An Ecological Framework for Reviewing Compensatory Mitigation:

Biotic Processes- Vernal Pool Case Study

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What is a Vernal Pool?

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Vernal Pool "Definition"

"Vernal pools are seasonally flooded landscape depressions where water ponds because of limitations to surface and subsurface drainage. Surface drainage is prevented by their depressed or concave topography. Subsurface drainage is inhibited by subsurface hardpan (duripan) or claypan soil layers or bedrock that impede the downward infiltration of water. Vernal pools support an endemic flora adapted to periodic or continuous inundation during the wet season and desiccation during the dry-season (i.e., summer and early fall)."

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- 17 vernal Pool Regions in California
- Greatest historic losses (by acreage) within the 6 regions surrounding the Central Valley

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Vernal Pool Abiotic Element - Soils

- Surface horizon often clay loam or clay
- Sub-surface impervious layer
  - Claypan
  - Hardpan
  - Bedrock
- Nutrient poor
- Chemistry ranges from acidic or alkaline

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Vernal Pool Abiotic Element - Hydrology

1. Initial Inundation Phase
   - Influx of water (rainfall), detrital based system, macrophytes not established

2. Undulating Inundation Phase
   - Water depths fluctuate based on rainfall and evapotranspiration ratios, aquatic phase of macrophytes established

3. Drying Phase
   - Filamentous algae dominates, low DO and high water temps, terrestrial phases of macrophytes are established

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Vernal Pool Abiotic Element - Hydrology

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Vernal Pool Biotic Element - Fauna

Vernal pool tadpole shrimp
> 30 days continuous inundation

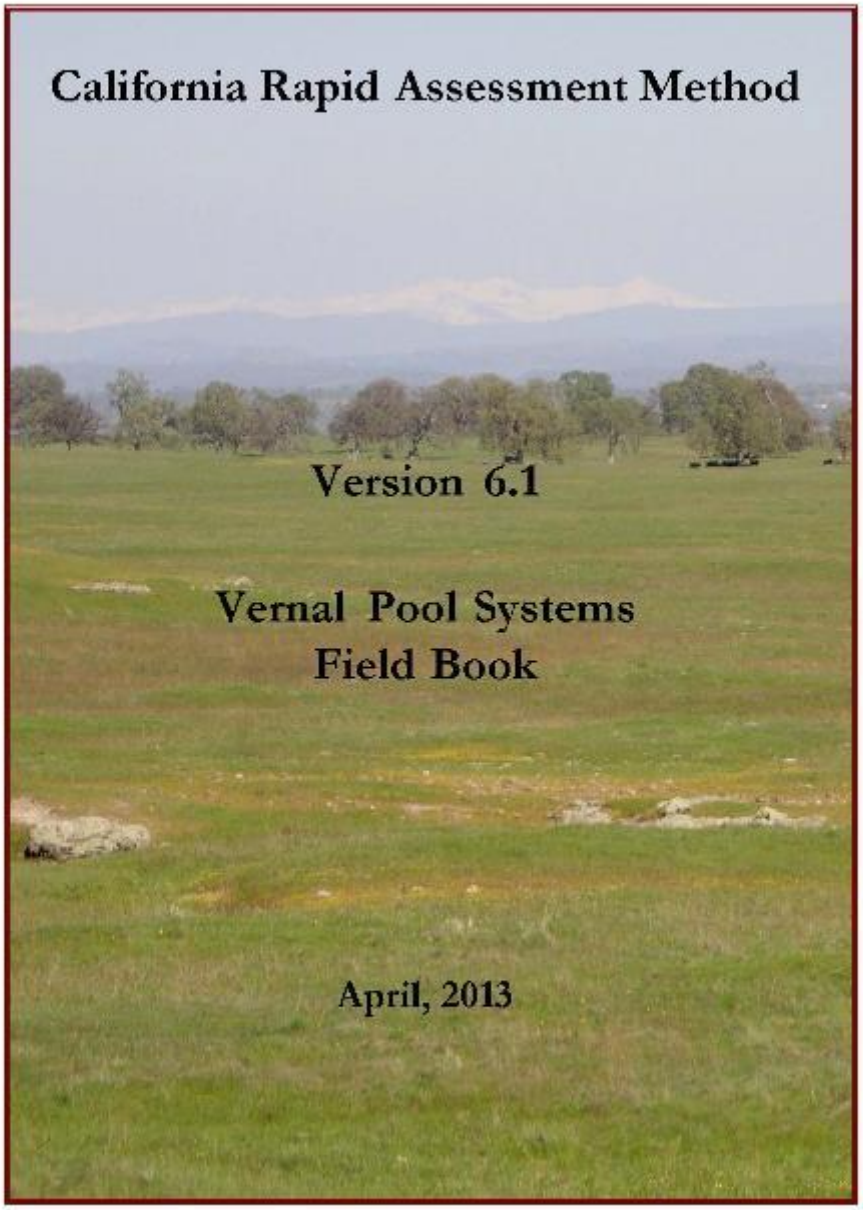
California tiger salamander larvae (>70 days continuous inundation, often turbid water)

