CSS and Chaparral Vegetation Monitoring Plan

San Diego Management and Monitoring Program Coordination Meeting

October 2023

Coastal Sage Scrub & Chaparral Vegetation Monitoring – History in San Diego County

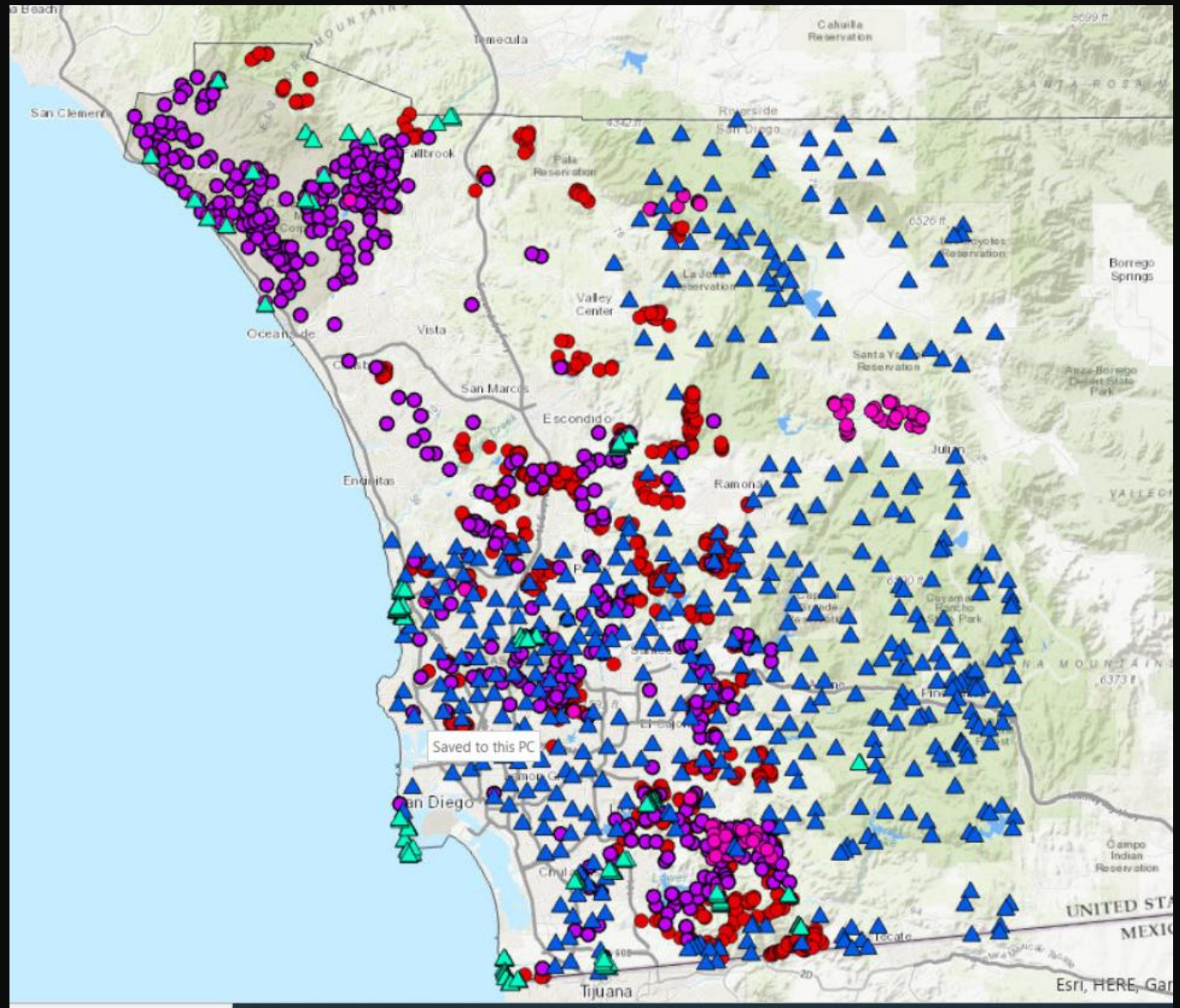
- Triangles 1930-2000
- Circles >2000
- Vegetation Datasets:

✓VTM (1930-1934)

✓Fisher Pit Fall (1995-2009)

✓AECOM Rapid Assessment Points (2002-2010)

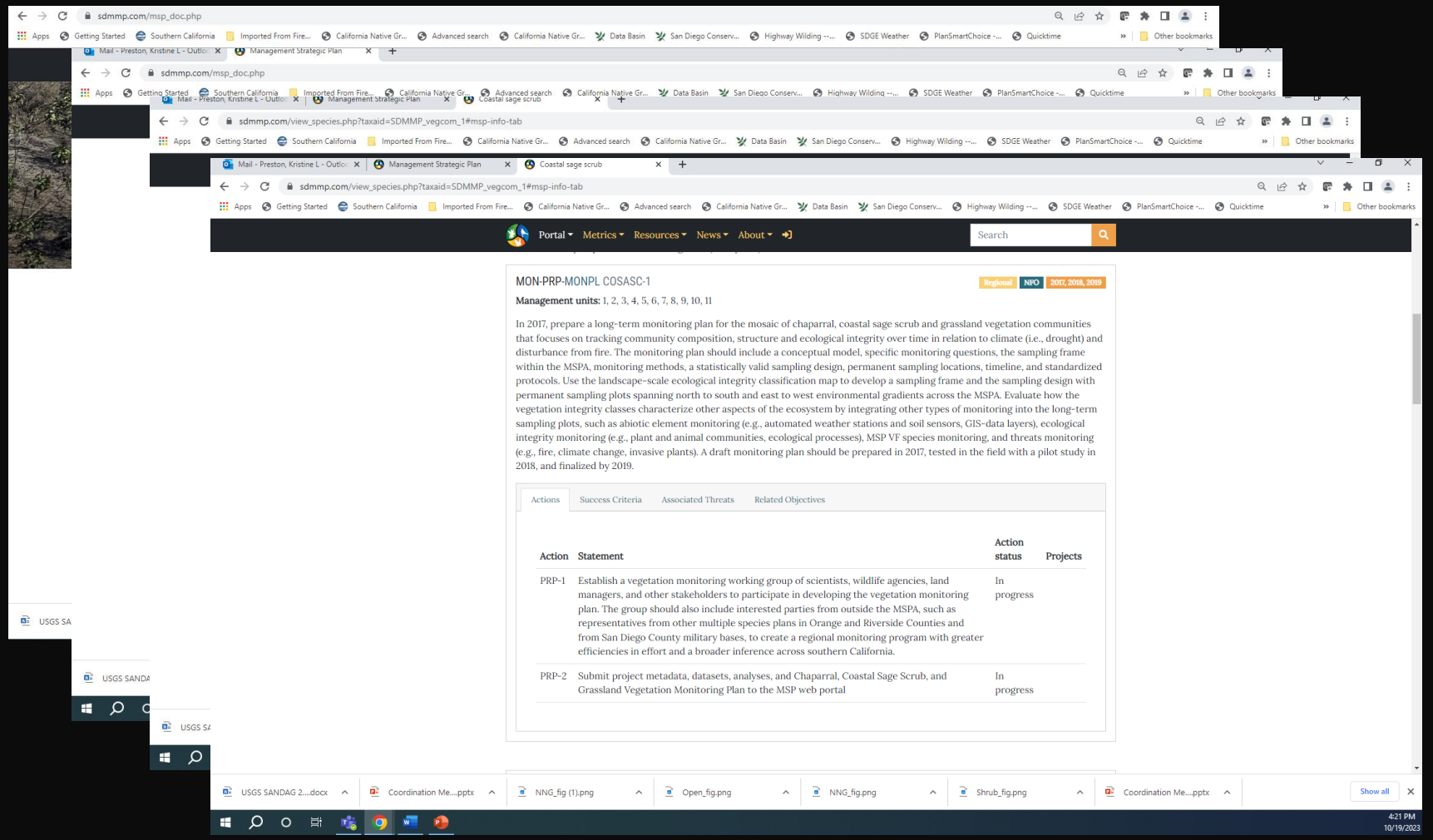
✓Kus USGS CAGN (2015 – 2020)



Coastal Sage Scrub & Chaparral Vegetation Monitoring – Regional Approach

Purpose:

- Track distribution & status over time
- Collect data on threat, habitat & abiotic characteristics
- Assess ecological integrity
- Apply data to management



https://sdmmp.com/

CSS & Chaparral Monitoring Question

What is the ecological integrity of CSS & chaparral vegetation, is it changing over time & why?

