

Ecological site group R017XY902CAESG

Duripan Vernal Pools

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Key Characteristics

- Landform Not As Above
- Mound and Swale Landscape Over Duripan

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

Physiography

This site historically occurred on the terraces of all major alluvial fans in the Central Valley. These ancient surfaces developed cemented duripans, or impervious claypans through pedogenic processes, which produce a perched water table that creates seasonal ponding at low lying positions following heavy rain. The season nature of these wetland sites defines them as vernal pools.

Climate

The average annual precipitation is 5 to 12 inches (125 to 305 millimeters) in the San Joaquin Valley. The Tulare Basin, at the southern end of this MLRA, typically receives less than 6 inches (150 millimeters) of rainfall per year. The average annual precipitation is 12 to 30 inches (305 to 760 millimeters) in most of the Sacramento Valley. It is 40 inches (1,015 millimeters) at the higher elevations on the edges of the valley at the north end. Summers are long, hot, and dry, and winters are cool and rainy. Most of the rainfall occurs as low- or moderate intensity, Pacific frontal storms from October to May. Snow is very rare in this MLRA but has occurred in the Sacramento Valley from Sacramento to points farther north. The average annual temperature is 59 to 67 degrees F (15 to 20 degrees C), decreasing from south to north. The freeze-free period averages 325 days and ranges from 280 to 365 days, decreasing in length with elevation and from south to north.

Soil features

This ecological site is associated with soils mapped extensively across the MLRA, including the San Joaquin, Redding and Corning series. Multiple site specific soil properties, most significantly depth to duripan, have been shown play a role in the level of diversity and community composition at the site. (Holland and Dain, 1990)

Holland and Dain: The Edaphic Factor in Vernal Pool Vegetation, 1990

Vegetation dynamics

Vernal pools and their associated upland are one of the MLRA's most iconic vegetation communities, and a hotspot of biodiversity. The species composition varies from year to year even at the alliance level because the species are annual and germinate in response to specific water depth and temperature factors, which fluctuate in response to amount and timing of rainfall (Sawyer et. al., 2009). Some common plant alliances at these wetland sites are *Lasthenia fremontii*- *Downingia Lasthenia glaberrima*, and *Leyia fremontii*, (Sawyer et. al., 2009) the upland sites are believed to have historically been dominated by perennial bunch grasses but are currently occupied principally by California annual grass communities.

These wetland sites are critical habitat for threatened fairy shrimp species and are currently protected by federal

regulation. The uplands are home to a great diversity of ground nesting bees many of which are the only pollinator species of specific vernal pool plants (Thorp and Leong, 1998). Historically this mound swale complex may have occupied up to 25% of MLRA 17, but it has largely been converted to agriculture or residential developments. A 2012 inventory of vernal pool habitat found only 765,000 acres remain, which is roughly 0.5%.

Invasive species and introduced annual grasses have crossed a threshold at the majority of sites. Though they invasive principally occupy the upland sites they have been shown to impact the hydrology of the swales and pools by decreasing the length of ponding (Faist and Beal, 2017) They may also occupy the swale sites during dry years leaving behind thatch which can reduce the success of wetland forbs in future years (Pollak and Kan, 1998) There are also invasive species that occupy the wetland sites such as waxy manna grass. Both grazing and prescribed fire have been shown to increase native plant abundance with appropriate timing and intensity (Pollak 1992).

Because the site must have both a wet period and a dry period annually it is susceptible to multiple causes of conversion. Land leveling removes pools, deep ripping or other activities that fracture the duripan remove the perched water table causing conversion to a grassland site and summer runoff from adjacent agricultural land is able to convert the site to a freshwater marsh (Witham et. al., 2014).

Restoration efforts generally have involved artificially recreating the perched water table and mound swale topography then reintroducing native species. These efforts have shown varying degrees of success (Moore et. al., 2003).

References/Citations:

Faist, A. M., & Beals, S. C. 2018. Invasive plant feedbacks promote alternative states in California vernal pools. *Restoration Ecology*, 26(2), 255-263.

Keeler-Wolf, T., J.O. Sawyer, and J. Evans. 2009. *A Manual of California Vegetation*. Edition, 2. California Native Plant Society Press.

Moore, C., Bastian, M., & Hunt, H. 2003. Long term evaluation of characteristics in an artificial Northern California vernal pool system (No. FHWA/CA/TL-2002/24). California. Dept. of Transportation.

