Rings around the posies: Updates on the classification of vernal pool vegetation

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California Native Plant Society
OBJECTIVES

• Discuss fine-scale vegetation classification
• Review indicator species in vernal pools
• Highlight applications to conservation and restoration
Are California’s vernal pools unique?

- Abiotically -- **NO**
- Floristically -- **YES**

1. The California Floristic Province is only region that has evolved an extensive flora endemic to vernal pools

2. Over 100 species are completely restricted to CA vernal pools
Vernal pool series

- Northern basalt flow vernal pools
- Northern claypan vernal pools
- Northern hardpan vernal pools
- Northern volcanic ashflow vernal pools
- Northern volcanic mudflow vernal pools
- San Diego mesa vernal pools
- San Jacinto Valley vernal pools
- Santa Rosa Plateau vernal pools
17 Vernal Pool Regions

California Vernal Pool Assessment Preliminary Report

Map showing species, communities, and complexes within one vernal pool region.
Four separate pools within just one vernal pool complex!
(Arena Plains, Merced Co.)
Fine-scale classification of vernal pool vegetation

- 5+ years of field work/data
- > 3000 plots across CA
- collected vegetation and environmental variables
Zonation of vegetation within vernal pools
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<th>Vegetation type</th>
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Table from Barbour et al. Madrono article 2003 -

**CLASS:** Downingio bicornuta-Lasthenieten fremontii

**ORDERS**
DCA Ordination

(14% of taxa shared among all 3 regions)
Endemic vernal pool genera

Navarretia (8 species)

Lasthenia (8 species)

Psilocarphus (4 species)

Plagiobothrys (13 species)

Limnanthes (5 species)

Pogogyne (5+ species)
Speciation of the genus *Downingia*  
*(6 of the 13 species are shown here)*
Listed Vernal Pool Plants

- Navarretia myersii
- Astragalus tener var. tener
- Juncus leiospermus ssp. leiospermus
- Legenere limosa
- Navarretia heterandra
- Hespervax caulescens
Conclusions of fine scale classification

- Vernal pool community types repeat across the landscape and some are localized to specific regions.

- Listed plant species are tightly associated with certain communities.

~ 50 communities in CA
MCV Classification

- **Alliance**
  The basic unit of floristic classification, usually named by the dominant and characteristic plant species in the uppermost layer of vegetation

- **Association**
  The smallest fundamental unit of classification, typically includes species from other strata
Lasthenia fremontii - Downingia (bicornuta) Herbaceous Alliance
Fremont’s goldfields - Downingia vernal pools

Characteristic Species
Downingia spp. and/or Lasthenia fremontii are characteristically present in the herbaceous layer with Castilleja campestris, Cuscuta howelliana, Eryngium castrense, Eryngium vaseyi, Gratiola ebracteata, Lilaeasclioides, Linnanthes douglasii, Plagiobothrys stipitatus var. micranthus, Plagiobothrys undulatus, Psilocarphus brevissimus var. brevissimus and Ranunculus bonariensis var. trisepalus. Other common species include Briza minor, Bromus hordeaceus, Centromadia itchii, Croton setigerus, Eriodictyon spp., Hordeum spp., Hypochaeris glabra, Leontodon saxatilis, Lomelosserene or Lythrum hyssopifolia.

Vegetation Layers
Herbs < 60 cm, cover is intermittent to continuous.

Membership Rules
- Castilleja campestris ssp. campestris, Downingia bicornuta, Gratiola ebracteata, Lasthenia fremontii, and/or Ranunculus bonariensis var. trisepalus present and abundant collectively or in part with upland species, or Eryngium castrense. E. vaseyi, Plagiobothrys stipitatus var. micranthus, and/or Psilocarphus brevissimus var. brevissimus present and abundant; or Downingia cuspidata, D. bicornuta, and/or D. ornatissima present in the herbaceous layer (Barbour et al. 2007).

Habitats
Shallow vernal pool bottoms and edges, mostly hardpan pools on older geomorphic surfaces but also on

USDA Ecological Section Map

Summary Information
- Primary Life Form: Herb
- Elevation: 15-710 m
- State Rarity: S3
Manual of California Vegetation Online

http://vegetation.cnps.org/

Habitats
Shallow vernal pool bottoms and edges, mostly hardpan pools on older geomorphic surfaces but also on volcanic substrates. Soils have short periods of inundation. The USFWS Wetland Inventory (1996 national list) recognizes Lasthenia fremontii, Downingia bicornuta, and other Downingia as OBL plants.

