Changes in the Distribution of Great Valley Vernal Pool Habitats from 2005 to 2012

Carol W. Witham, Robert F. Holland and John E. Vollmar. 2014.

Results of the mapping report

Prepared by Robert F. Holland for presentation to SWFO staff
September 25, 2014
Study Objectives

- Remap the San Joaquin and Sacramento valleys (collectively Great Valley) vernal pool landscapes as of the 2012 high-resolution National Agriculture Imaging Program (NAIP) geo-referenced aerial photography and compare with the 2005 map.
  - Identify vernal pool habitat lost since 2005,
  - Identify the land uses to which the habitat was converted,
  - Identify new or previously unmapped habitat,
  - Score with 2012 conditions of disturbance area and intensity, and
  - Identify surrounding land use for each mapped habitat polygon.

- Provide summary analysis and tabulation of the data.
  - Assess losses and gains by Core Recovery Unit, and
  - Assess the amount of remaining habitat that is afforded some level of protection.

- Prepare final GIS database and associated metadata for USFWS.
Basemap from 2005

- Study area: 21.4 million acres
- Vernal pool habitat: 807,820 acres
- Number polygons: 1,909
Additions to 2005 geodatabase for 2012 remapping

- Changes observed in each polygon between 2005 and 2012:
  - unmodified, converted, modified, or new habitat

- If converted, what the habitat had been converted to as of the 2012 imagery:
  - orchards, vineyards, Eucalyptus; alfalfa, irrigated pasture; bare, plowed agricultural lands; other ag; ag res; mitigation bank/managed wetlands; and urban, commercial, industrial

- 2012 disturbance attributes (separately assessed from those recorded in 2005):
  - area of disturbance; disturbance type; and disturbance intensity.

- Surrounding land use (a completely new assessment in the 2012 mapping):
  - proportion of polygon surrounded by natural/naturalized habitat, and type of surrounding land use, in order by proportion, for areas that encompassed 25% or more of the polygon’s perimeter.
2012 Methods

• Focused on 807,820 acres mapped in 2005 plus immediately surrounding areas on the valley floor.

• Each polygon was inspected for changes.
  • 2005 polygon was cut as appropriate to reflect 2012 conditions
  • If new habitat was detected, a new polygon was added
Habitat mapped north west of Lincoln, Placer County, in 2005
Habitat mapped north west of Lincoln, Placer County, in 2012
Habitat boundaries as mapped in 2005 in pink, in 2012 in lime, on 2012 image.
2012 Results

- 764,868 acres extant vernal pool habitat (down from 807,820)
  - 47,306 acres extirpated from 2005 (502 polygons)
  - 1,679 acres added in the form of mitigation banks
  - 2,675 acres added that was missed in 2005

- Tabular comparison of 2005 and 2012 mapping results by county and by Core Recovery Area

- Analysis of land use types to which vernal pool habitat was converted between 2005 and 2012

- Analysis of how surrounding land use might predispose a site to land use conversion

- Analysis of how much remaining habitat is under some form of protection

- Discussion of wetted acres lost and implications for vernal pool species
2012 Results

- Habitat was lost (47,306 acres) in every county except Calaveras, Kings and Mariposa.
- New mitigation banks (1,679 acres) were identified in 11 counties.
- Previously mapped habitat was modified to higher density mitigation banks (2,816 acres) in 6 counties.
- Added habitat not mapped in 2005 (2,675 acres) in 10 counties.
## Table 1: Changes in mapped vernal pool habitat between 2005 and 2012 by county.

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<td>2,675</td>
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<td>1,679</td>
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</table>

2012 Unmodified: Habitat mapped in 2005 that appeared unchanged in 2012; 2012 Modified: Areas mapped in 2005 (usually at low density) which had been converted to high density and often highly disturbed mitigation banks by 2012; Missed in 2005: Areas of habitat found in the 2012 imagery that were not apparent in the 2005 imagery; 2012 New Banks: Areas in which vernal pool mitigation banks were built between 2005 and 2012; 2012 Total Extant: The sum of the previous four columns showing the total extant vernal pool acreage mapped in 2012; 2012 Converted: Habitat converted to other (incompatible) land uses between 2005 and 2012; 2012 All Mapping: The total polygons and acres contained in the 2012 geodatabase including extant and extirpated; Percentage Converted: The percentage of all mapping that was converted to other land uses between 2005 and 2012.
Disposition of 47,306 acres converted between 2005 and 2012

- Bare plowed ground: 48%
- Orchards, vineyards: 32%
- Alfalfa, pasture: 12%
- Urban, industrial: 5%
- Other ag: 2%
- Ag residential: 1%
Habitat loss and adjacent land use

• Land surrounded by incompatible use was more likely to be extirpated

![Extirpated Acres](image)

- **Percent of surroundings in natural/naturalized land use.**

• There was regional variation in land use conversion
  - Olives in Tehama County
  - Almonds in Stanislaus County
  - Pistachios in Madera County
Vernal pool habitat under protection