Ecological integrity –

The ability of an ecological system to support & maintain a community of organisms that has species composition, diversity & functional organization comparable to those of natural habitats within a region

Karr & Dudley 1981, Parrish et al. 2003

CSS & Chaparral Monitoring Question

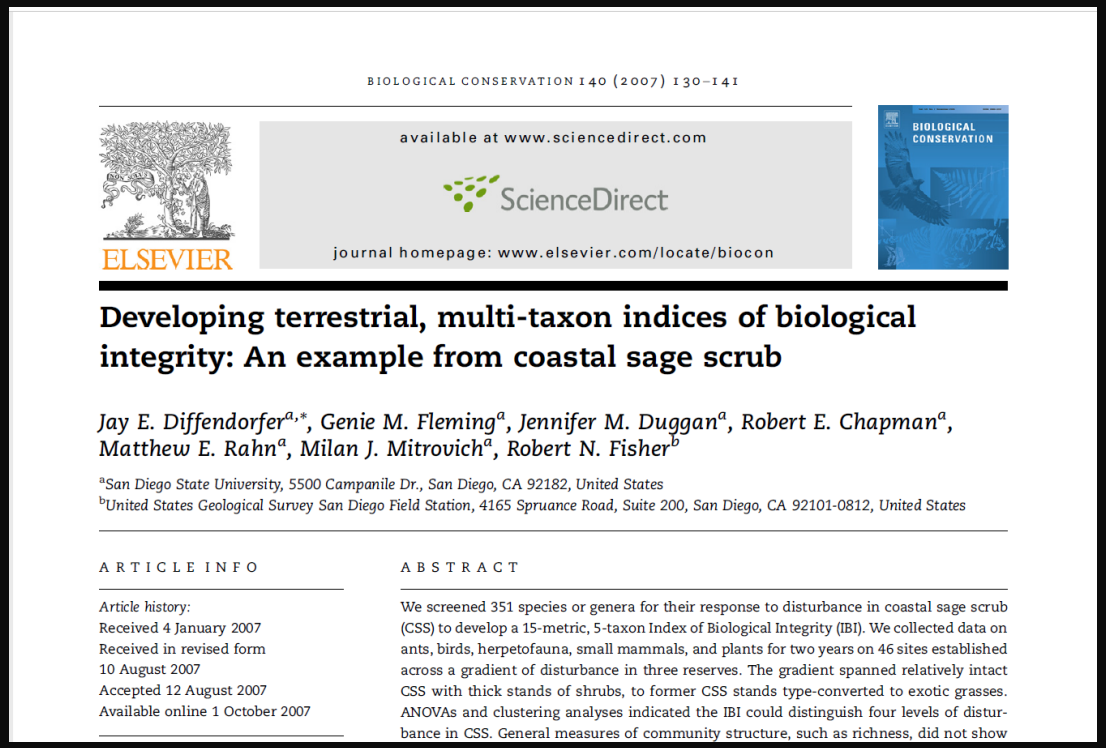
What is the ecological integrity of CSS & chaparral vegetation, is it changing over time & why?

Ecological integrity –

Today is commonly understood as holistic concept and framework that focuses on conserving natural biodiversity using natural or historic range of variation as a reference point and promoting resilience (capacity to reorganize while undergoing change so as to retain essentially the same function, structure, identity and feedbacks).

