CRAM Vernal Pool Module Validation and Applications in Vernal Pool Landscapes

Cara Clark

Central Coast Wetlands Group at Moss Landing Marine Labs

April 11, 2018

Vernal Pool Landscapes: Past, Present, and Future

Sierra Nevada Brewing Company, Chico, CA

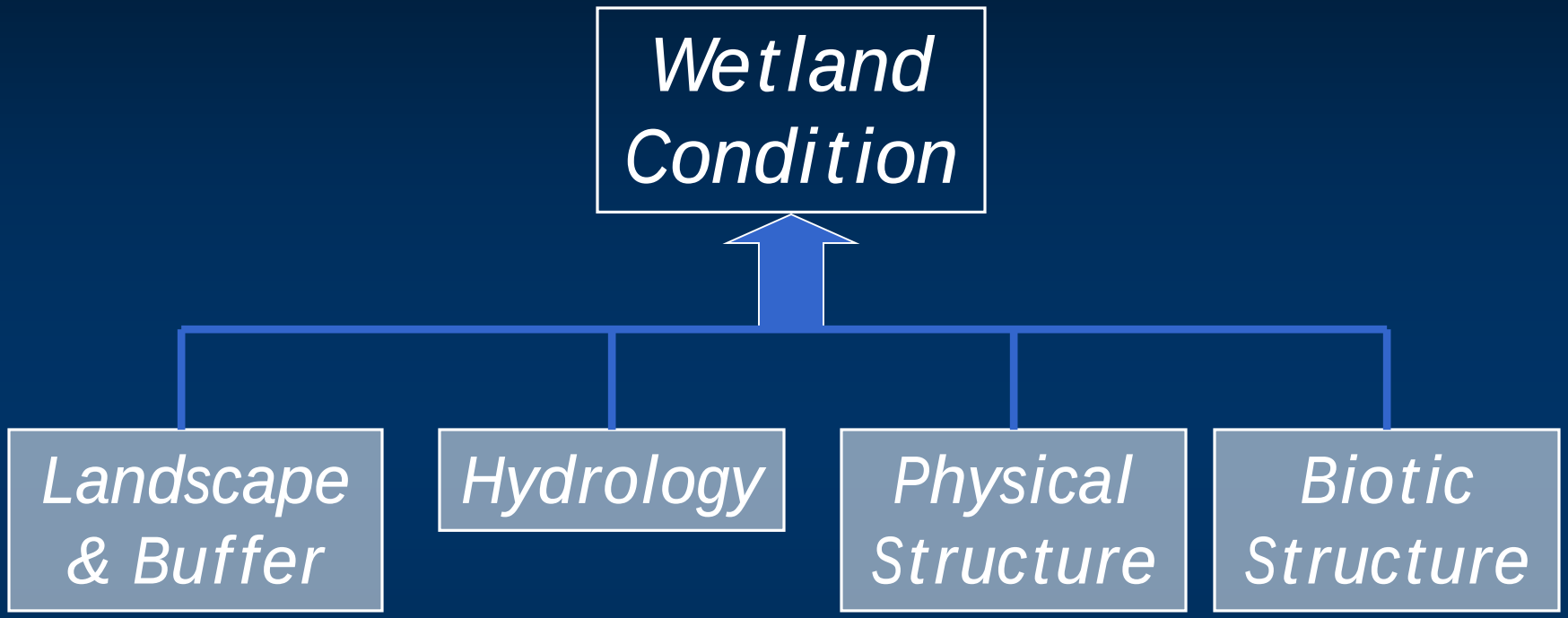
What *is* the California Rapid Assessment Method?

CRAM is a field-based "walk and talk" diagnostic tool that, when used as directed, provides rapid, repeatable, numeric assessment of the *overall condition* of a wetland based on visible indicators of its form, structure, and setting, relative to the least impacted reference condition.

What is *overall condition?*

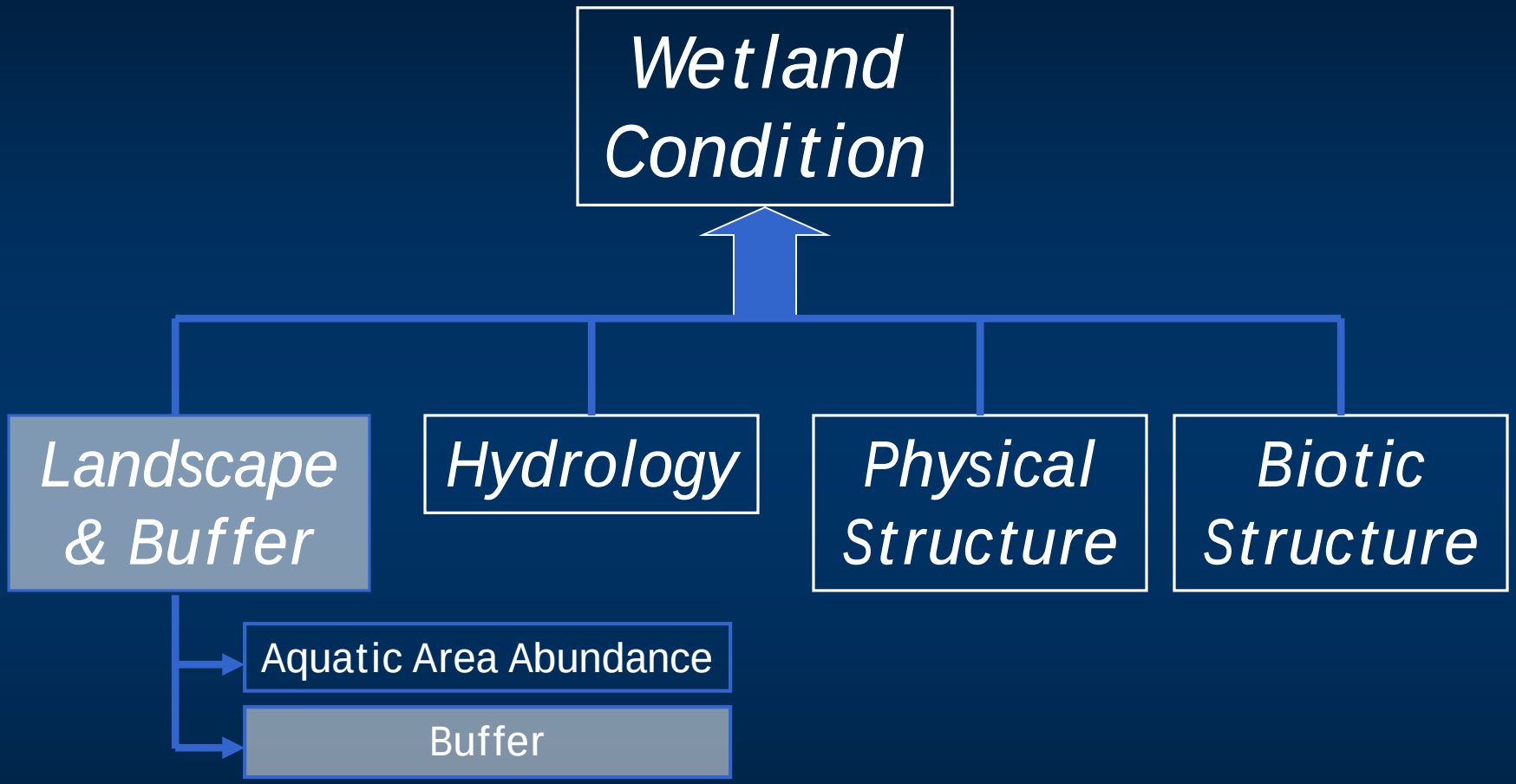
Overall condition is the capacity or potential of a wetland to provide the functions and services expected for the same type of wetland in its natural setting, assessed relative to "best" reference condition.