• External sources of information
  • California Protected Areas Database (CPAD 2014)
  • California Conservation Easement Database (CCED 2014)
  • National Conservation Easement Database (NCED 2014)
  • USDA Conservation Easement Database (USDA 2012)

• Data limitations
  • More recent acquisitions or easements may not be reflected
  • Databases sometimes disagreed on the outline of any given parcel
  • Department of Fish and Wildlife conservation easements are not included
  • Military installations are not included
  • Some areas depicted in the dataset are just plain wrong
  • Just because an area is “protected” does not mean it is being managed for natural resources
2012 “protected” habitat

- Of the 764,868 acres of extant habitat, 229,637 acres are “protected” (30%)

- Of the 438,417 acres of habitat in the Core Recovery Areas, 102,854 acres are “protected” (24%)

- 94,881 acres (12%) of the “protected” habitat is in waterfowl management areas, especially in Merced County
Figure 6: Acres of extant habitat by county

- Not Protected
- Protected
Protected areas by various database attributes

- **Acres by cover class**
  - <2: 0.42 (Not Protected), 0.42 (Protected)
  - 2-5: 0.42 (Not Protected), 0.14 (Protected)
  - 5-10: 0.14 (Not Protected), 0.02 (Protected)

- **Acres by diversity class**
  - Low: 0.67 (Not Protected), 0.24 (Protected)
  - Med: 0.24 (Not Protected), 0.08 (Protected)

- **Acres by disturbance area**
  - 100: 0.01 (Not Protected), 0.15 (Protected)
  - 50-99: 0.15 (Not Protected), 0.05 (Protected)
  - 25-50: 0.11 (Not Protected), 0.11 (Protected)
  - 5-25: 0.19 (Not Protected), 0.19 (Protected)
  - 1-5: 0.48 (Not Protected), 0.48 (Protected)

- **Acres by disturbance intensity**
  - Hi: 0.13 (Not Protected), 0.76 (Protected)
  - Med: 0.11 (Not Protected), 0.11 (Protected)
  - Low: 0.76 (Not Protected), 0.76 (Protected)
Vernal pool habitat losses

- Madera County had the greatest loss of habitat (14,603 acres)
  - 100% to agricultural conversion

- Merced County had the second greatest loss (7,300 acres)
  - 97% to agricultural conversion
  - 3% to urban or industrial conversion (U.C. Merced)

- San Joaquin County had 6,234 acres of habitat loss
  - 100% to agricultural conversion

- Stanislaus County had 3,041 acres of habitat loss
  - 100% to agricultural conversion

- Only 2,557 acres (5%) of the total habitat losses were attributed to urban or industrial conversion
  - The majority of the habitat losses to urban or industrial conversion (73%) occurred in Placer, Sacramento and Tehama counties
How many wetted acres (acres of vernal pool species habitat, not including matrix) were lost between 2005 and 2012?

- Estimated from the vernal pool habitat cover classes
  - Using midpoint of cover class to approximate vernal pool density

<table>
<thead>
<tr>
<th>Cover class limits</th>
<th>Midpoint of cover class range</th>
<th>Total habitat acres converted 2005-2012</th>
<th>Calculated wetted acres lost 2005-2012</th>
<th>Average annual loss of wetted acres 2005-2012</th>
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<tr>
<td>&lt;2%</td>
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<td>178</td>
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<tr>
<td>2-5%</td>
<td>3.5%</td>
<td>24730</td>
<td>866</td>
<td>124</td>
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<td>5-10%</td>
<td>7.5%</td>
<td>4301</td>
<td>323</td>
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<td>&gt;10%</td>
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<td></td>
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<td>1563</td>
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- 95% of these losses were to apparently unregulated agricultural conversion and presumably were not subject to mitigation
What do these losses mean for vernal pool species?
But complete extirpation does not tell the whole story

- Only portions of the Hickman vernal pool complex in Stanislaus County were extirpated between 2005 and 2012

- Encroachment of incompatible land use (here almond orchards) has altered the hydrology of the entire site

- The greenish ponded water in the 2012 aerial image is indicative of type conversion from vernal pool habitat to freshwater marsh
Recommendations

• Increase enforcement of Endangered Species Act (and Clean Water Act) violations occurring through unregulated agricultural conversion
  • Northern San Joaquin Valley
    • San Joaquin, Stanislaus, Merced and Madera counties

• The geodatabase accompanying this report is *simply a map* created through interpretation of aerial imagery
  • It contains both qualitative and quantitative attributes for each polygon on vernal pool cover, diversity, disturbance, adjacent land use, etc.
    • But, it cannot by itself answer complex questions of what to protect next
  • It can contribute to a Gnostic Integrative Synthesis to help prioritize areas for conservation; other information could include:
    • Species occurrence information
    • Core Recovery Areas
    • Critical Habitat
    • Proximity to already protected areas
    • Biological attributes of target taxa