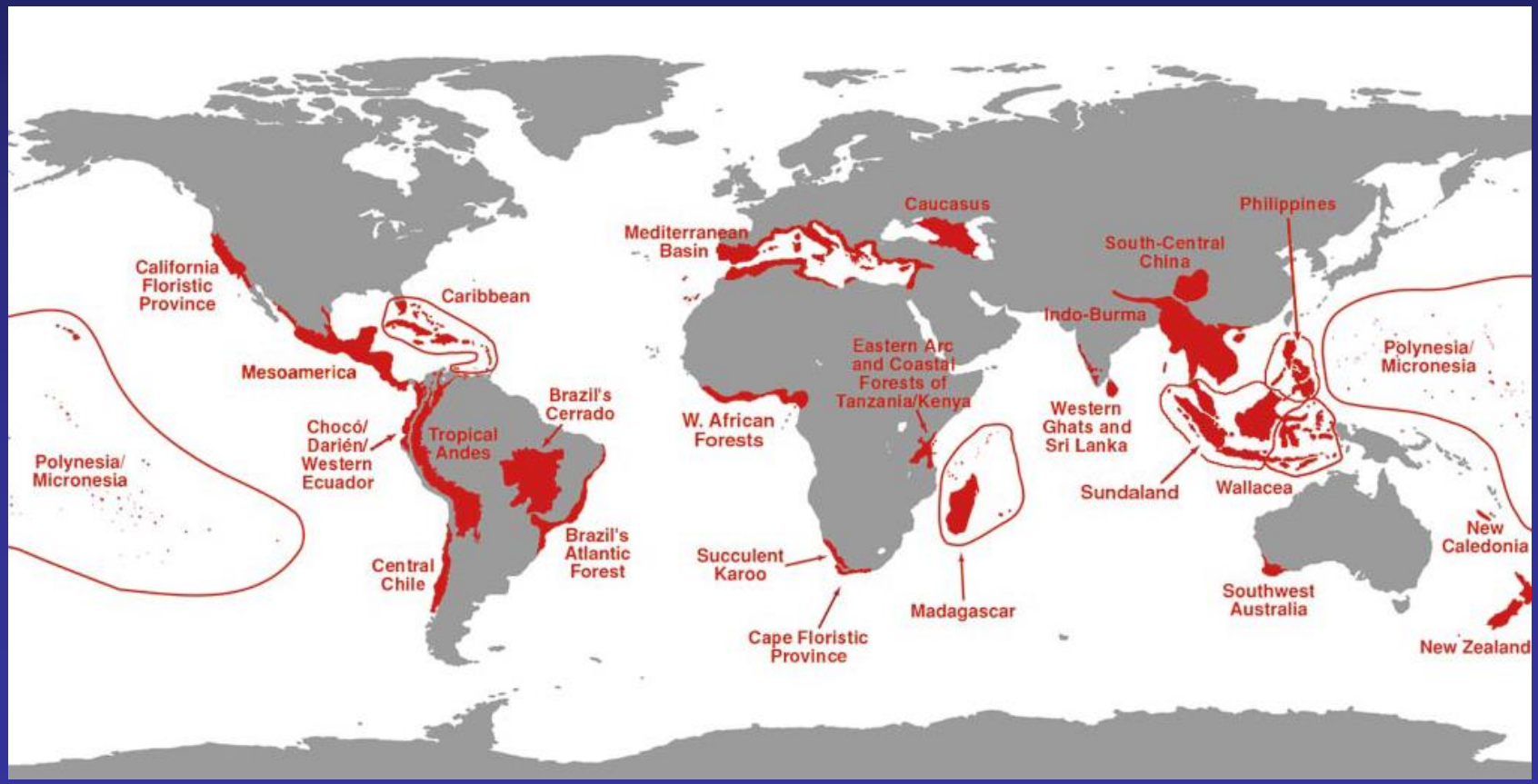
Pine Hill 2013 2,031 ft elevation

Map of Pine Hill area



BIODIVERSITY HOTSPOTS

"As many as 44% of all species of vascular plants are confined to 25 hotspots comprising only 1.4% of the land surface of the Earth." Norman Myers et al, 2000, Nature.



Flora vs. vegetation

Flora: a particular set of plants; usually in the form of a list

e.g., Flora of Pine Hill

Vegetation: refers to the overall life form of plants in a particular area

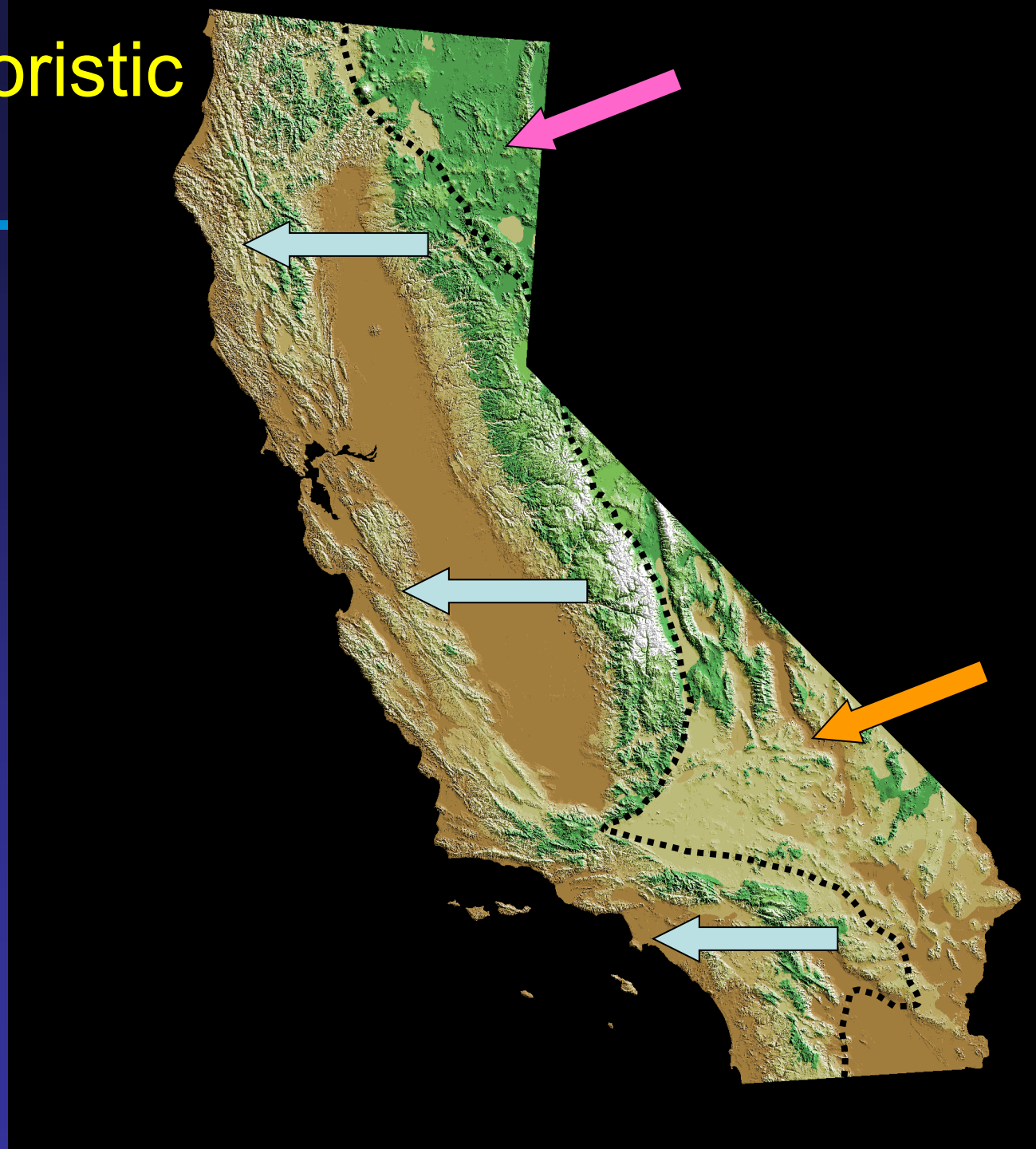
e.g., grassland, shrub, woodland

California's floristic provinces

California

Great Basin

Desert



Diversity of the CA flora

- ~7,000 plant taxa
  - 5,862 native taxa
    - 4,693 distinct sp. + 1,169 var. or subsp.
  - 1,023 introduced
- Of natives, 1,416 endemic species
  - 737 var. or subsp.
- 26 endemic species extinct

PINE HILL Island

- 741 plant species and subspecies
- 583 native and 158 introduced plants
- 8 rare species
  - 4-5 species endemic to Pine Hill area
- 30,000 Acres
- Biodiversity Hotspot: 0.05% of the area of CA but contains about 10% of the plant taxa

Comparisons of Pine Hill Diversity

- New Caledonia 0.18 species/km^2
- Polynesia 0.14 sp./km^2
- Cape – So. Africa 0.11 sp./km^2
- Madagascar 0.026 sp./km^2
- CA Floristic Prov. 0.0013 sp./km^2

Comparisons of Pine Hill Diversity

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- CA Floristic Prov. 0.0013 sp/km^2