CRAM Design: Attributes



- For all wetland classes, CRAM recognizes 4 *attributes* of wetland condition (consistent across all modules).
- Each attribute is represented by 2-3 *metrics*, some of which have *submetrics* (some differences between modules).

CRAM Design: Metrics



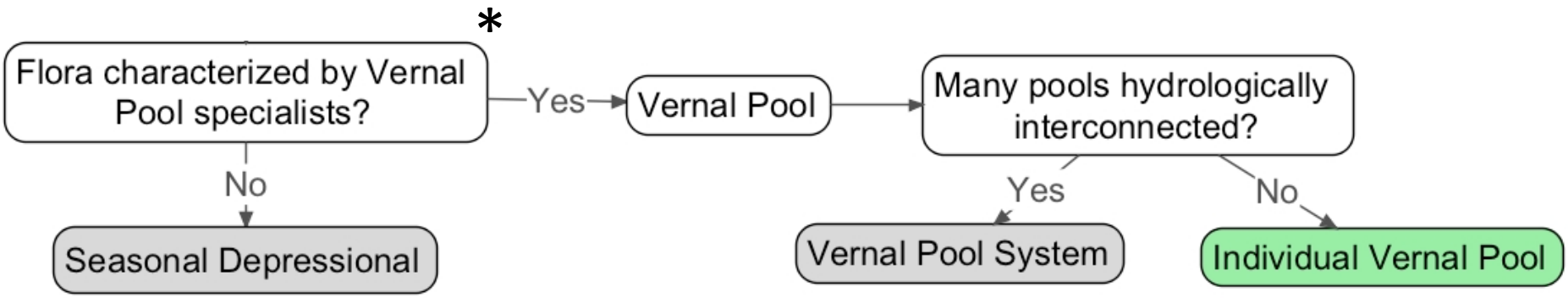
Submetric Scoring Example

- Mutually exclusive alternative states
- Represent full range of possible condition

Buffer Width

Alphabetic Score	Numeric Score	Alternative State
A	**12**	Average buffer width 190-250m
B	**9**	Average buffer width is 130–189m
C	**6**	Average buffer width is 65–129m
D	**3**	Average buffer width 0-64m

When to use vernal pool modules?



- Use for wetlands clearly dominated by non-vernal pool endemics such as *Eleocharis*

- 3 or more pools interconnected
- Hydrologic connectivity can be subsurface
- Subsample when > than 3 pools

- Should also be used when a pool is significantly different than the rest of the pools

* *Flora characterized by vernal pool specialists (endemics)*

=

*species designated as "**vpi**" in Appendix 1 or BPJ*

What is Validation?

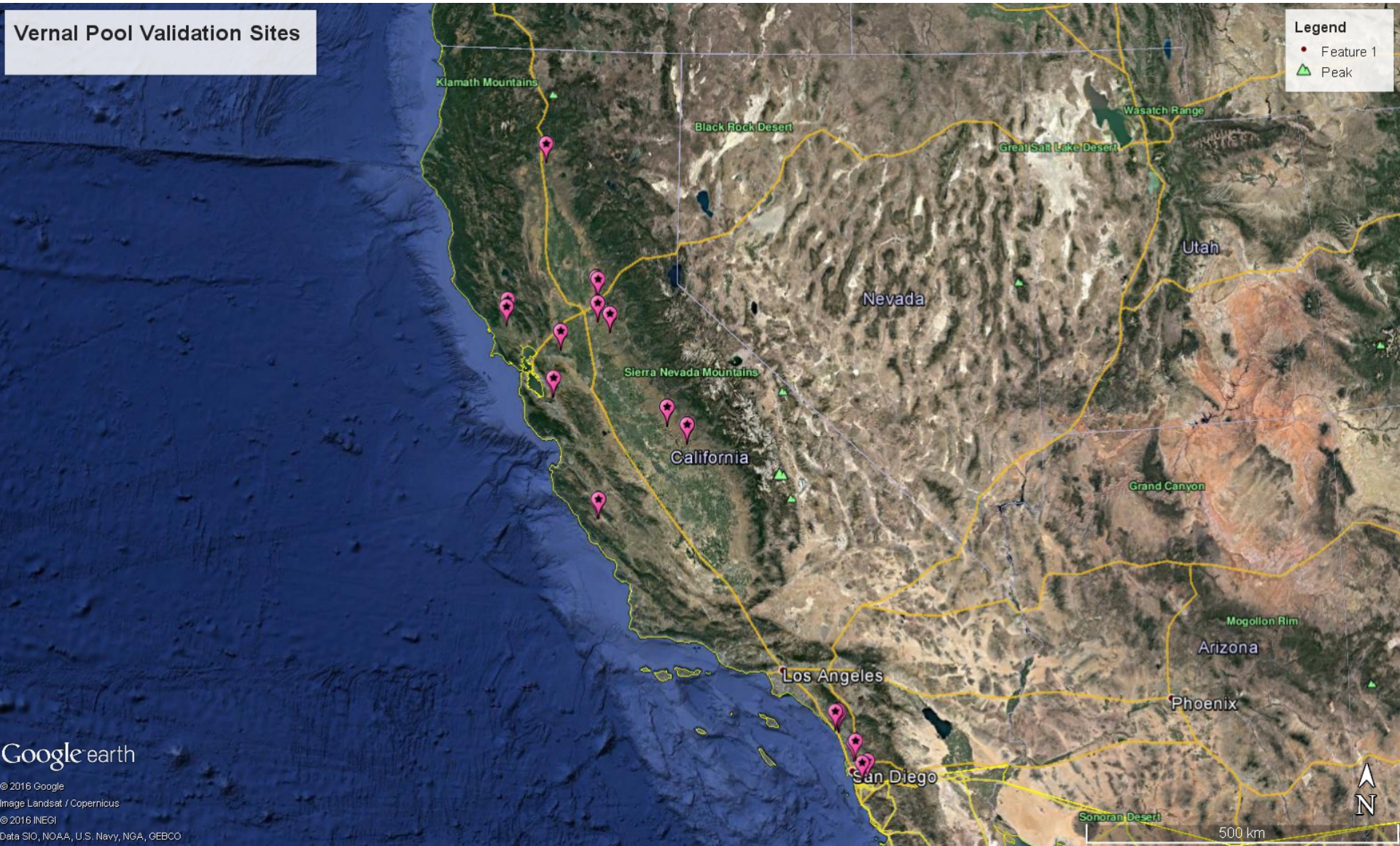
- Validation is defined as:

  "the process of documenting relationships between CRAM results and independent measures of condition in order to establish CRAM's defensibility as a meaningful and repeatable measure of wetland condition" (Stein et al., 2009).

Ten Steps to Validation

1. Begin with the existing Verification version of the module, and make any necessary updates to create a useable Validation version,
2. Identify the gradient of stress
3. **Identify appropriate detailed Level 3 data to validate the CRAM scores**
4. Identify the metrics that will be calculated from the detailed data
5. Create conceptual modules that describe the expected relationship between the detailed data and CRAM scores
6. Select field site locations that have the selected existing data, or collect the data themselves
7. Conduct new CRAM assessments
8. **Develop correlations between the Level 3 data and CRAM scores**
9. Consider any necessary modifications to the module to better capture the full range of condition
10. Report the findings to the Level 2 and the CWMW for discussion

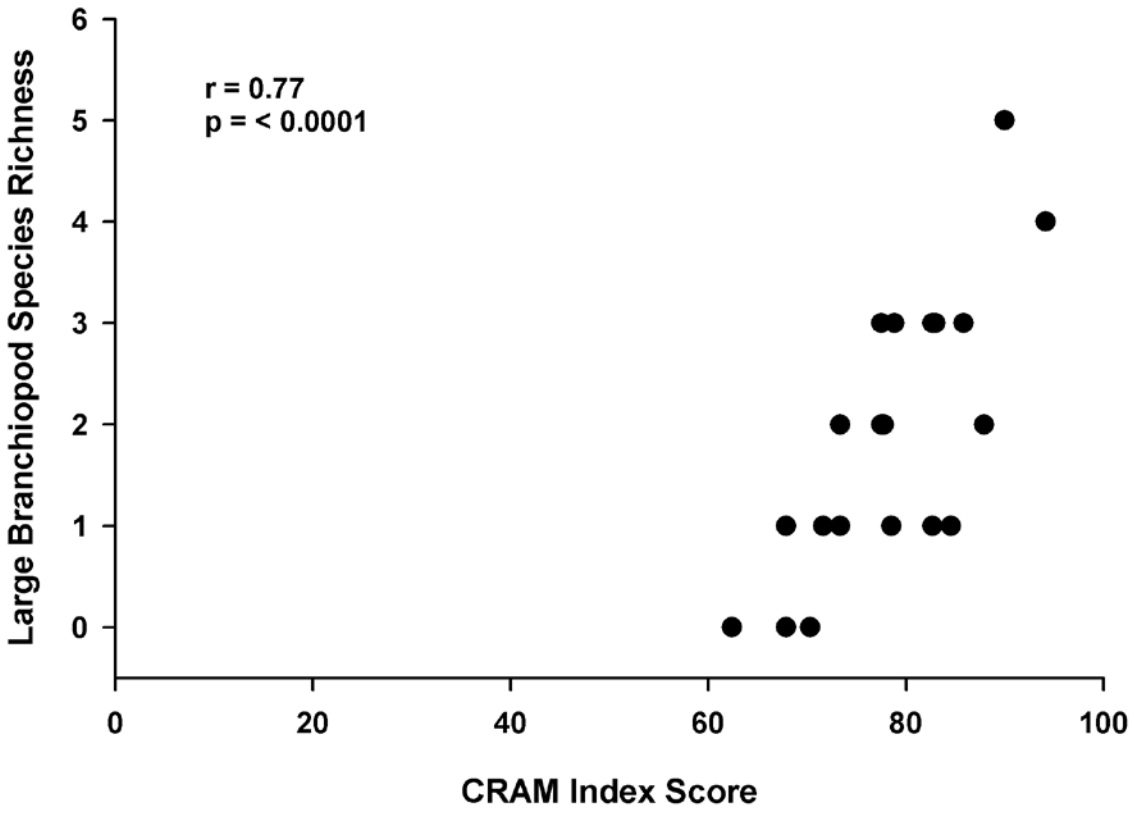
Vernal Pool Validation Sites



Level 3 Data

- Vegetation data
  - Species Richness
  - Percent Native Cover
  - Shannon Diversity Index
  - Shannon Evenness Index
- Invertebrate data
  - Large Branchiopod Species Richness
  - Species Richness of All Invertebrates

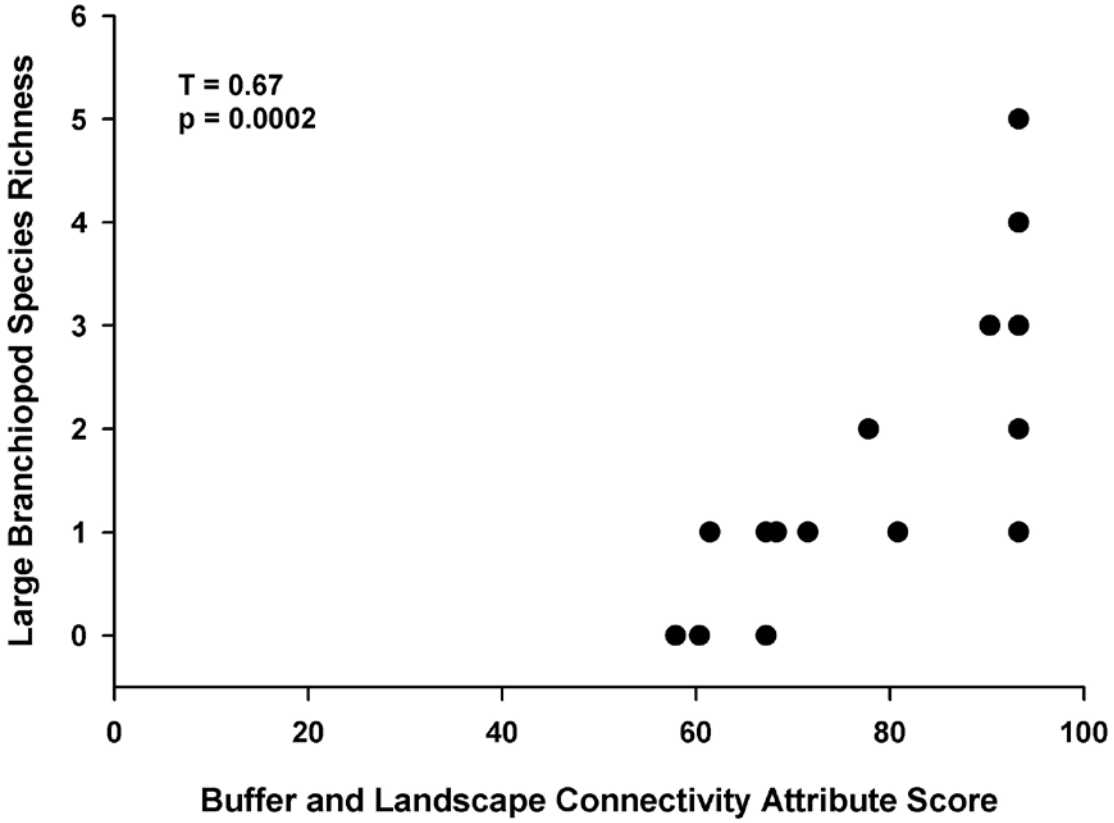
Significant Correlation!