Vernal Pool Biotic Element - Flora

- Highly specialized endemic flora
- >190 endemic species and subspecies
- Several endemic specialist native bee pollinators
- Floristic species composition largely driven by duration of inundation and soil chemistry

Vernal Pool Biotic Element - Flora

- Numerous vernal pool classification schemes developed
  - Landform based (i.e., terrace, basin-rim, basin, floodplain basin etc)
  - Soil restrictive layer based
  - Floristic (dominance) based
  - Plant community (phytoassociation) based
  - And many more


California Rapid Assessment Method
Version 6.1
Vernal Pool Systems
Field Book
April, 2013

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Vernal Pool Mitigation

Two components:

- Preservation- 2:1 or greater ratio
- Restoration or Creation- 1:1 or greater ratio, often 2:1
- Rehabilitation- it depends

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Vernal Pool Mitigation - Construction

- Must have appropriate soils
- **Total vernal pool wetted acreage cannot exceed 15% density across landscape**
- Excavate to create a depression
- Manage excavation to control thickness of soil over restrictive layers
- Manage depth of excavation in concert with outlet invert to manage water depth
- Inoculate with vernal pool species

- Cross your fingers

Van Vleck Ranch Mitigation Bank

Van Vleck, August 2009


Van Vleck, August 2009


Van Vleck, March 2017

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Vernal Pool - Performance Standards

- Measures of performance hotly debated for 25 years
- No "universal" set of performance standards
- "I'll know if it's a vernal pool when I see it"

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Vernal Pool - Performance Standards

- Flora: relative cover and richness of vernal pool endemic plant species within range of reference vernal pools
- Flora: relative cover of Non-native invasive species within range of reference vernal pools
- Hydrology: duration (and depth?) of inundation within range of reference vernal pools

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Vernal Pool - Monitoring and Performance Standards

Example performance standard:

"***The % RCNS and % RCVPIND of the mitigation vernal pool is at least 20%, or falls within the range of values for the Reference Pools, whichever is greater.***"