- **Pine Hill** **7.1 sp/km^2**

Conservation

- Maximize bang-for-the-buck
- → Preserve species rich areas
- Conserve 10% of CA Flora by preserving < 0.05% of land area

Conservation of Pine Hill

- First Step:
- Identify endangered & threatened species
  - T &E plants are the drivers due to the ESA
- Mid-1980 Jim Wilson Master's thesis on flora and vegetation of Pine Hill

Rare Species

Stebbins' Morning Glory

Pine Hill Ceanothus

Pine Hill Flannel Bush

El Dorado Mule's ears

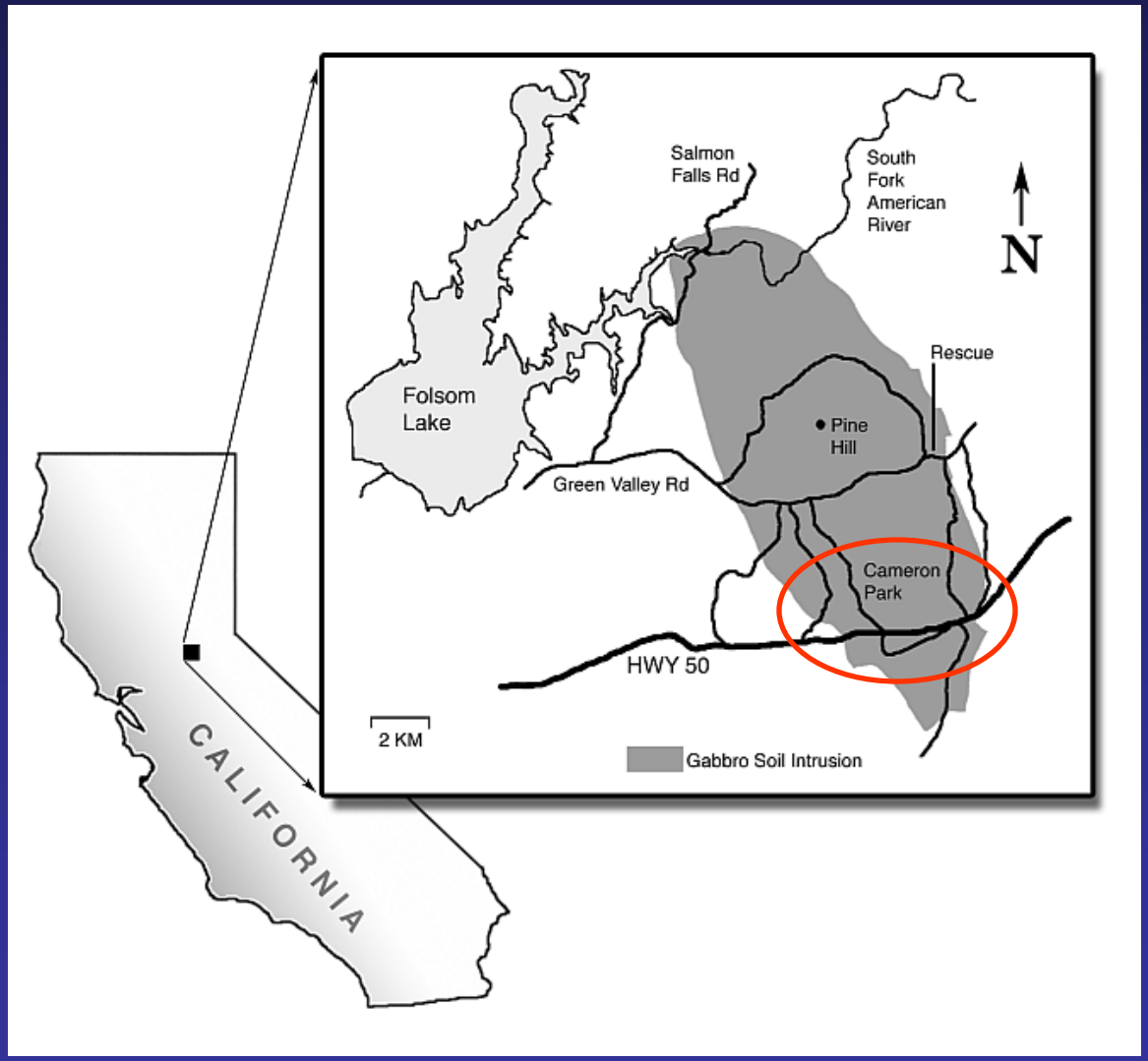
El Dorado Bedstraw

Layne's Butterweed

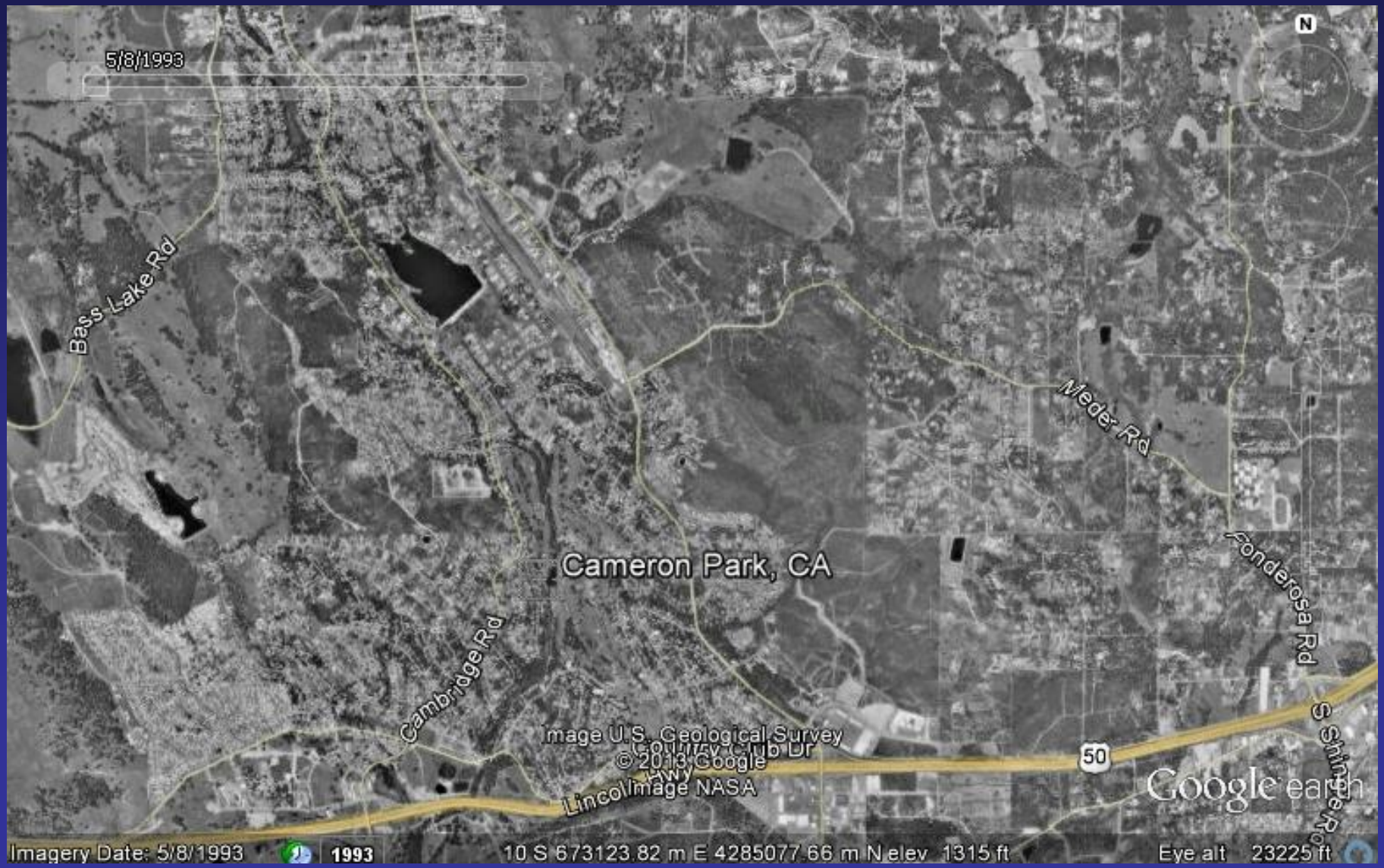
Conservation of Pine Hill

- Second Step:
- List species under Federal Endangered Species Act
  - Identify threats to rare species
- But, little protection is given to plants while a lot is given to animals

Threats to rare species



Conservation of Pine Hill (CP 1993)



Conservation of Pine Hill

- Wilson's Master's thesis formed the foundation for listing of 5 rare species in 1996:

DEPARTMENT OF THE INTERIOR Fish and Wildlife Service

50 CFR Part 17 RIN 1018–AC47

Endangered and Threatened Wildlife and Plants; Determination of

Endangered Status for Four Plants and Threatened Status for One Plant From the Central Sierran Foothills of California

AGENCY: Fish and Wildlife Service, Interior.