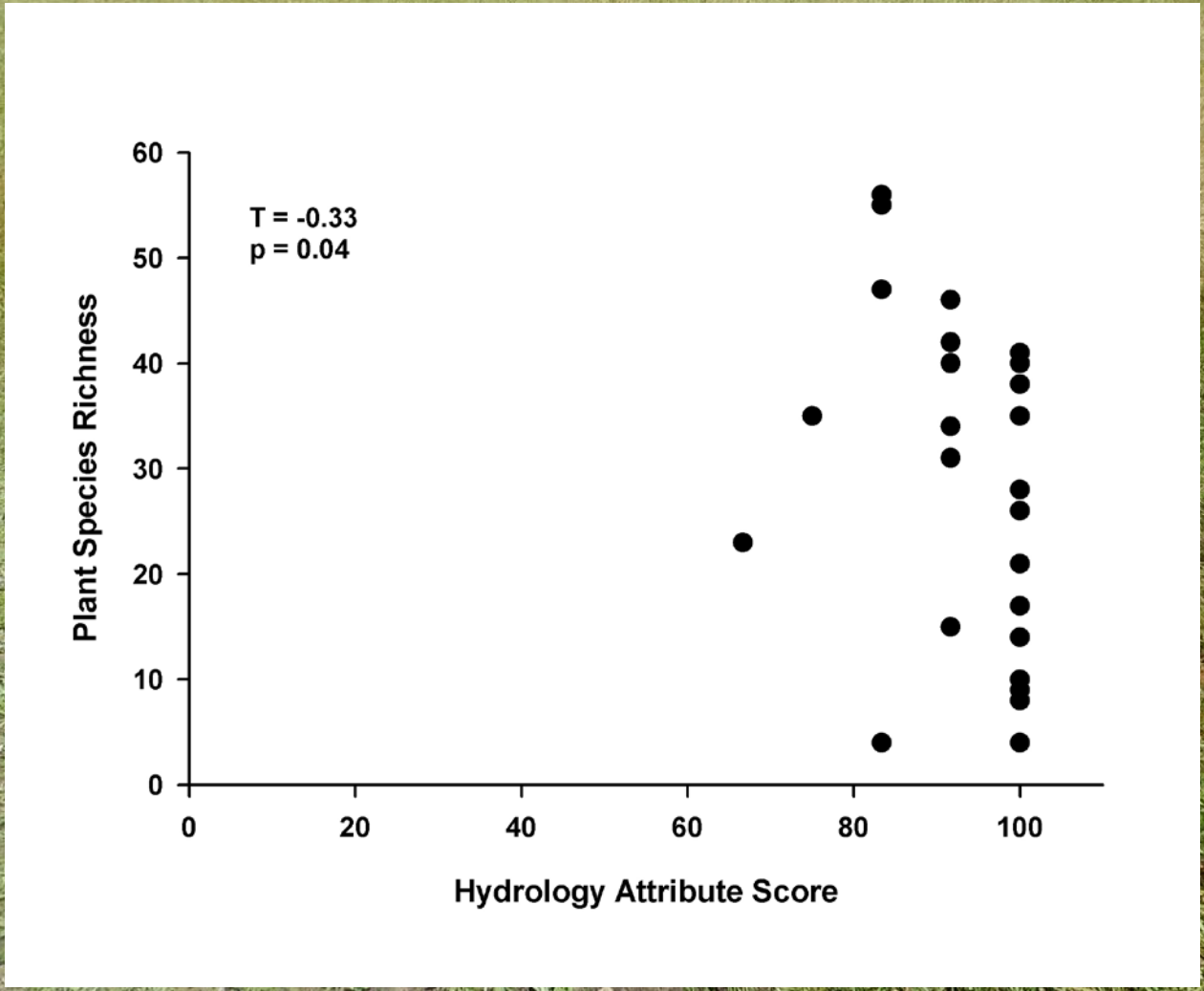
Correlation Table

	Log transformed Invert Sp Rich	Large Branchiopods	Plant Species Richness	Endemic Plant Species Richness	Native % Cover	Non-native % Cover	Shannon Diversity Index	Shannon Evenness Index
CRAM Score	0.23	0.77	0.21	0.32	0.33	-0.16	0.34	0.43
p-value	0.35	**<0.0001**	0.31	0.11	0.15	0.50	0.17	*0.07*
n	19	21	26	26	20	20	18	18
Physical Structure	0.18	0.52	0.14	0.17	0.12	-0.1	0.55	0.23
p-value	0.47	**0.02**	0.48	0.40	0.63	0.70	**0.02**	0.36
n	19	21	26	26	20	20	18	18
Biotic Structure	0.23	0.63	0.42	0.52	0.34	-0.09	0.58	0.56
p-value	0.35	**0.002**	**0.03**	**0.006**	0.14	0.70	**0.01**	**0.01**
n	19	21	26	26	20	20	18	18