Wurtzebach & Schultz 2016, Walker et al. 2004

Coastal Sage Scrub & Chaparral Vegetation Monitoring – Regional Approach



BIOLOGICAL CONSERVATION 140 (2007) 130–141

available at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/biocon

ELSEVIER

Developing terrestrial, multi-taxon indices of biological integrity: An example from coastal sage scrub

Jay E. Diffendorfer[a,], Genie M. Fleming[a], Jennifer M. Duggan[a], Robert E. Chapman[a], Matthew E. Rahn[a], Milan J. Mitrovich[a], Robert N. Fisher[b]*

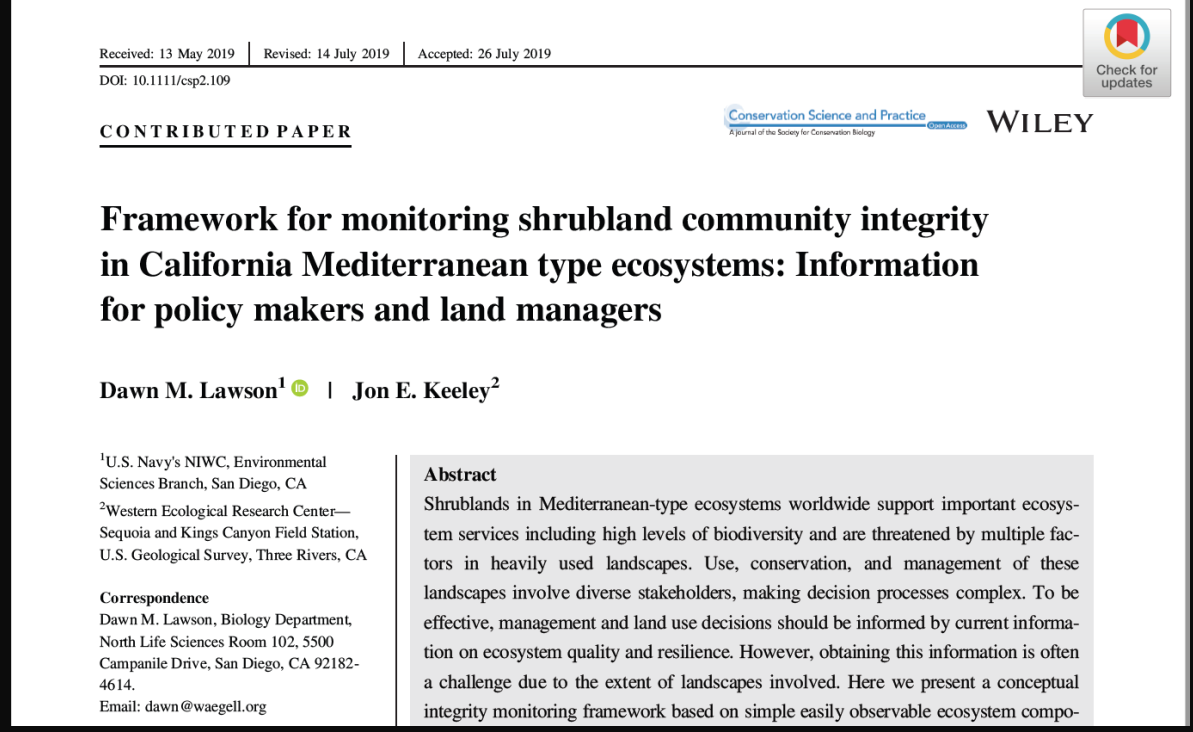
[a]San Diego State University, 5500 Campanile Dr., San Diego, CA 92182, United States
[b]United States Geological Survey San Diego Field Station, 4165 Spruance Road, Suite 200, San Diego, CA 92101-0812, United States

ARTICLE INFO

Article history:
Received 4 January 2007
Received in revised form
10 August 2007
Accepted 12 August 2007
Available online 1 October 2007

ABSTRACT

We screened 351 species or genera for their response to disturbance in coastal sage scrub (CSS) to develop a 15-metric, 5-taxon Index of Biological Integrity (IBI). We collected data on ants, birds, herpetofauna, small mammals, and plants for two years on 46 sites established across a gradient of disturbance in three reserves. The gradient spanned relatively intact CSS with thick stands of shrubs, to former CSS stands type-converted to exotic grasses. ANOVAs and clustering analyses indicated the IBI could distinguish four levels of disturbance in CSS. General measures of community structure, such as richness, did not show