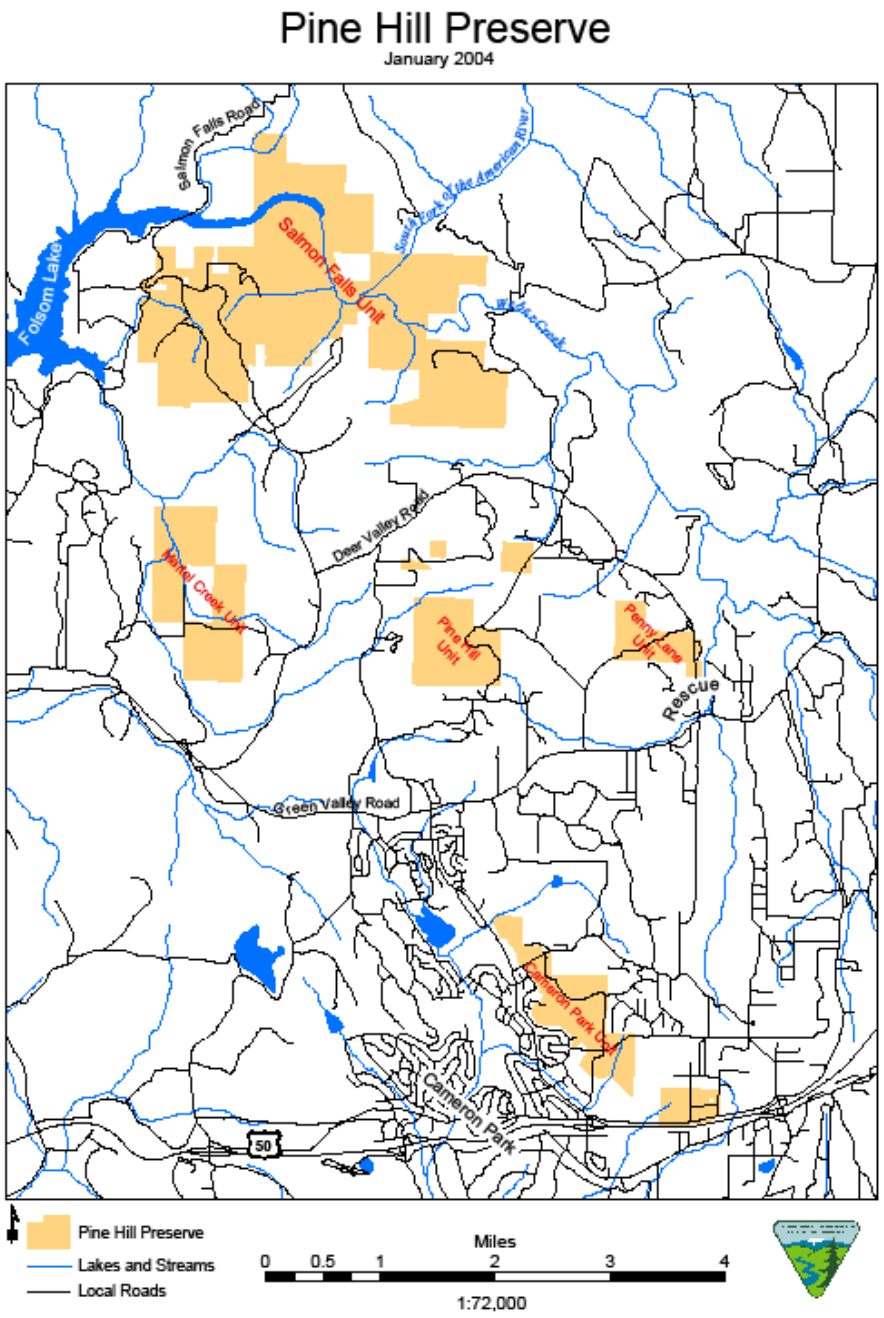
ACTION: Final rule.

Conservation of Pine Hill

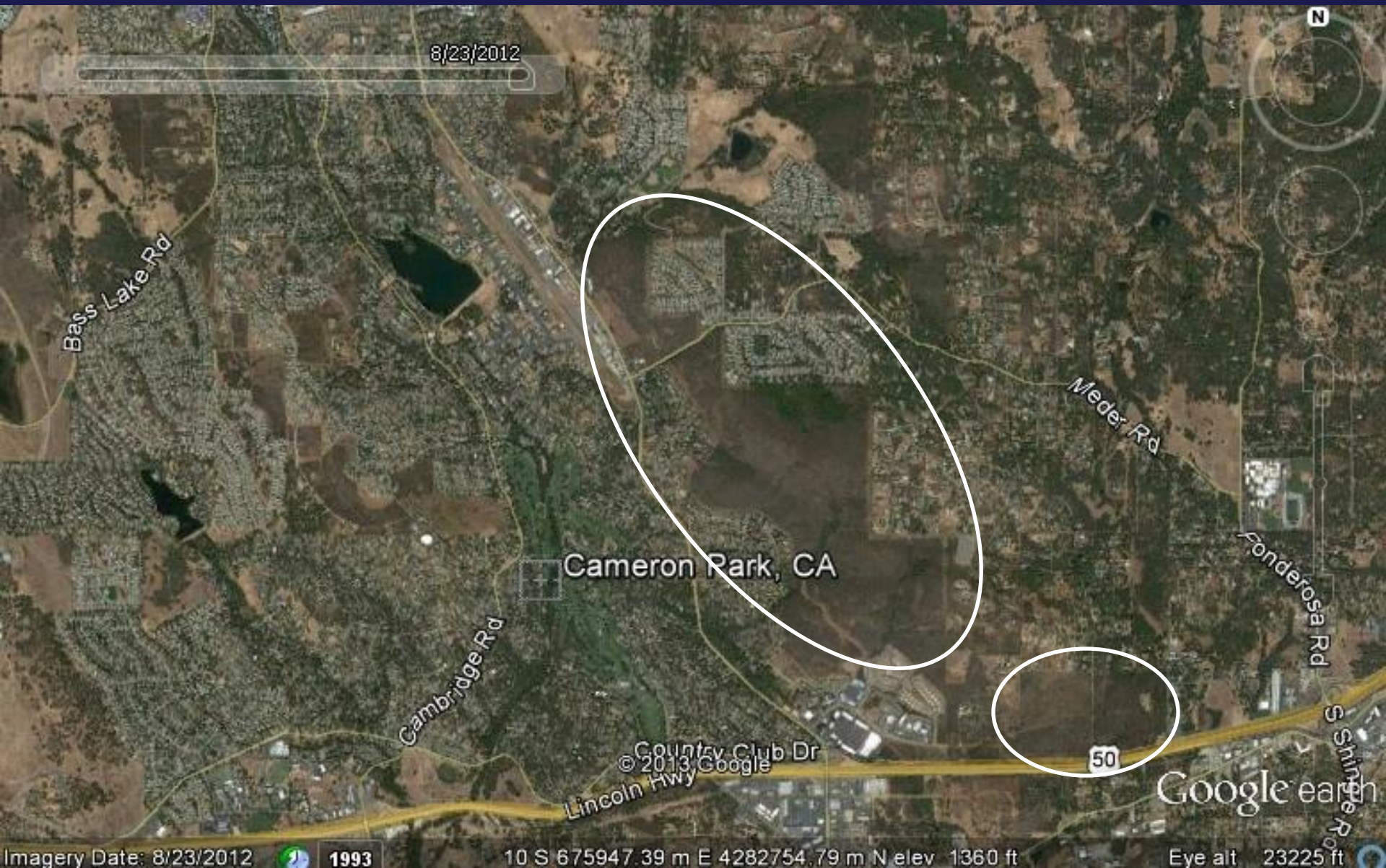
- Third Step:
- Identify “Federal Nexus”:
  - No federal agency can act in a way that threatens a listed species
- It was determined that water, supplied by the Bureau of Reclamation water projects, would promote development that would imperil listed species