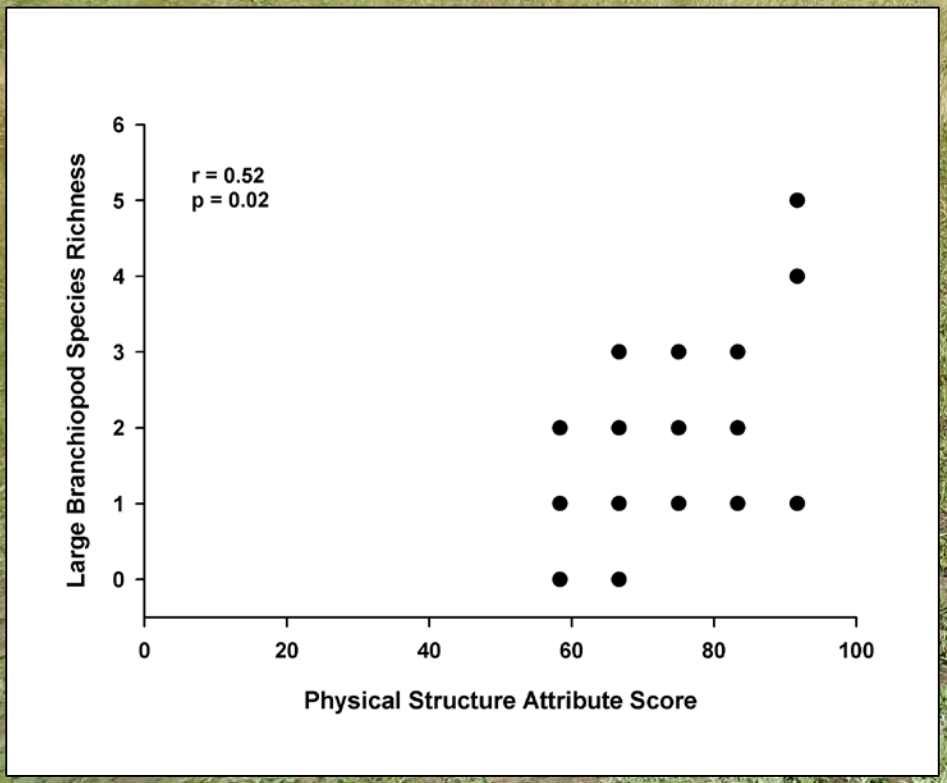
Buffer and Landscape Context

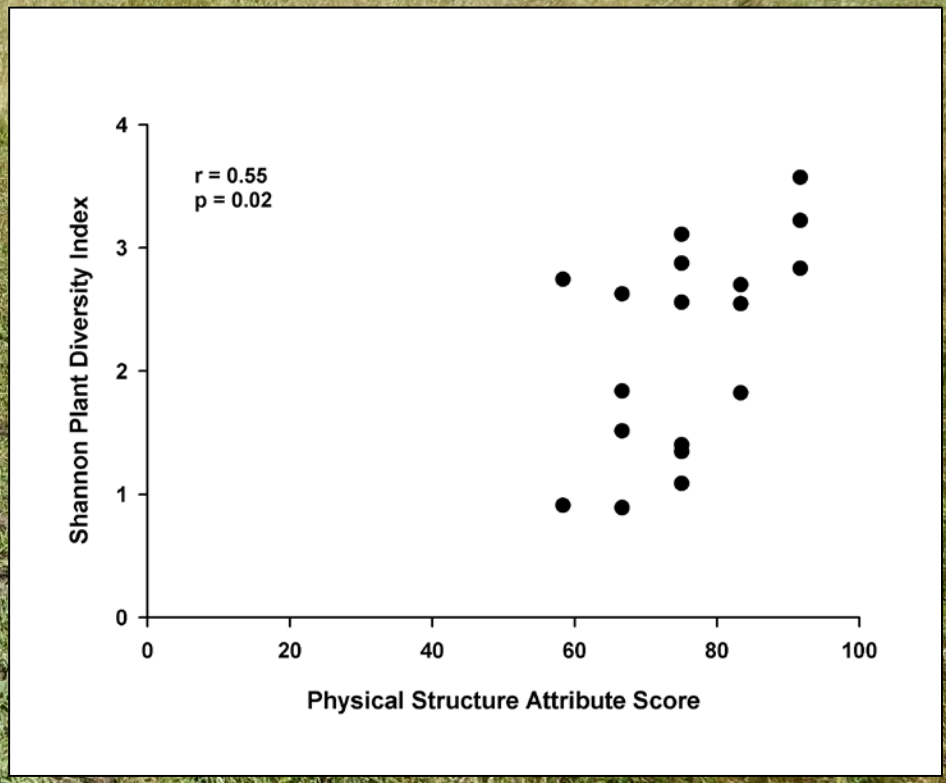


Hydrology – unexpected negative correlation – artifact of skewness

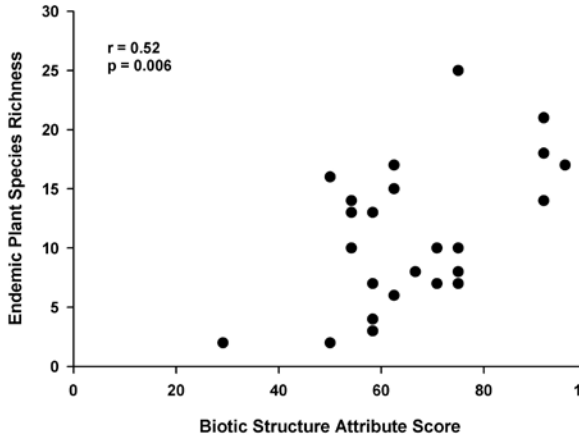


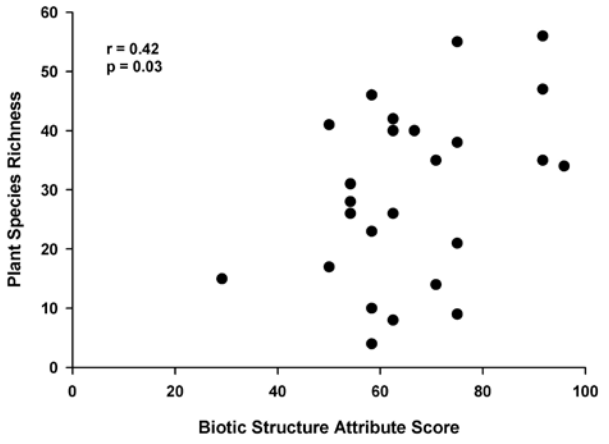
Physical Structure

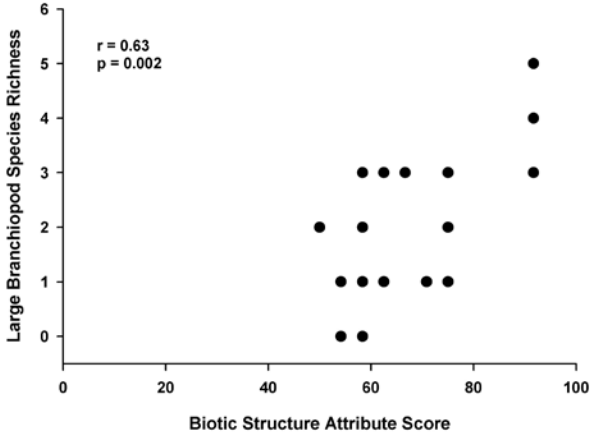


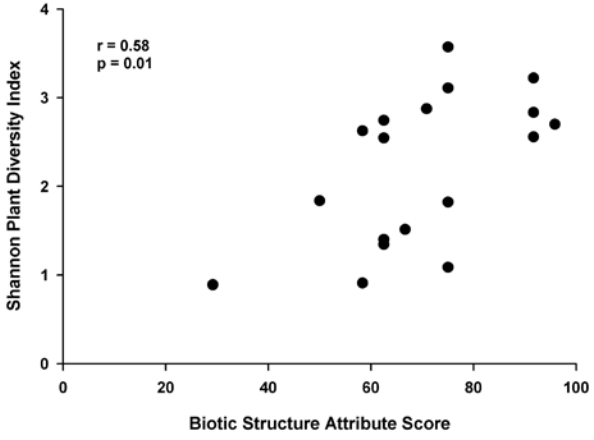


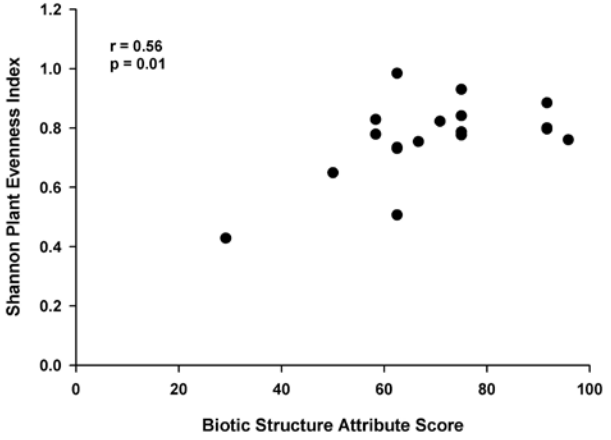
Biotic Structure

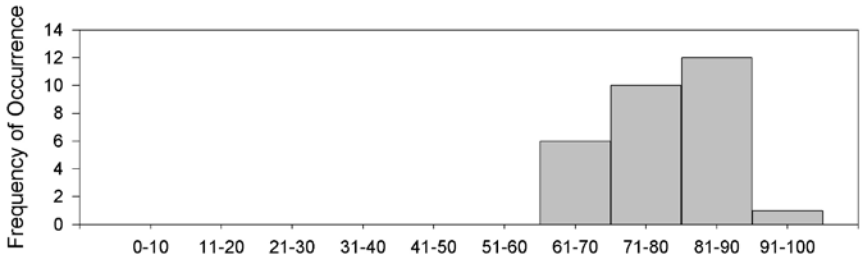




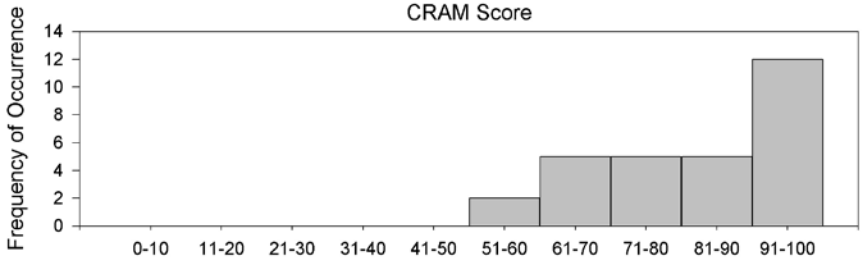