Pollak, O., & Kan, T. 1998. The use of prescribed fire to control invasive exotic weeds at Jepson Prairie Preserve. In *Ecology, Conservation, and Management of Vernal Pool Ecosystems—Proceedings from a 1996 Conference*. California Native Plant Society, Sacramento, CA: 241-249.

Thorp, R. W., & Leong, J. M. 1995. Determining effective mitigation techniques for vernal pool wetlands: Effect of host-specific pollinators on vernal pool plants (No. FHWA/CA/TL-96/24).

Witham, C. W., Holland, R. F., & Vollmar, J. E. 2014. Changes in the distribution of great valley vernal pool habitats from 2005 to 2012 Sacramento, CA: Report Prepared for the US Fish and Wildlife Service and Bureau of Reclamation CVPIA Habitat Restoration Program under Grant Agreement No. F11AP00169 with the USFWS. [Google Scholar].

Major Land Resource Area

MLRA 017X

Sacramento and San Joaquin Valleys

Subclasses

- R017XD001CA—CLAYEY
- R017XD045CA—LOAMY
- R017XD047CA—LOAMY CLAYPAN
- R017XD079CA—CLAYPAN TERRACE
- R017XD081CA—LOAM STREAM TERRACE
- R017XD084CA—STONY CLAY
- R017XD090CA—GRAVELLY LOAMY

- R017XD091CA–GRAVELLY LOAMY INTERMOUND
- R017XD093CA–CLAYPAN
- R017XE100CA–GRAVELLY LOAMY
- R017XE104CA–LOAMY CLAYPAN
- R017XE105CA–GRAVELLY LOAMY CLAYPAN
- R017XE113CA–TERRACE 12-14"
- R017XE116CA–ALKALI HARDPAN
- R017XY902CA–Duripan Vernal Pools