Pine Hill Preserve

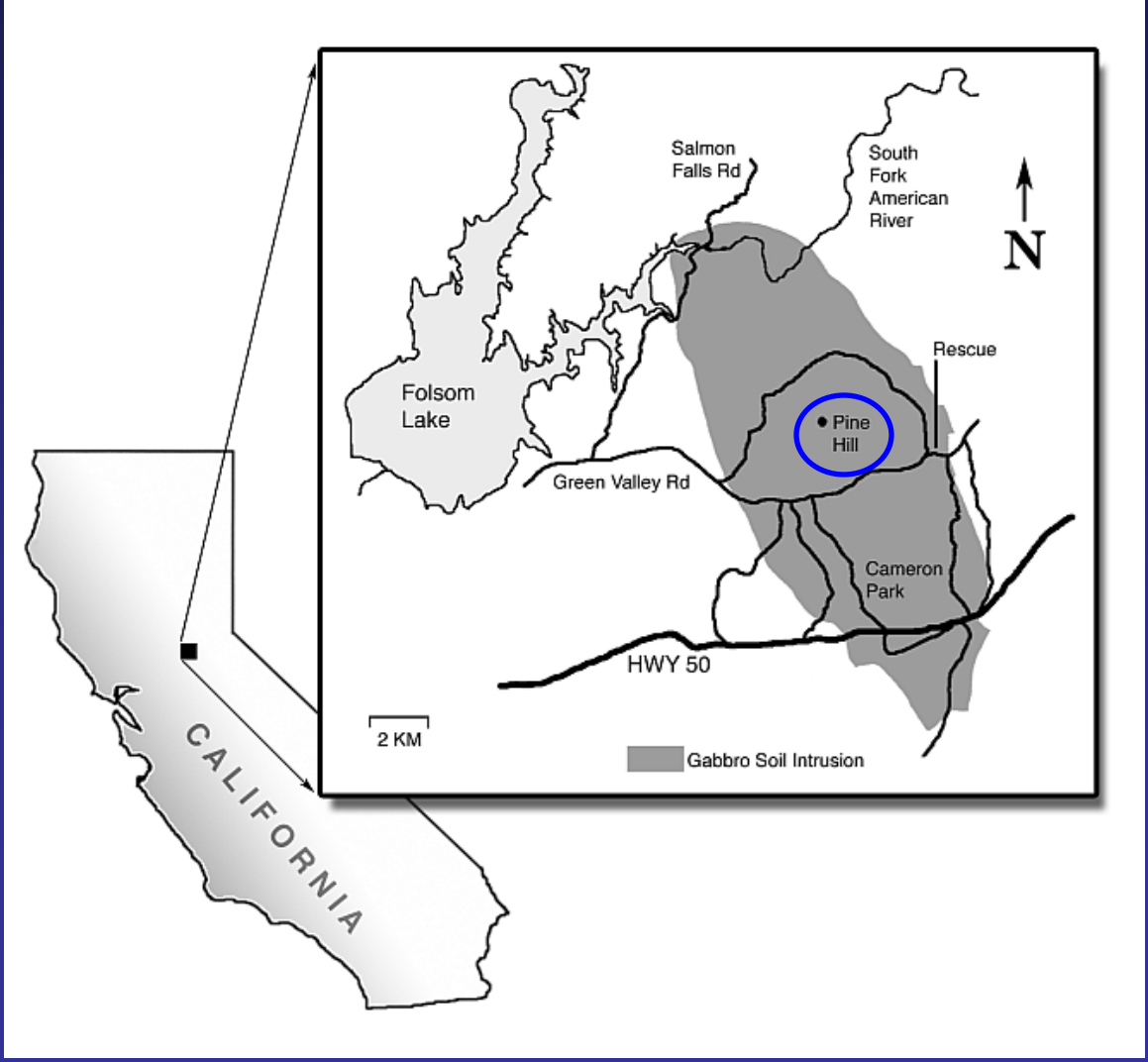
4,746 acres under Federal, State, and County ownership



Cameron Park 2012



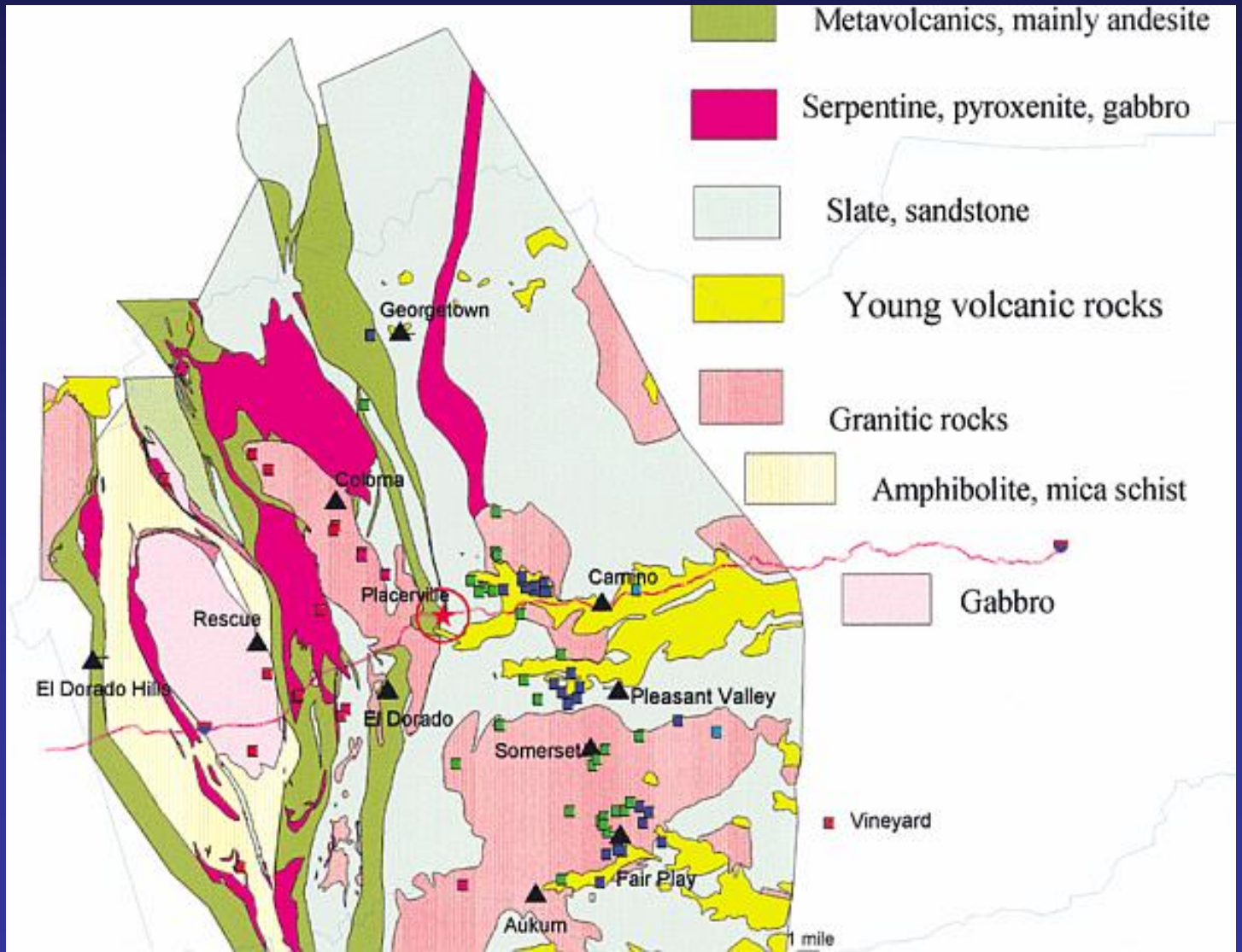
Pine Hill “Ecological Island”



PINE HILL

- Island of Gabbro soil derived from the magma chamber of an ancient volcano (175 MYBP)
- Other soils derived from granite, metamorphic and serpentine rocks
- Variable topography – river canyons to meadows to hilltops

Pine Hill Soils



Wilson's work published 2009

MADROÑO, Vol. 56, No. 4, pp. 246–278, 2009

VEGETATION AND FLORA OF A BIODIVERSITY HOTSPOT: PINE HILL, EL DORADO COUNTY, CALIFORNIA, USA

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ABSTRACT

Pine Hill lies near the center of a gabbrodiorite intrusion in the foothills of the Sierra Nevada mountain range in El Dorado County, CA, USA. We assembled an extensive flora, examined the

Wilson et al paper - Methods

- Plot Work
  - 138 plots covering all vegetation and rock types
  - Species data – ID and cover
  - Environmental data
    - Slope, aspect, parent rock, etc.
- Data Analysis
  - TWINSPAN – ID plant communities
  - CANOCO - ID correlates of communities

Wilson Study - Results

- Three main vegetation types – oak woodlands, grasslands, and chaparral
- Rare species were mostly in chaparral; one was in woodland/chaparral transition, none in grassland