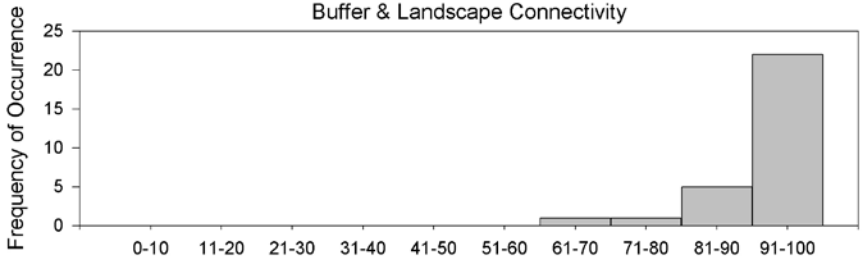




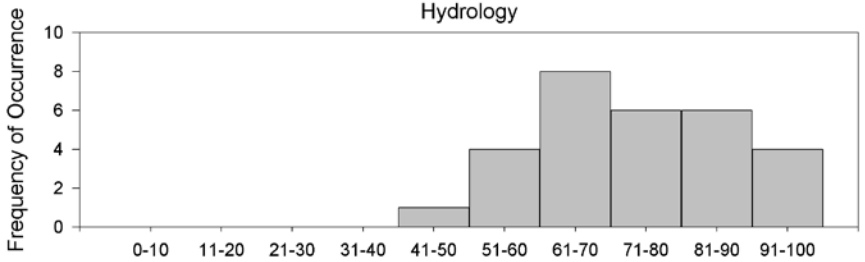
CRAM Score



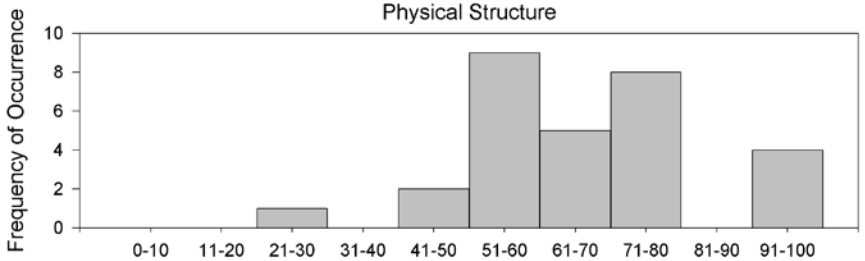
Buffer & Landscape Connectivity



Hydrology



Physical Structure



Biotic Structure

Partners and Collaborators: Vernal Pools

- Partners and contractors: Vollmar Natural Lands Consulting (John Vollmar and Jake Schweitzer), ICF International (Lindsay Teunis), ECORP (Debra Sykes)
- Collaborators: USFWS, U.S. Dept. of the Army, U.S. Marine Corps, CDFW, CalTrans, City of Roseville, Larry Stromberg, private landowners