Received: 13 May 2019 | Revised: 14 July 2019 | Accepted: 26 July 2019

DOI: 10.1111/csp2.109

CONTRIBUTED PAPER

Conservation Science and Practice

WILEY

Framework for monitoring shrubland community integrity in California Mediterranean type ecosystems: Information for policy makers and land managers

Dawn M. Lawson[1] | Jon E. Keeley[2]

[1]U.S. Navy's NIWC, Environmental Sciences Branch, San Diego, CA

[2]Western Ecological Research Center—Sequoia and Kings Canyon Field Station, U.S. Geological Survey, Three Rivers, CA

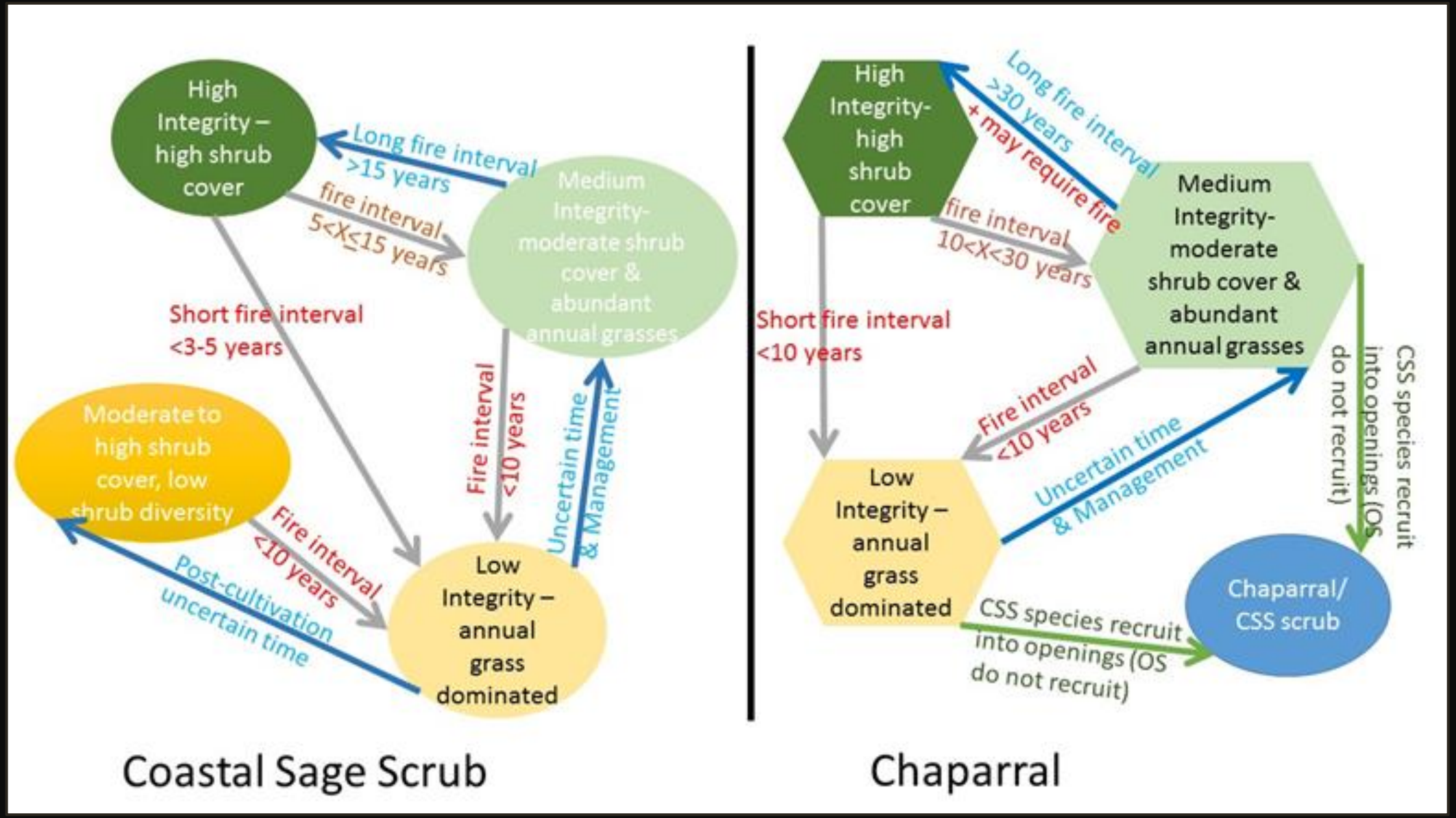
Correspondence
Dawn M. Lawson, Biology Department, North Life Sciences Room 102, 5500 Campanile Drive, San Diego, CA 92182-4614.
Email: dawn@waegell.org