Other Habitat, Alliance and Community Groupings
MCV (1995): Northern hardpan vernal pool habitat, Northern volcanic mudflow vernal pool habitat
NVCS (2009): North Pacific hardpan vernal pool, Northern California volcanic vernal pool
Calveg: Annual grasses and forbs, Vernal pool
Holland: Northern hardpan vernal pool
Munz: Valley grassland
WHR: Annual grassland
CDFW CA Code: 42 007 00

National Vegetation Classification Hierarchy
Formation Class: Mesomorphic Shrub and Herb Vegetation (Shrubland and Grassland)
Formation Subclass: Temperate and Boreal Shrubland and Grassland
Formation: Temperate and Boreal Freshwater Marsh
Division: Western North American Freshwater Marsh
Macro Group: Western North America Vernal Pool
Group: Californian mixed annual/perennial freshwater vernal pool / swale bottomland

Summary Information
- Primary Life Form: Herb
- Elevation: 15-710 m
- State Rarity: S3
- Global Rarity: G3
- Distribution: CAN: BC, USA: CA, OR, WA (NatureServe)
- Endemic to California: No
- Endemic to California Floristic Province and Deserts: No
- Date Added: 2009/09/01

Related Links
Macro Group: Western North America Vernal Pool
Group: Californian mixed annual/perennial freshwater vernal pool / swale bottomland

Remarks  (more)

Life History Traits of the Principal Species  (more)

Fire Characteristics  (more)

Regional Status  (more)

Management Considerations  (more)

Associations  (hide)
- Downingia bicornuta [4]
- Downingia (bicornuta, cuspidata) [1], [3]
- Eryngium (vaseyi, castrense) [1], [3]
- Lasthenia californica - Downingia bicornuta [5]
- Lasthenia fremontii [3]
- Lasthenia fremontii - Downingia bicornuta [1], [2], [5]
- Lasthenia fremontii - Downingia ornatissima [1], [3]
- Ranunculus bonariensis - Holocarpha virgata [1]

References  (more)

Related Links
- Feedback
- How to read alliance descriptions
- Full bibliography
Vegetation of long-inundated pools
Lasthenia glaberrima alliance
Eleocharis (acicularis, macrostachya) alliance

Vegetation in shallower pools
Lasthenia fremontii – Downingia (bicornuta) alliance
Centromadia (pungens) alliance
Deinandra fasciculata alliance
Layia fremontii – Achyrachaena mollis alliance
Montia fontana – Sidalcea calycosa alliance
Trifolium variegatum alliance

Vegetation of alkaline/saline pools
Cressa truxillensis – Distichlis spicata
Frankenia salina alliance
Lasthenia fremontii – Distichlis spicata alliance
Keying out vernal pools

IIA2a.ii. Downingia ornatissima is characteristic with other herbs including Alopecurus saccatus, Deschampsia danthonioides, and Pliagiobothry sspitatus. Other species present may include natives Lasthenia fremontii, Navarretia laevocephala, Eryngium castrense, and Blennosperma ranum. Found in northeastern and northwestern Sacramento Valley regions on northern hardpan and volcanic mudflow vernal pools...

**Lasthenia fremontii – Downingia ornatissima Herbaceous Association**

IIA2a.iii. Downingia bicornuta and/or Downingia cuspidata are present with characteristic species Psilocarphus brevissimus, Deschampsia danthonioides, and Eryngium castrense. Gratiola ebracteata and Lasthenia fremontii are either absent or insignificant. Found in the northeastern Sacramento Valley region in volcanic vernal pools including high terrace and mudflows...

**Downingia ( bicornuta, cuspidata) Herbaceous Association**

IIA2a.iv. Downingia insignis is characteristically present along with other vernal pool species such as Lasthenia fremontii, Deschampsia danthonioides, and Eryngium vaseyi. Stands are found in the northern Solano- Colusa vernal pool region

**Downingia insignis – Psilocarphus brevissimus Herbaceous Association**

IIA2a.v. Downingia ornatissima, D. cuspidata, D. bicornuta, and Lasthenia fremontii are absent or insignificant in the herbaceous layer. Eryngium vaseyi, E. castrense, Pliagiobothry sspitatus var. bicolor, and Psilocarphus brevissimus are present and abundant with other vernal pool taxa. Found in vernal pools with deeper or longer inundation, hardpan pools, and volcanic mudflows in the northeastern and northwestern Sacramento Valley as well as central and northeastern San Joaquin Valley regions...

**Eryngium (vaseyi, castrense) Herbaceous Association**

IIA2a.vi. Lasthenia fremontii is constant and conspicuous while species of Downingia are absent or insignificant. Lolium perenne, Deschampsia danthonioides, Alopecurus saccatus, Achyrachaena mollis, and Navarretia spp. are characteristic...