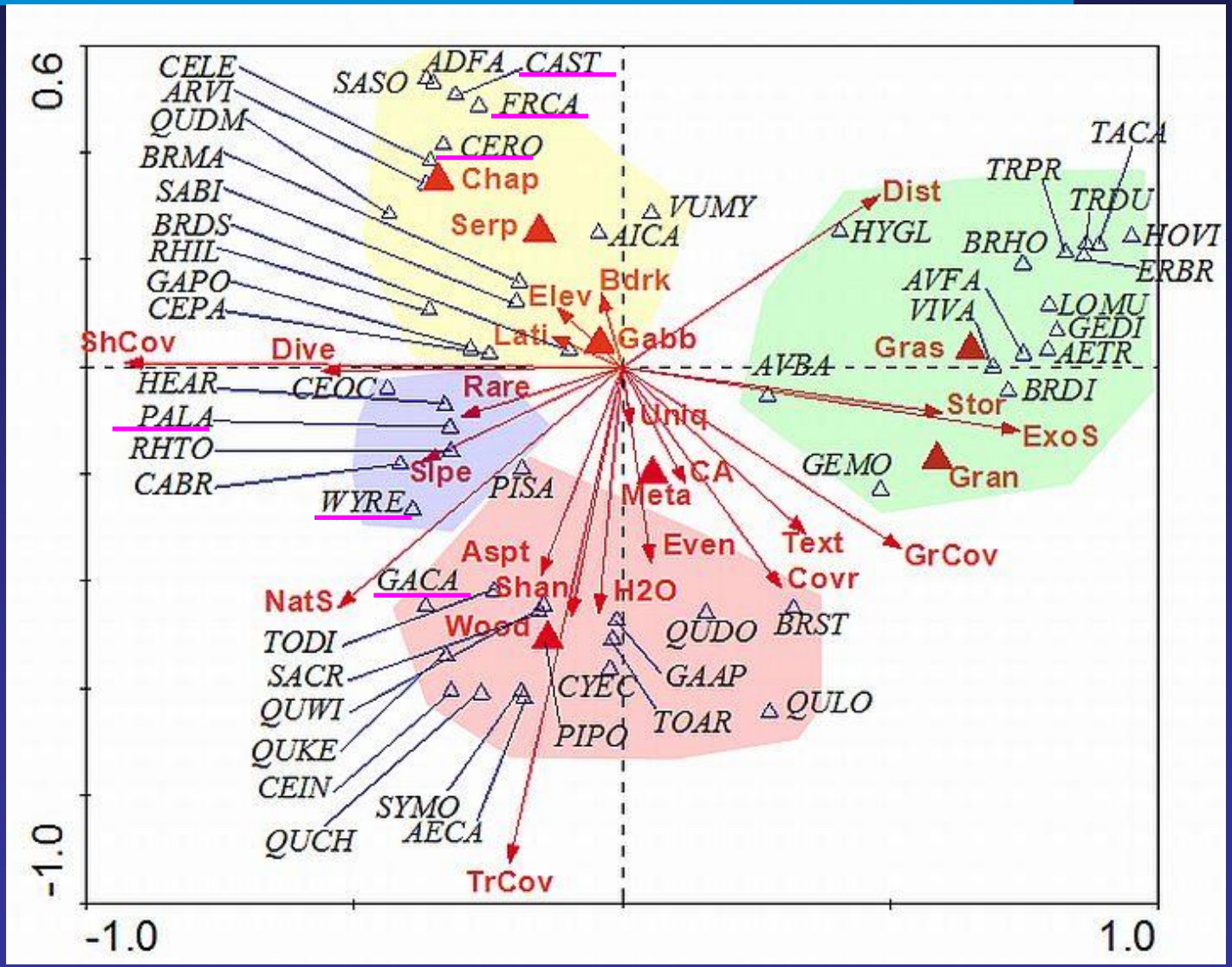
Wilson Study - Results

- 741 distinct taxa including:
  - 91 subspecies and varieties, 8 fern species and 3 lichens
  - From 376 genera in 91 families
  - Asteraceae (108) and Poaceae (71)
- Percent native plants:
  - Chaparral, Woodland, Serpentine – 76%
  - Grassland, Granite – 36%

CANOCO statistical software

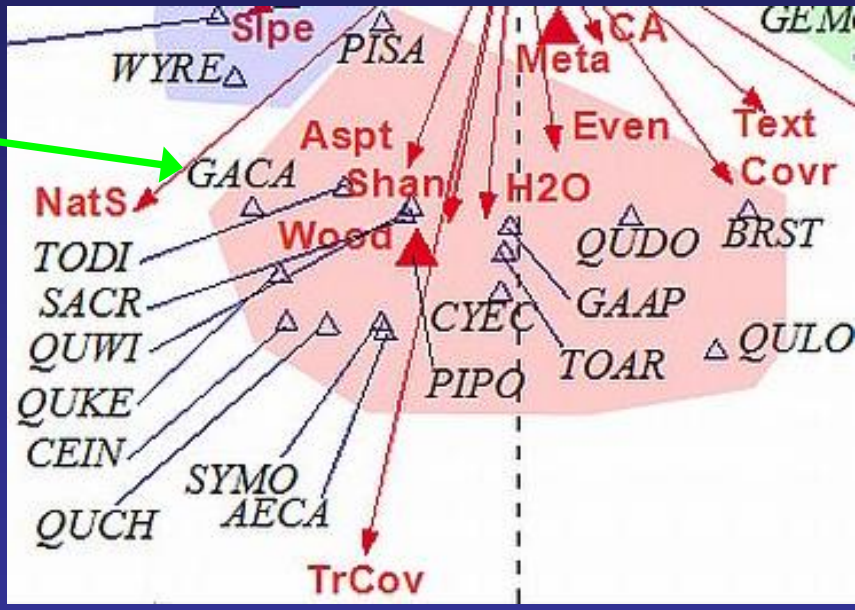
- **canonical correspondence analysis (CCA)** is a multivariate constrained ordination technique that extracts major gradients among combinations of explanatory variables in a dataset. (Wiki)

Wilson et al – Results - CANOCO

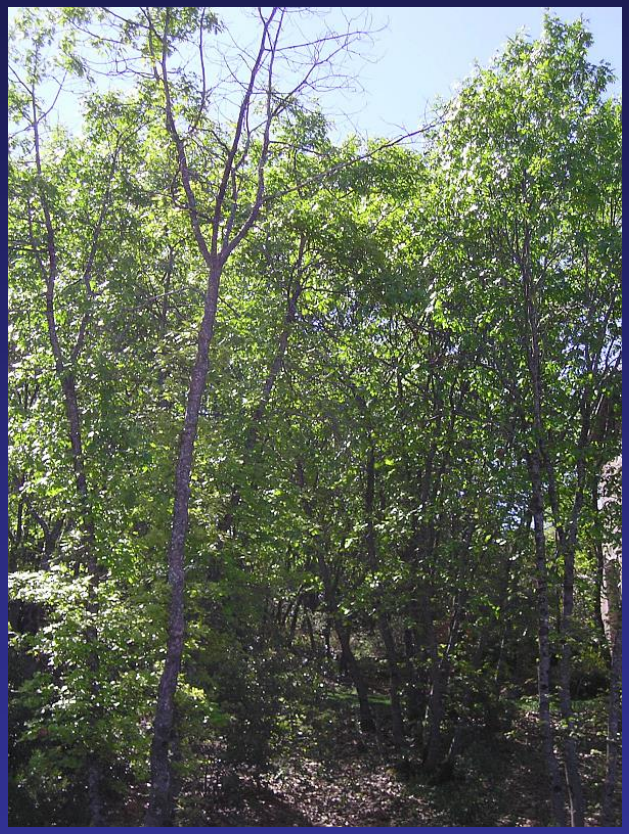


Wilson Study – Results - CANOCO

- Woodland – Oak Dominated
  - Environmental correlates:
    - Biotic
      - Tree Cover
      - Native Species
      - High Diversity and Evenness
    - Abiotic
      - North-facing slopes
      - Water
      - Metamorphic parent rock