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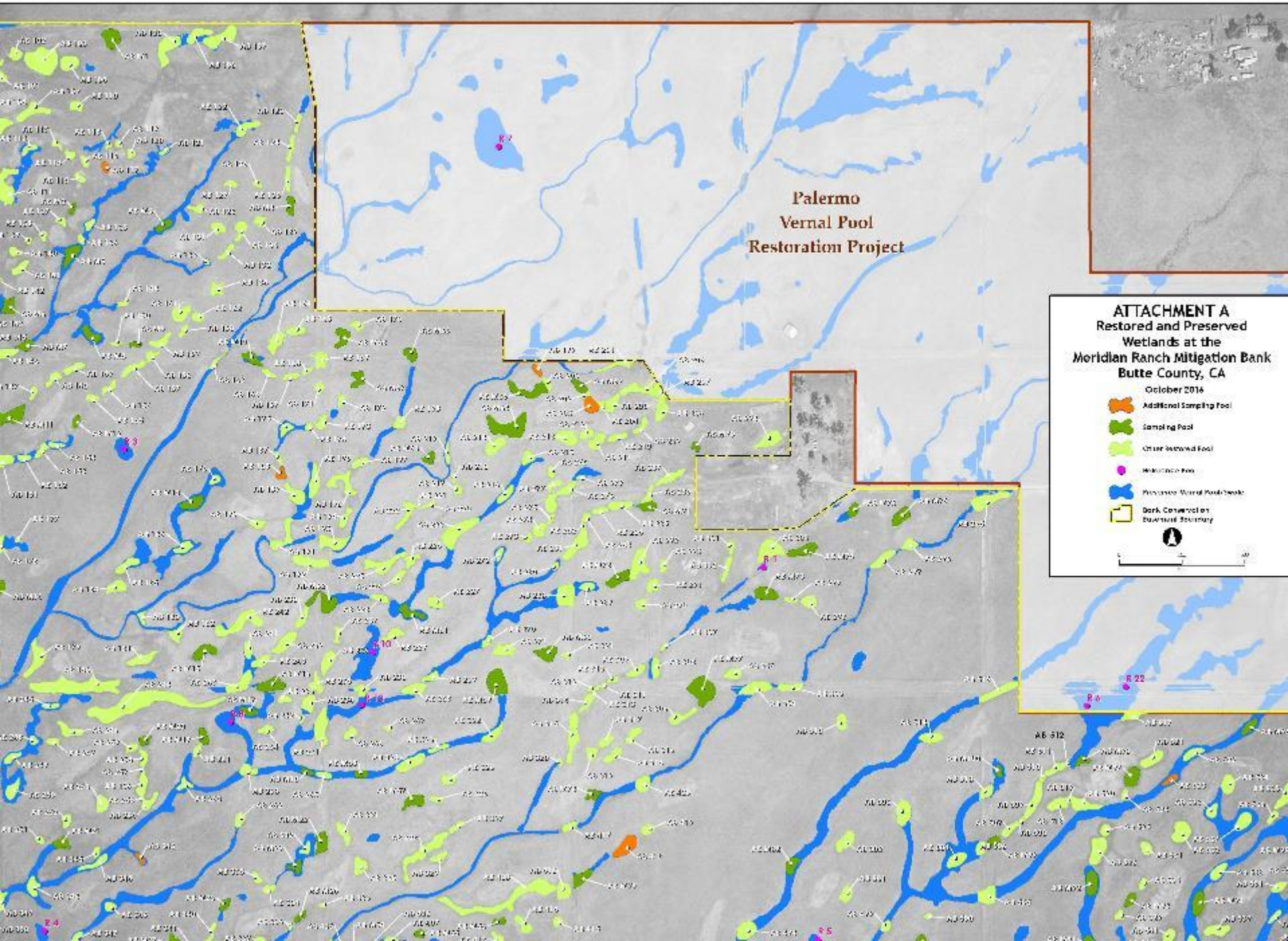
Vernal Pool - Monitoring

- Vegetation Monitoring:
  - "Whole pool" relevé (Mueller-Dombois and Ellenberg 1974)
- Hydrology Monitoring:
  - Dataloggers and/or staff gauges
- Monitoring period of 5, 7 or 10 years


Palermo
Vernal Pool
Restoration Project
ATTACHMENT A
Restored and Preserved
Wetlands at the
Meridian Ranch Mitigation Bank
Butte County, CA
October 2016
Additional Sampling Pool
Sampling Pool
Other Restored Pool
Preservation Vernal Pools/Swale
Bank Conservation Easement Boundary

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Managing Biotic Factors

Questions?

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