Abstract

Shrublands in Mediterranean-type ecosystems worldwide support important ecosystem services including high levels of biodiversity and are threatened by multiple factors in heavily used landscapes. Use, conservation, and management of these landscapes involve diverse stakeholders, making decision processes complex. To be effective, management and land use decisions should be informed by current information on ecosystem quality and resilience. However, obtaining this information is often a challenge due to the extent of landscapes involved. Here we present a conceptual integrity monitoring framework based on simple easily observable ecosystem compo-

Ecological integrity broadly measured at landscape-scale as percent cover of nonnative annual grasses in shrublands

CSS & Chaparral Conceptual Model



Coastal Sage Scrub & Chaparral Vegetation Monitoring Components

- Vegetation mapping (10-15 years)
- Landscape scale ecological integrity – change over time & GIS-based threats:
  - ✓ Fire
  - ✓ Climate
  - ✓ Nitrogen deposition
  - ✓ Land use change
- Historic & recent vegetation data – change over time & threats
- Field based vegetation monitoring (2024) – cover & composition, ecological integrity & landscape model evaluation

Coastal Sage Scrub & Chaparral Vegetation Monitoring – Guiding Questions

1. What is distribution, composition, structure & integrity of CSS and chaparral vegetation communities in the MSPA?

2. How are these traits of the vegetation community changing over time?

3. What threats & abiotic factors are associated with changes in vegetation community attributes?

Similar questions for Vegetation Focus (VF) Species & taxa-based communities

Coastal Sage Scrub & Chaparral Vegetation Monitoring – VF Species


Patrica Gordon-Reedy


Jessie Vinje

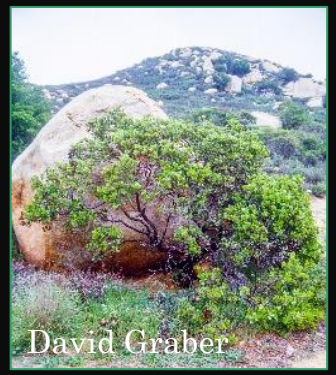

Andrew Borcher


Vince Scheidt


Keir Morse


John Martin


David Graber


David Graber


Keir Morse


John Martin


Patrica Gordon-Reedy


USGS Camera Trap


Chris Brown


Ron Wolf


Alexandra Houston

Coastal Sage Scrub & Chaparral Vegetation Monitoring – Taxa Groups

Pollinators

Arthropods

Reptiles

Birds

Mammals

Overall Approach

- Management and Monitoring Strategic Plan (MSP) 2017
  - https://sdmmp.com/msp_doc.php#volume2A_3
- Core = gathering existing GIS and remote sensing data and analyzing trends (annually)
- Core+ = long-term monitoring at permanent plots that measures plant composition, structure, integrity, abiotic components and threats (every 5 years)
- Core++ = rapid assessment protocols to assess animal species composition and presence/absence of targeted covered animal and plant species (first year- pollinator and rare plants only)

Core Monitoring
Office GIS/Remote Sensing Component

- Answers the questions:
  - 1. What is the integrity across the landscape?
  - 2. Where are areas of stability and areas of change over time?
  - 3. What abiotic or threat variables explain the variation over time and space?