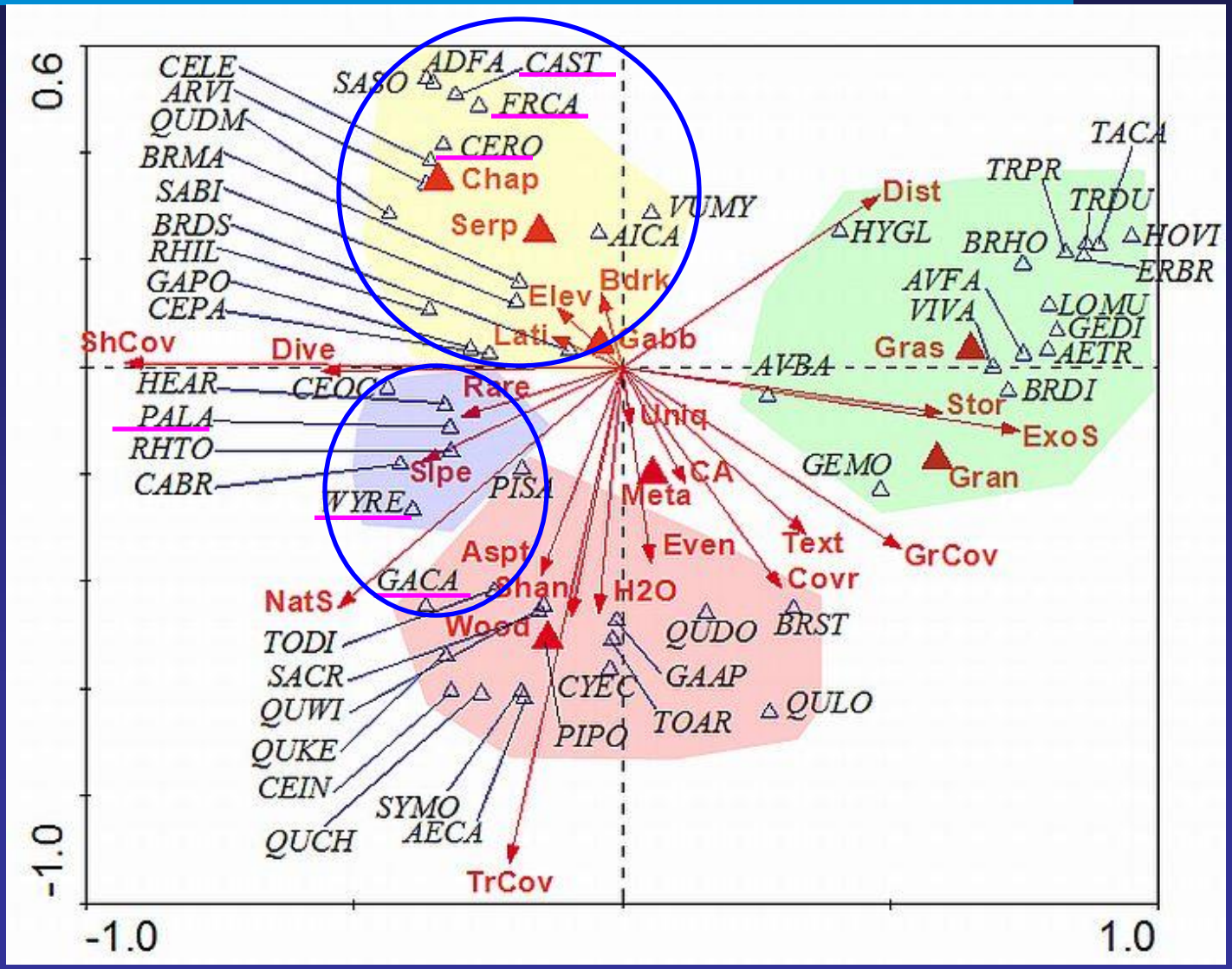


Oak Woodlands



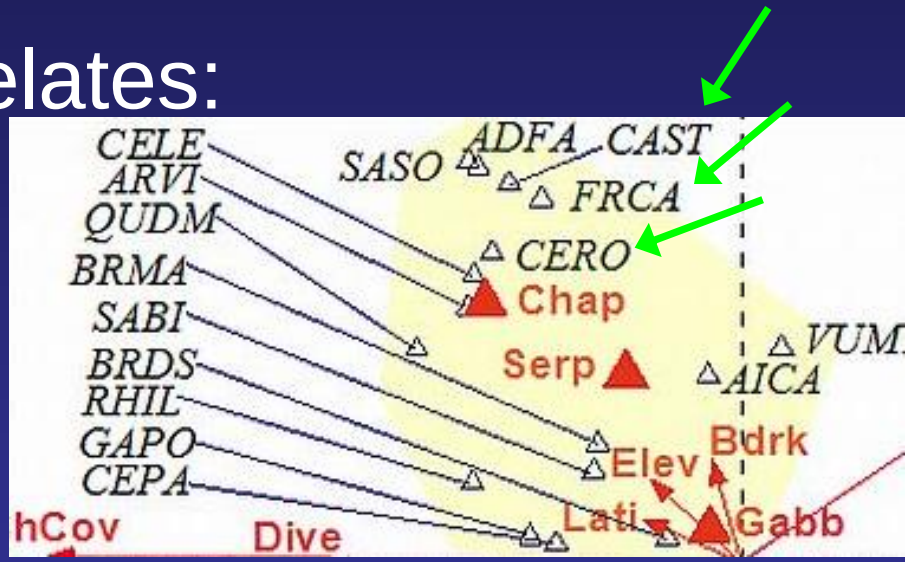
- 219 species; 76% native; 28% of PH area

Wilson et al – Results - CANOCO



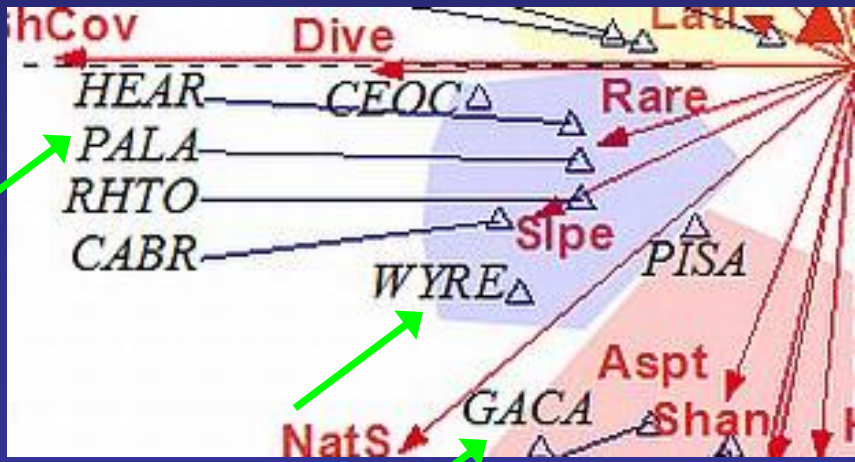
Wilson Study – Results - CANOCO

- Chaparral I – Chamise, Manzanita Dominants
  - Environmental correlates:
    - Biotic
      - Shrub Cover
      - Diversity
    - Abiotic
      - South-facing slopes
      - Deeper soil
      - Gabbro and Serpentine parent rock



Wilson Study – Results - CANOCO

- Chaparral II –
  - Toyon, Redbud, Coffeeberry > 3% cover
    - Melanie Gogol-Prokurate
  - Environmental correlates:
    - Biotic
      - Shrub Cover
      - Diversity
      - Rare species
    - Abiotic
      - Non-South-facing slopes
      - Steep slopes



Chaparral

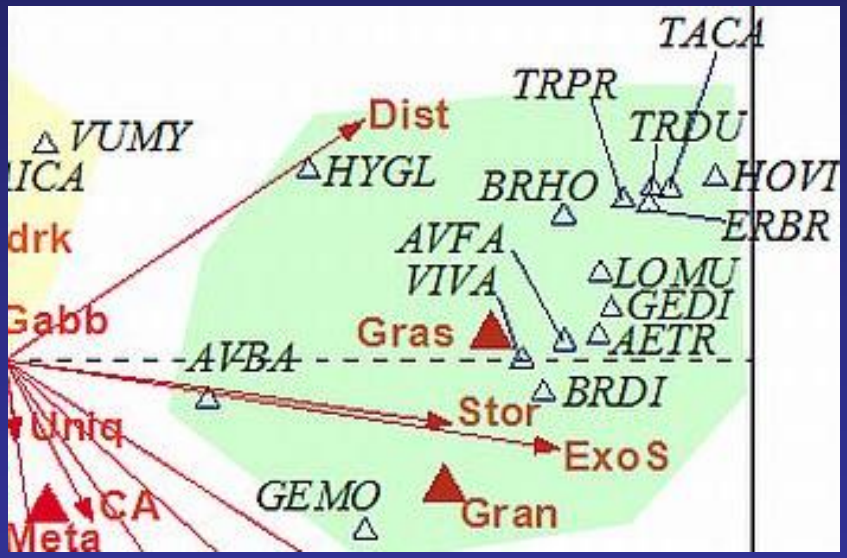
North –west facing slope

South-west facing slope

- 190 species, 75% native; 45% of PH area

Wilson Study – Results - CANOCO

- **Grassland – Exotic grasses/forbs dominate**
  - Environmental correlates:
    - Biotic
      - Exotic species
      - Low Diversity
      - Rare species absent
    - Abiotic
      - High Storie index
      - High disturbance
      - Granite parent rock



Grassland

149 species; 36% native species; 27% of PH area; dominated by exotic annual grasses

Chaparral

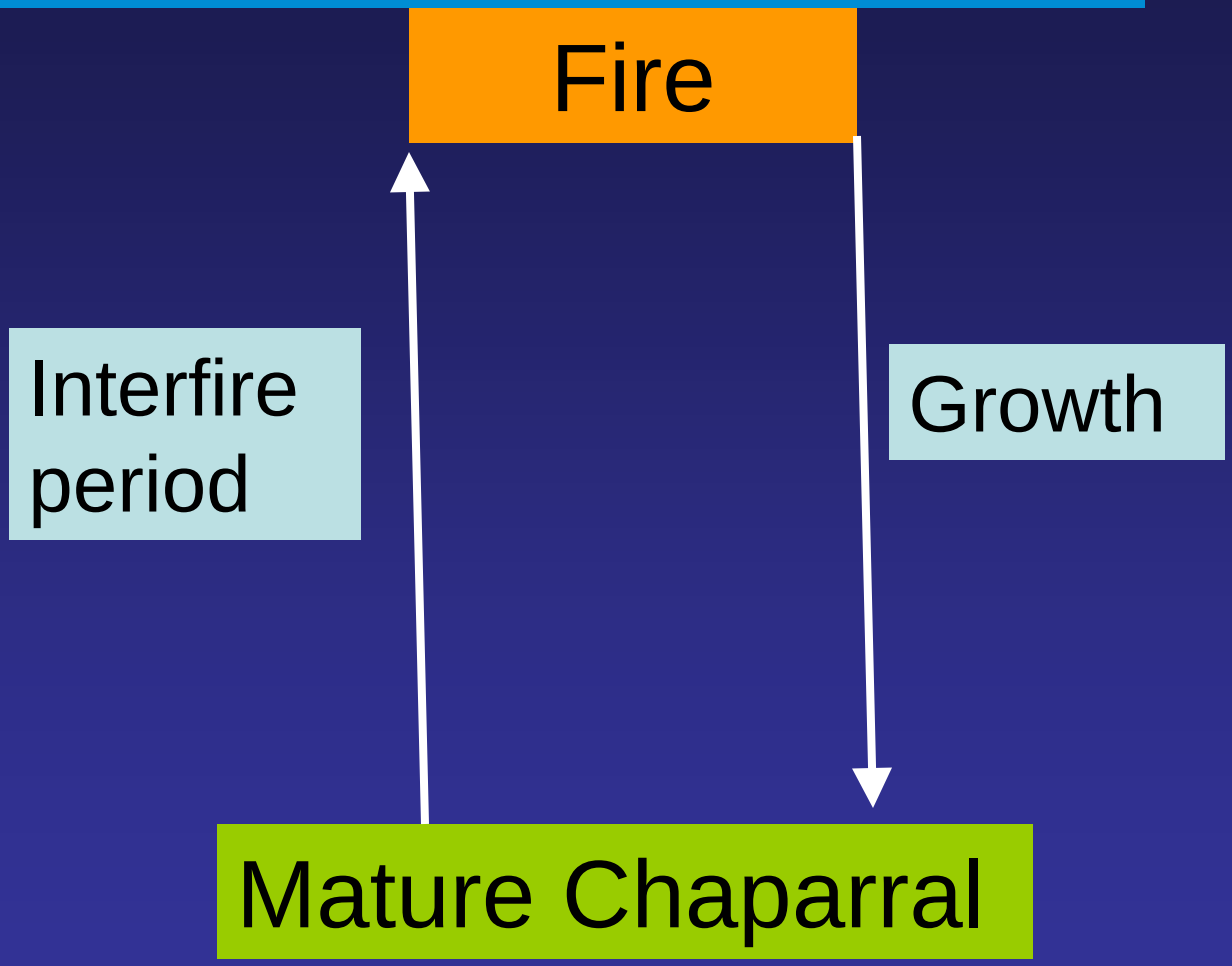
- Shrub-dominated vegetation
- Controversial vegetation type
- Rare species occur as understory species
- Manzanita (ARVI)