Project Impact/ Mitigation and Voluntary Assessment Using CRAM

- Approach depends on objectives of assessment
- Impact Assessments:
  - Probabilistic survey (watershed or reach effects)
  - Targeted survey (project specific)
- Restoration/Mitigation Assessments:
  - Mitigation opportunities/alternatives
  - Performance standards
    - Short term (5-10 yrs)
    - Long term (every 5 yrs in perpetuity)
- Large Scale Planning
  - Habitat/Natural Communities Conservation Plans (HCP/NCCP)
  - Voluntary monitoring on preserves and military bases

Example of 5-Year Comprehensive Monitoring Plan

- Level 1: Vegetation Mapping and Delineation
- Level 2: CRAM and other Site Conditions
  - Plant survival and plant condition
  - Erosion issues, trash, trespass/vandalism
- Level 3: Quantitative Assessments
  - Vegetation transects (Cover, Richness, and Diversity)
  - Bird counts/focused surveys
  - IBI (Macroinvertebrates, Algae, etc.)
  - Soil development
  - Hydrology (depth of groundwater, flooding interval)

2013 USACE Mitigation Ratio Procedure

Step 3: Before After Mitigation Impact (BAMI)

Functions/conditions	$Impact_{Before}$	$Impact_{After}$	$Impact_{delta}$	$Mitigation_{Before}$	$Mitigation_{After}$	$Mitigation_{delta}$
4.1 Buffer and Landscape Context						
4.1.1 Landscape Connectivity	9	3	-6	6	6	0
4.1.2 Percent of AA with Buffer	12	6	-6	3	9	6
4.1.3 Average Buffer Width	3	3	0	3	12	9
4.1.4 Buffer Condition	6	6	0	3	9	6
RAW SCORE	**15.0**	**8.0**	**-7**	**9.0**	**15.7**	**7**
FINAL SCORE	**76.0**	**33.6**	**-42**	**37.5**	**65.3**	**28**
4.2 Attribute 2: Hydrology						
4.2.1 Water Source	6	6	0	6	6	0
4.2.2 Hydroperiod or Channel Stability	9	12	3	3	9	6
4.2.3 Hydrologic Connectivity	12	9	-3	3	12	9
RAW SCORE	**27.0**	**27.0**	**0**	**12.0**	**27.0**	**15**
FINAL SCORE	**75.0**	**75.0**	**0**	**33.4**	**75.0**	**42**
4.3 Attribute 3: Physical Structure						
4.3.1 Structural Patch Richness	6	3	-3	3	9	6
4.3.2 Topographic Complexity	6	3	-3	3	6	3
RAW SCORE	**12.0**	**6.0**	**-6**	**6.0**	**15.0**	**9**
FINAL SCORE	**63.0**	**25.0**	**-38**	**25.0**	**62.5**	**38**
4.4 Attribute 4: Biotic Structure						
4.4.1 Number of Plant Layers	12	9	-3	6	9	3
4.4.2 Co-Dominant Species	6	6	0	6	12	6
4.4.3 Percent Invasion	6	9	3	3	12	9
4.4.4 Interspersion/Zonation	9	3	-6	3	9	6
4.4.5 Vertical Structure	6	3	-3	3	6	3
RAW SCORE	**23**	**14**	**-9**	**11**	**26**	**15**
FINAL SCORE	**38.0**	**38.9**	**1**	**30.6**	**72.3**	**42**
OVERALL SCORE	**63.0**	**44.0**	**-20**	**32.0**	**69.0**	**38**

1. Assess existing condition at project (impact) site and post impact

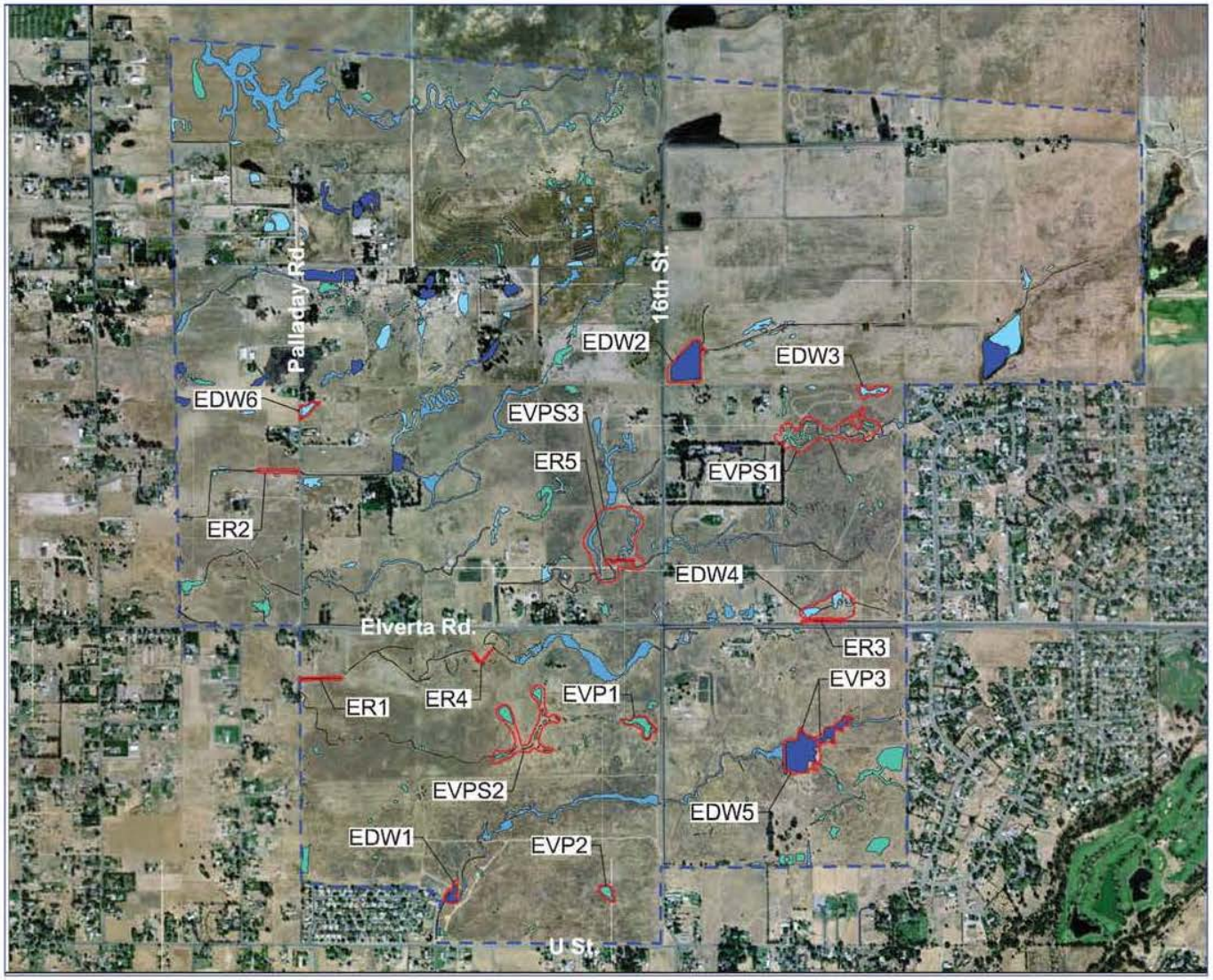
2. Assess existing condition at mitigation site and project future