**Lasthenia fremontii Herbaceous Association (Provisional)**

IIA2.b. Hemizonia congesta ssp. tuzilitolia, Lasthenia glabrata, Lepidium latipes var. latipes, Lupinus bicolor, Medicago polymorpha, and Trifolium wildenowii are characteristic species in the herbaceous layer. Other common non-native species include Bromus hordeaceus, Lolium perenne and Medicago polymorpha. See Barbour et al. 2007 for full alliance description...

**Hemizonia congesta Herbaceous Association (Provisional) of the Eryngium aristulatum Herbaceous Alliance**

IIA2.c. Montia fontana and/or Sidalcea calycosa is characteristic present along with other vernal pool species such as Lasthenia fremontii, Limnanthes alba, Pliagiobothry spp., and Trifolium spp. ...

**Montia fontana – Sidalcea calycosa Herbaceous Association of the Montia fontana – Sidalcea calycosa Herbaceous Alliance**

IIA2.d. Crotalaria coronopifolia, Cressa truxillensis, Crlypsi schoenodes, Distichlis spicata, Frankenia salina, Triphysaria spp., and Myosurus minimus present along with diagnostic vernal pool plants including Downingia insignis, D. pulchella, Lasthenia fremontii, and Psilocarphus brevissimus. Found in alkaline or saline vernal pools...

**Lasthenia fremontii – Distichlis spicata Herbaceous Alliance**

IIA2.d.i. Cressa truxillensis is characteristically present and usually abundant, and Downingia pulchella is also present and often abundant...

**Downingia pulchella – Cressa truxillensis Herbaceous Association**
Publications/Reports:


Classification, ecological characterization, and presence of listed plant taxa of vernal pool associations in California. UC Davis. 2007. Final report submitted to the U.S. Fish and Wildlife Service

Great Valley

Indicator species

- Eryngium castrense
- Eryngium vaseyi vallicola
- Eryngium aristulatum aristulatum
- Downingia bicornuta picta
- Navarretia leucocephala leucocephala
- Plagiobothrys stipitatus micranthus

- Pogogyne zizyphoroides
- Pogogyne douglasii
- Hemizonia fitchii
- Hemizonia pungens
- Lasthenia fremontii
- Castilleja campestris
Modoc and Sierra Valley

Indicator species

- *Eryngium alismifolium*
- *Plagiobothrys cusickii*
- *Plagiobothrys mollis*
- *Navarretia leucocephala minima*
- *Downingia bacigalupii*
- *Marsilea oligospora*

- *Porterella carnosula*
- *Muhlenbergia richardsonii*
- *Polygonum polygaloides*
North and Central Coast

Indicator species

- Eryngium armatum
- Eryngium aristulatum aristulatum
- Eryngium vaseyi vaseyi
- Plagiobothrys bracteatus
- Plagiobothrys chorisianus hickmanii
- Navarretia leucocephala bakeri
- Navarretia leucocephala plieantha
- Navarretia leucocephala pauciflora
- Ranunculus pusillus
- Lasthenia conjugens
- Lasthenia burkei
- Blennosperma bakeri
Southern California

Indicator species
- *Eryngium aristulatum parishii*
- *Deinandra fasciculata*
- *Navarretia fossalis*
- *Navarretia hamata leptantha*
- *Pogogyne abramsii*
- *Pogogyne nudiuscula*
Application:
Which communities are rare, which are common?
How many reserves and where?
Which communities are protected, which are not?
Application:

Improve criteria restoration success

• community diversity
• reference pools
• focus on diagnostic species

Fresno Table Mountain

San Diego County

Herbert Preserve
Next Steps…

- Publish results of regional vernal pool vegetation classification (coast, so. cal, Modoc).
- Use vernal pool locations/vegetation to highlight Important Plant Areas (IPA’s) for conservation planning.
- Tie wildlife habitat relationships to vernal pool floristics
- Monitor and understand change over time
- Continue outreach and education
Special Thanks to:

• Dr. Michael Barbour and Valerie Whitworth
• Vernal Pool Team
  – Ayzik Solomeshch
  – Bob Holland
  – Carol Witham
  – Rod Macdonald

• Collaborators:
  – California Native Plant Society – state staff and chapter volunteers
  – Department of Fish and Wildlife – Biogeographic Data Branch, Wildlife Conservation Board
  – Federal Agencies – BLM, BOR, DOD, EPA, NPS, USFS, USFWS, USGS
  – Other State Agencies – CDF, CalTrans, DWR, State Parks, UC
  – Other Agencies and Organizations – County Parks, City governments, Land conservancies, Packard Foundation, TNC