Stage

Provisional

State and transition model

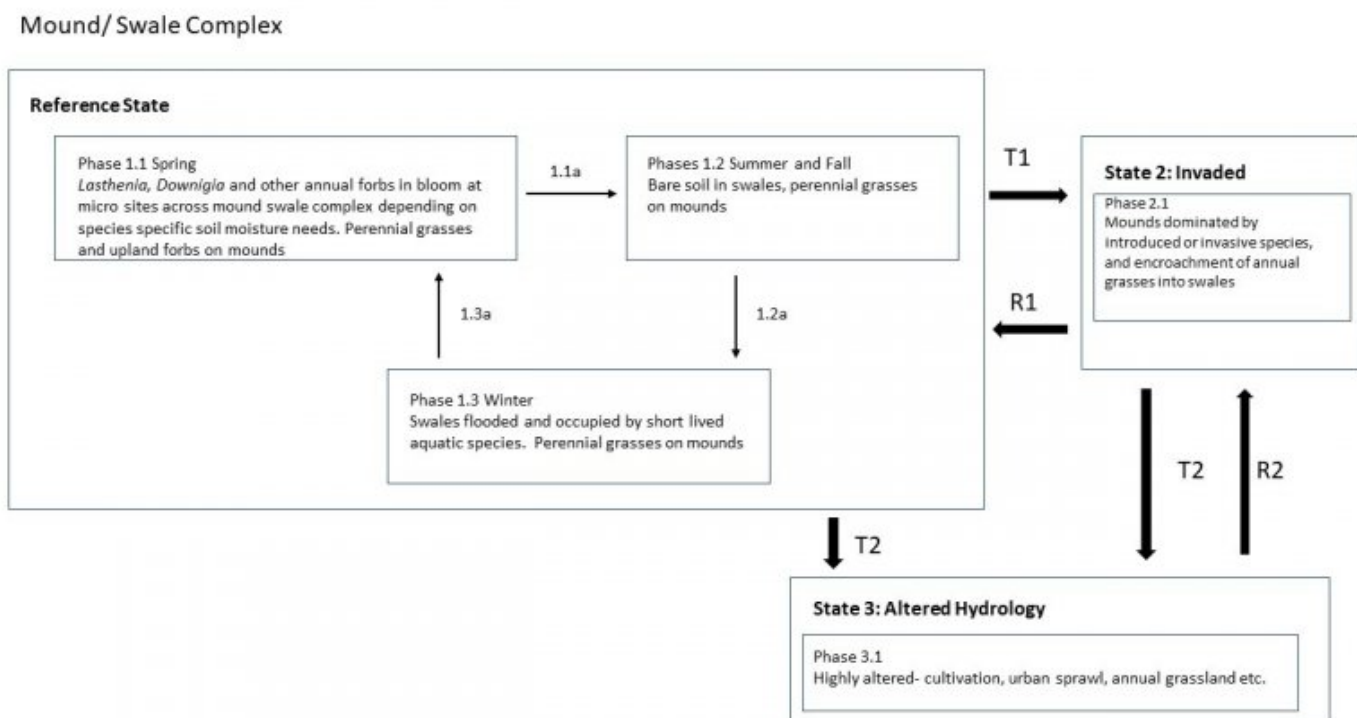


Figure . State and Transition Model diagram with three boxes connected by arrows.

STM Narrative

Reference Community

1.1a This community pathway takes place annually under natural conditions

1.2a This community pathway takes place annually given sufficient rainfall

1.3a. This community pathway takes place annually given sufficient rainfall

State 2: Invaded

Community 2.1 – This community phase represents all the varied expressions of the mound/swale sites where the uplands are dominated by non-native species.

State 3: Altered Hydrology

Community 3.1 - This community phase represents all the varied land uses that significantly alter this ecological site. This is an extremely varied community phase that includes all types of alterations that so significantly alter the ecological site that it is permanently changed and no longer has typical or even representative ecological dynamics.

Transitions

T1 This transition is caused by the introduction of invasive grasses and forbs which out compete native grasses for resources on upland sites, that force the ecological site over a threshold.

R1 This restoration pathway occurs only when significant time and money inputs are focused on removing introduced species and restoring the seedbank of native species. Grazing to low RDM levels and low intensity fire have been shown to reduce the cover of annual grasses and increase diversity, depending on timing, intensity and duration.

T2 This transition is caused by human practices or natural processes that disconnect the soil surface from the high water table, such as, land leveling, deep ripping and creek down cutting through the duripan.

R2 This restoration pathway occurs only when significant time and money inputs are focused on restoring the site hydrology and vegetation.

Figure 1. Text of the STM narrative

State 1 Reference State

Site is in reference condition with seasonal variation of native annual forbs.

Characteristics and indicators. Low-laying microsites across the landscape pond during the winter.

Community 1.1 Spring Plant Community

Lasthenia, Downigia and other annual forbs in bloom at micro sites across mound swale complex depending on species specific soil moisture needs. Perennial grasses and upland forbs on mounds

Community 1.2 Summer and Fall Community

Bare soil in swales, perennial grasses on mounds

Community 1.3 Winter Community

Swales flooded and occupied by short lived aquatic species. Perennial grasses on mounds

Pathway 1.1a Community 1.1 to 1.2

This community pathway takes place annually due to Mediterranean climate

Pathway 1.2a Community 1.2 to 1.3

This community pathway takes place annually given sufficient rainfall

Pathway 1.3a

Community 1.3 to 1.1

This community pathway takes place annually given sufficient rainfall

State 2

Invaded State.

Introduced species have suppressed native forbs.

Community 2.1

Invaded Community

Mounds dominated by introduced or invasive species with encroachment of annual grasses into swales.

State 3

Highly Altered State

Site characteristics have been substantially altered.

Community 3.1

Highly Altered

This community phase represents all the varied land uses that significantly alter this ecological site. This is an extremely varied community phase that includes all types of alterations that so significantly alter the ecological site that it is permanently changed and no longer has typical or even representative ecological dynamics.

Transition T1

State 1 to 2

This transition is caused by the introduction of invasive grasses and forbs, which out compete native grasses for resources on upland sites and force the ecological site over a threshold.

Transition T2

State 1 to 3

This transition is caused by human practices or natural processes that disconnect the soil surface from the high water table, such as, land leveling, deep ripping and creek down cutting through the duripan.

Restoration pathway R1

State 2 to 1

This restoration pathway occurs only when significant time and money inputs are focused on removing introduced species and restoring the seedbank of native species. Grazing to low RDM levels and low intensity fire have been shown to reduce the cover of annual grasses and increase diversity, depending on timing, intensity and duration.

Transition T2

State 2 to 3

This transition is caused by human practices or natural processes that disconnect the soil surface from the high water table, such as, land leveling, deep ripping and creek down cutting through the duripan.

Restoration pathway R2

State 3 to 2

This restoration pathway occurs only when significant time and money inputs are focused on restoring the site hydrology and vegetation.

Citations