3. Look at Delta Loss vs. Delta Gain. Add into SOP, Step 2.

Example: Functional Loss < Functional Gain Mitigation Ratio is Adjusted down

Quotient=ABS(M/I)$_d$
1 9/10
Baseline ratio:
1 : 1.9

Elverta Specific Plan



Legend

EDW - Elverta Depressional Wetland
ER - Elverta Riverine
EVP - Elverta Vernal Pool
EVPS - Elverta Vernal Pool System
Specific Plan Boundary

Wetlands Delineation Key

- Channel
- Ditch
- Pond
- Seasonal Wetland
- Seep
- Vernal Pool
- Wetland Swale

Figure 1. Assessment Area locations for the Elverta Specific Plan Site. Additional information for these AAs is presented in the Technical Appendix, including photopoint locations, photos, AA data sheets, and stressor checklists.

Not To Scale

N

Example CRAM for Linear Projects

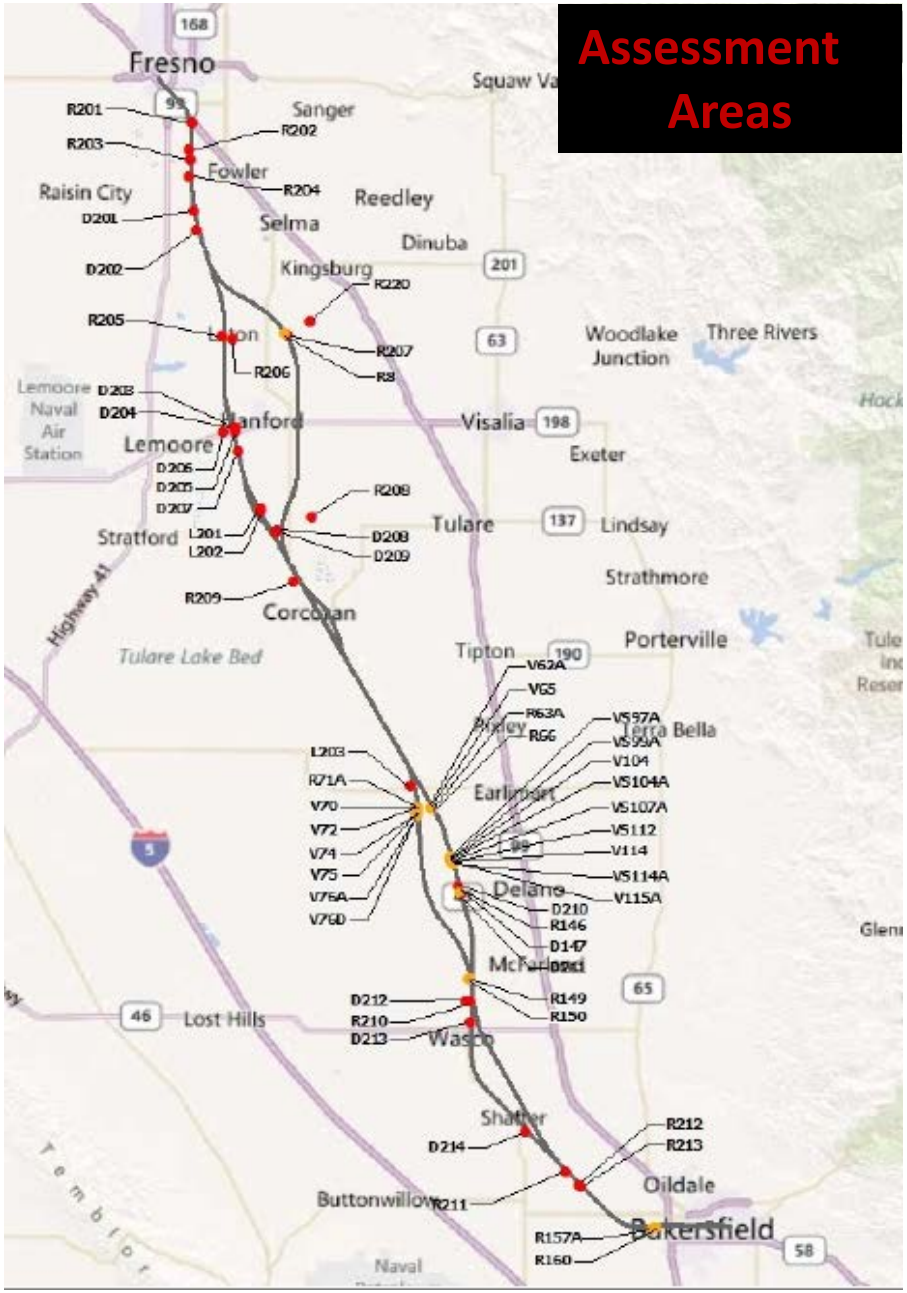
Example Projects

- High Speed Train
- Sunrise Powerlink
- Orange County Freeways
- Caltrans I-5 Corridor

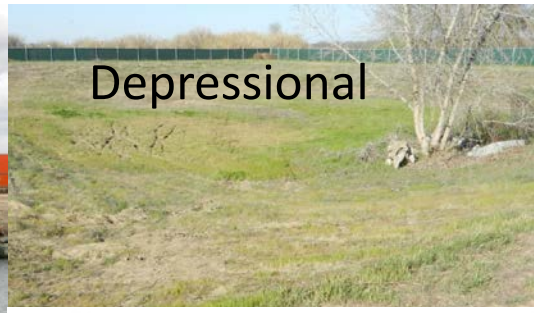
Many types of wetlands including:

- Riverine, Depressional, Vernal Pools, Estuarine

CRAM provides a common language to assess them.



Many Types of Wetlands




I-5
bing™
0
250
500
Meters
G:\NAVFAC\CampPendelton_Compare VP Methods\MXD\field_maps_250mExtent.mxd
Imagery Source: Image courtesy of USGS © 2016 Microsoft Corporation)


Thank you