Chamise (ADFA)

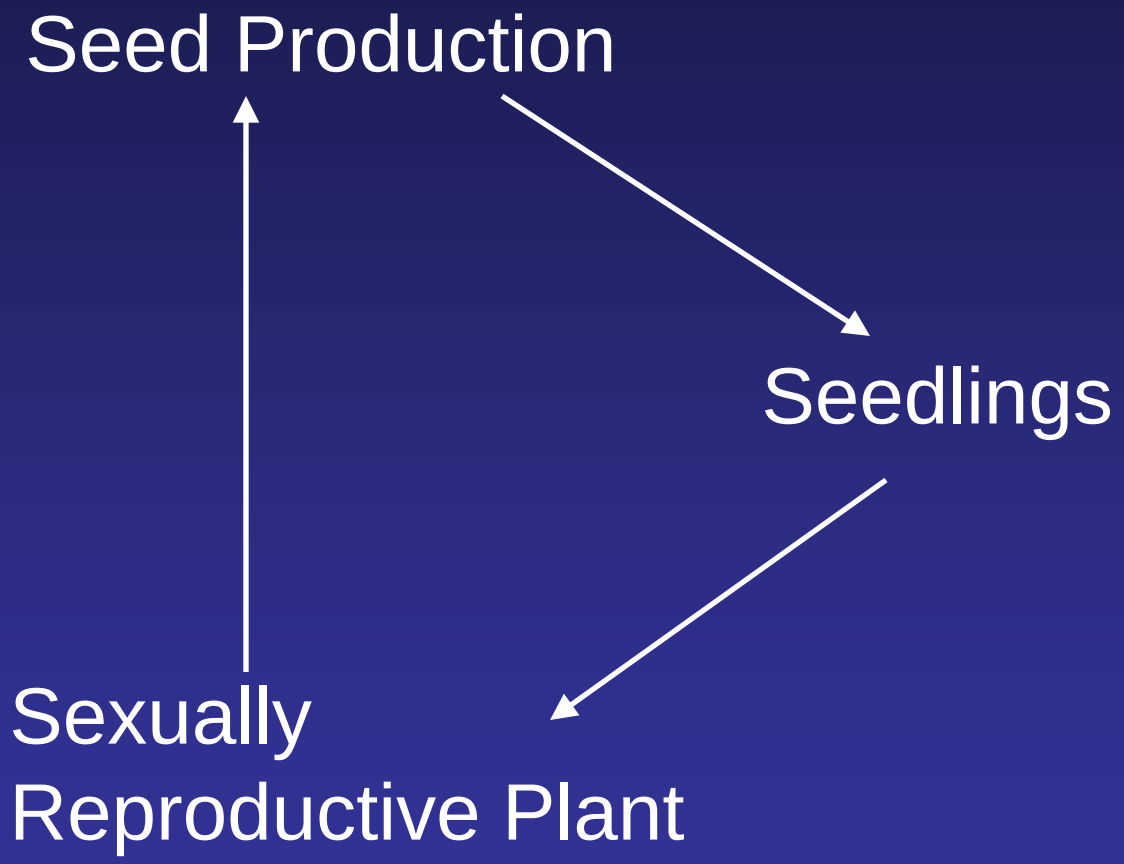
Chaparral

- Fire re-starts plant succession
- Patches in different stages of recovery contain different species = temporal diversity

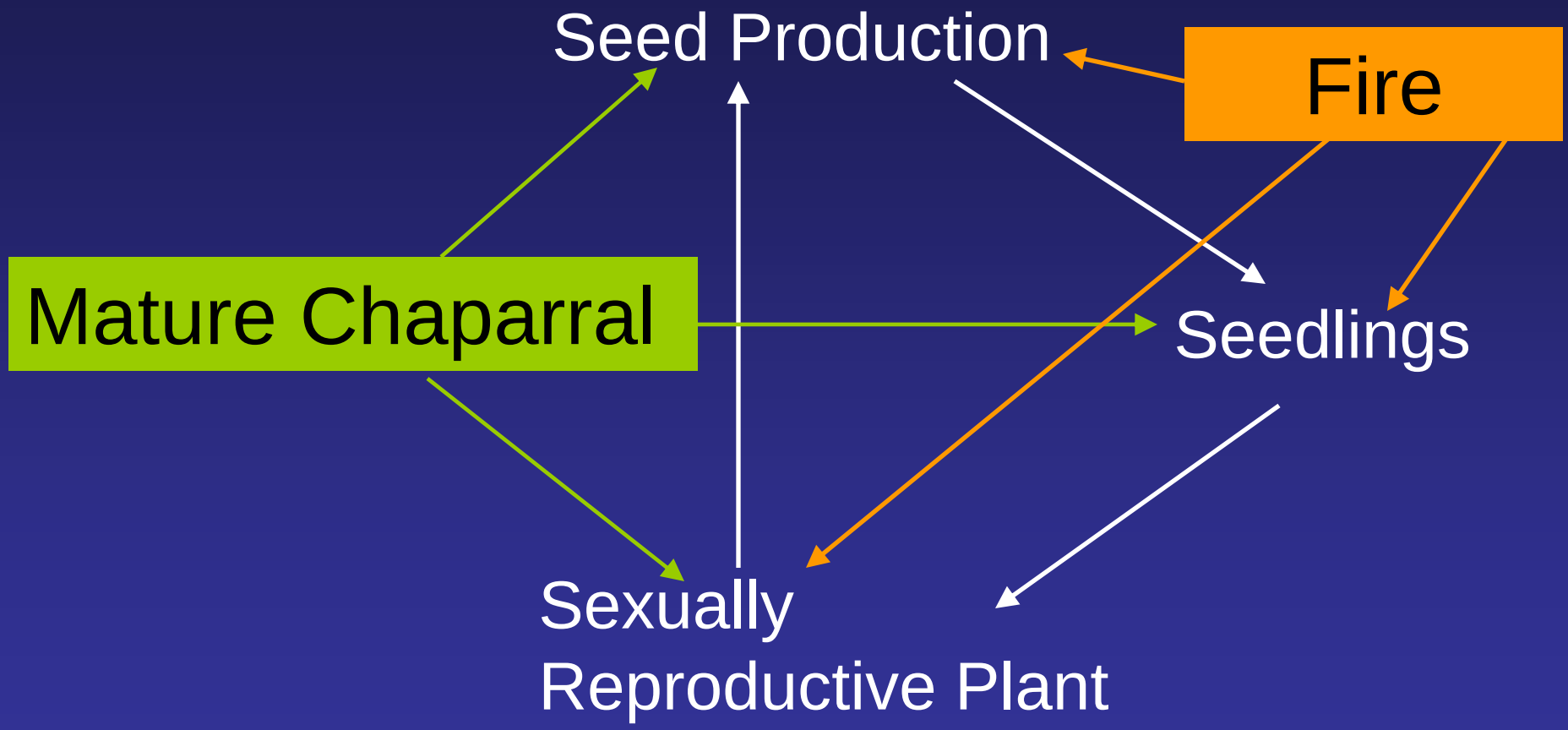
FIRE DYNAMICS



PLANT DYNAMICS



PLANT- FIRE DYNAMICS



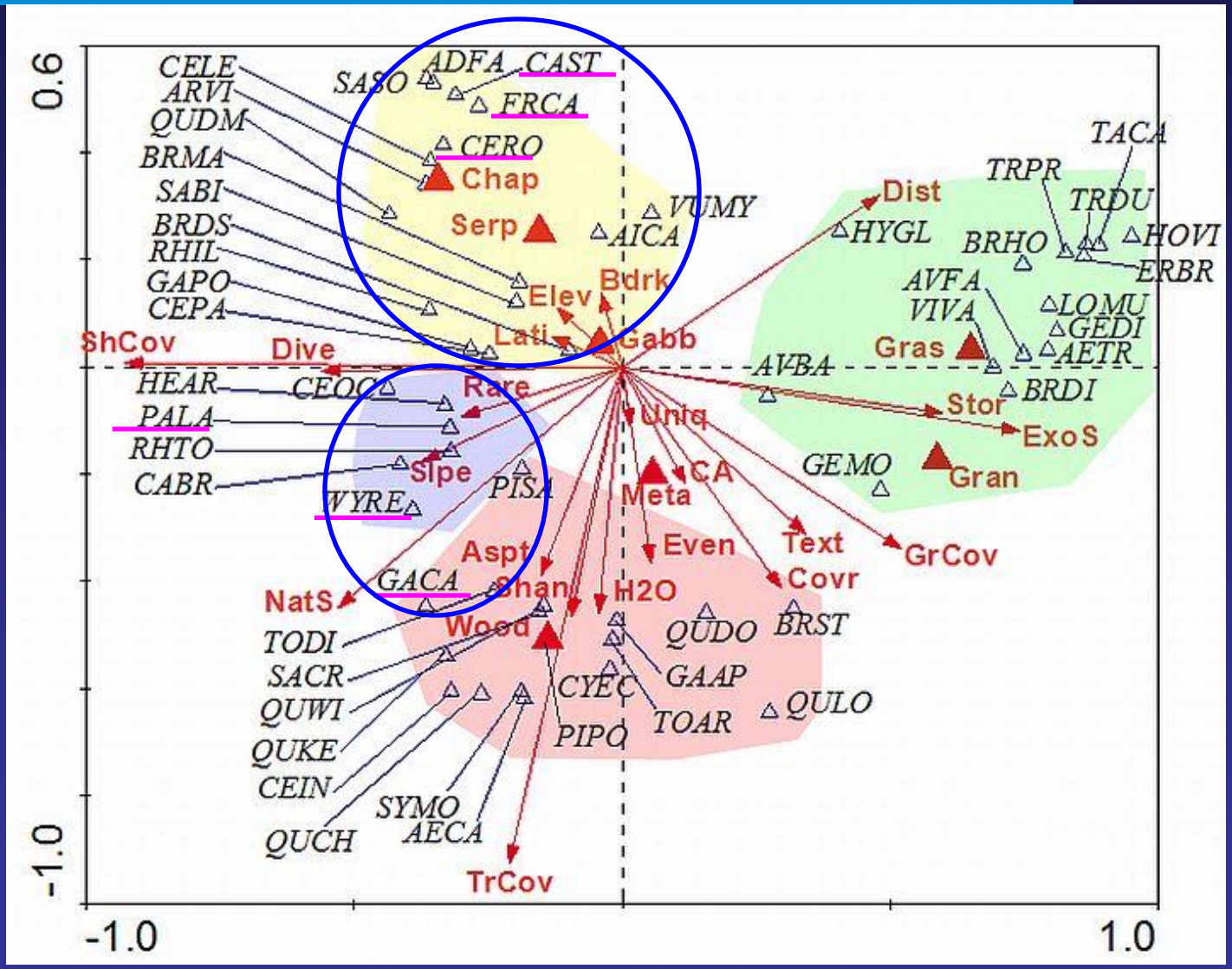
Chaparral

- Plants have different strategies to cope with fire

Resprouters arise from below-ground roots, rhizomes, corms

Seeders germinate from fire-cued seeds buried in the soil

Wilson et al – Results - CANOCO



Chaparral – Two sub-types

North –west facing slope

- Mesic – resprouting species

South-west facing slope

- Xeric – reseeding species

Chaparral – Two sub-types

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Chaparral – Two sub-types



North –west facing slope

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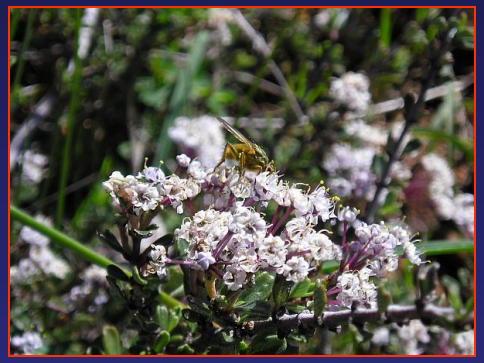


South-west facing slope

- Xeric – reseeding species

Wilson et al Paper – Conclusions

High plant diversity due to:

- 3 main vegetation types; 2 subtypes of chaparral
- variable soils
- variable topography
- temporal variation in disturbance (i.e. fire)

Wilson et al Paper – Conclusions

High plant diversity due to:

- rich weed flora (>150 plants)
- high endemism (on both gabbro and serpentine derived soils)

Conservation of Pine Hill

- T &E plants were the drivers due to the ESA
- Strategy: establish preserves throughout the gabbro island to protect listed species
- Goal: management of preserves to protect the rare species and ensure the ecological functioning of the preserves

Conservation of Pine Hill

Both types of chaparral must be preserved

- Common species such as Redbud, Coffee Berry, and Toyon can be used as indicators of appropriate habitat for the rare Mule's Ears, Layne's Butterweed and Bedstraw
- Dominance by Manzanita and Chamise can be used as indicators of appropriate habitat for the rare Ceanothus, Morning Glory, and Flannel Bush

Conservation of Pine Hill

- Management for the listed species can differ based on the chaparral type where it occurs
  - Prescribed burning for Chaparral I species since seeds require fire to germinate BUT…

Conservation of Pine Hill

- A second fire will kill seedlings and juveniles eliminating the species from the site as the seed bank was exhausted from the first fire
- Short interval fires must be avoided

Conservation of Pine Hill

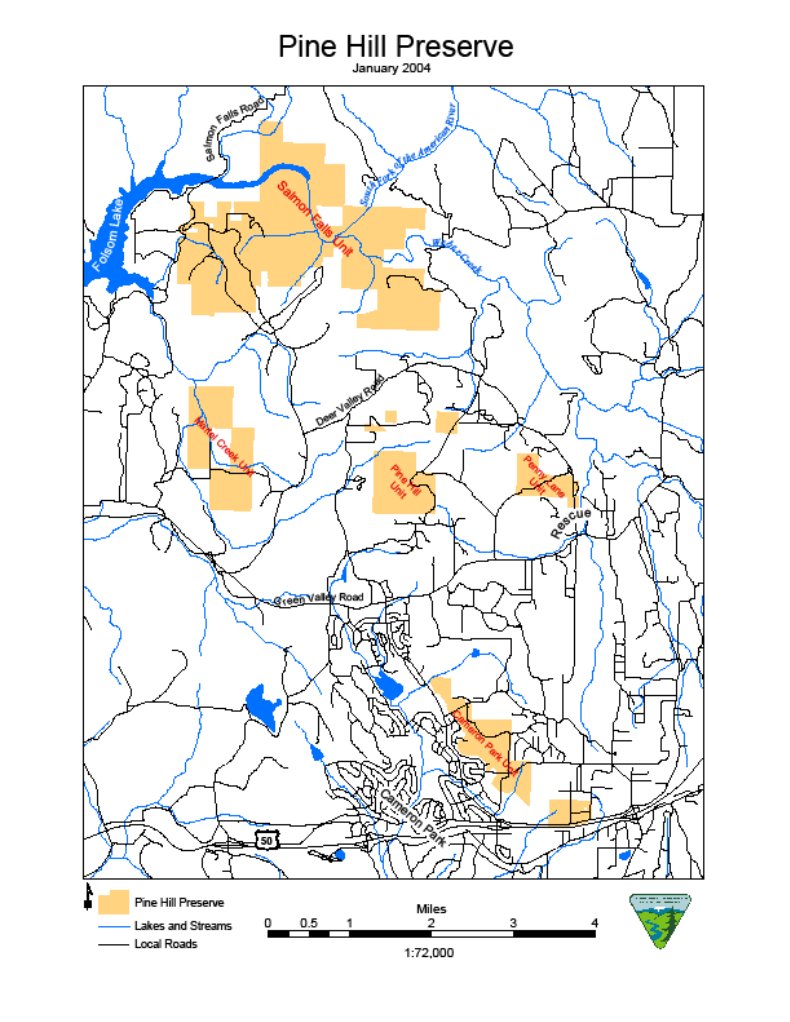
- Short interval fires occur when exotic annual grasses provide fuel and humans or lightening provide ignition
  - Over sowing the burned area with annual grasses must be avoided
  - Bare zones around preserves near roads will help prevent ignition
- Long interval fires (+50 years) may be OK

Conservation of Pine Hill

- Management for the listed species can differ based on the chaparral type where it occurs
  - Canopy removal via grading is an option for Chaparral II since plants re-sprout in response to canopy opening
  - Research is needed to determine how the whole community responds, not just the re-sprouters

Conservation of Pine Hill

- Establish preserves
- Manage preserves
- Increase public awareness of the uniqueness of Pine Hill



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http://www.blm.gov/ca/st/en/fo/folsom/pinehillpreserve.html

http://www.pinehillpreserve.org/