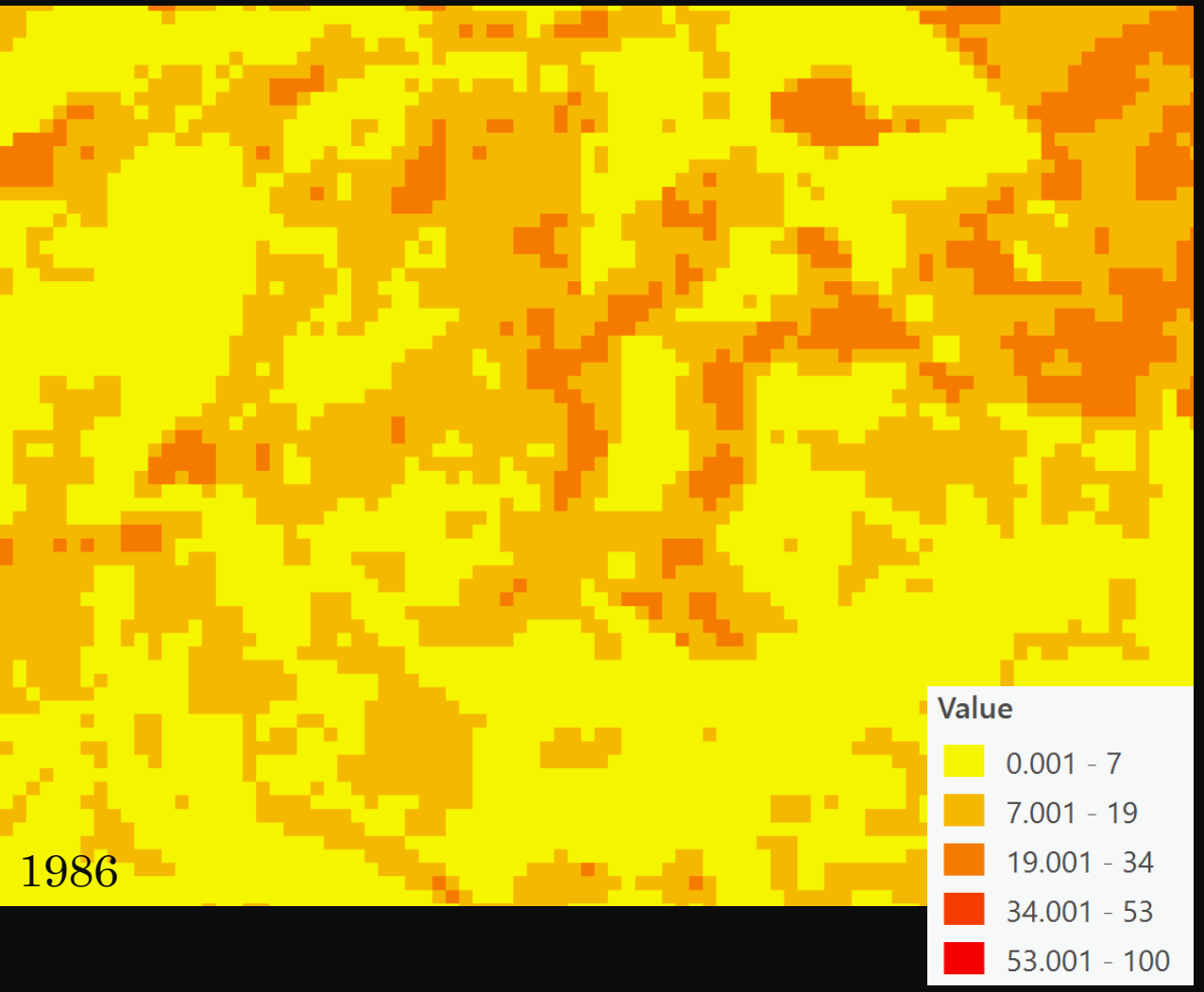
Core Monitoring
Office GIS/Remote Sensing Component

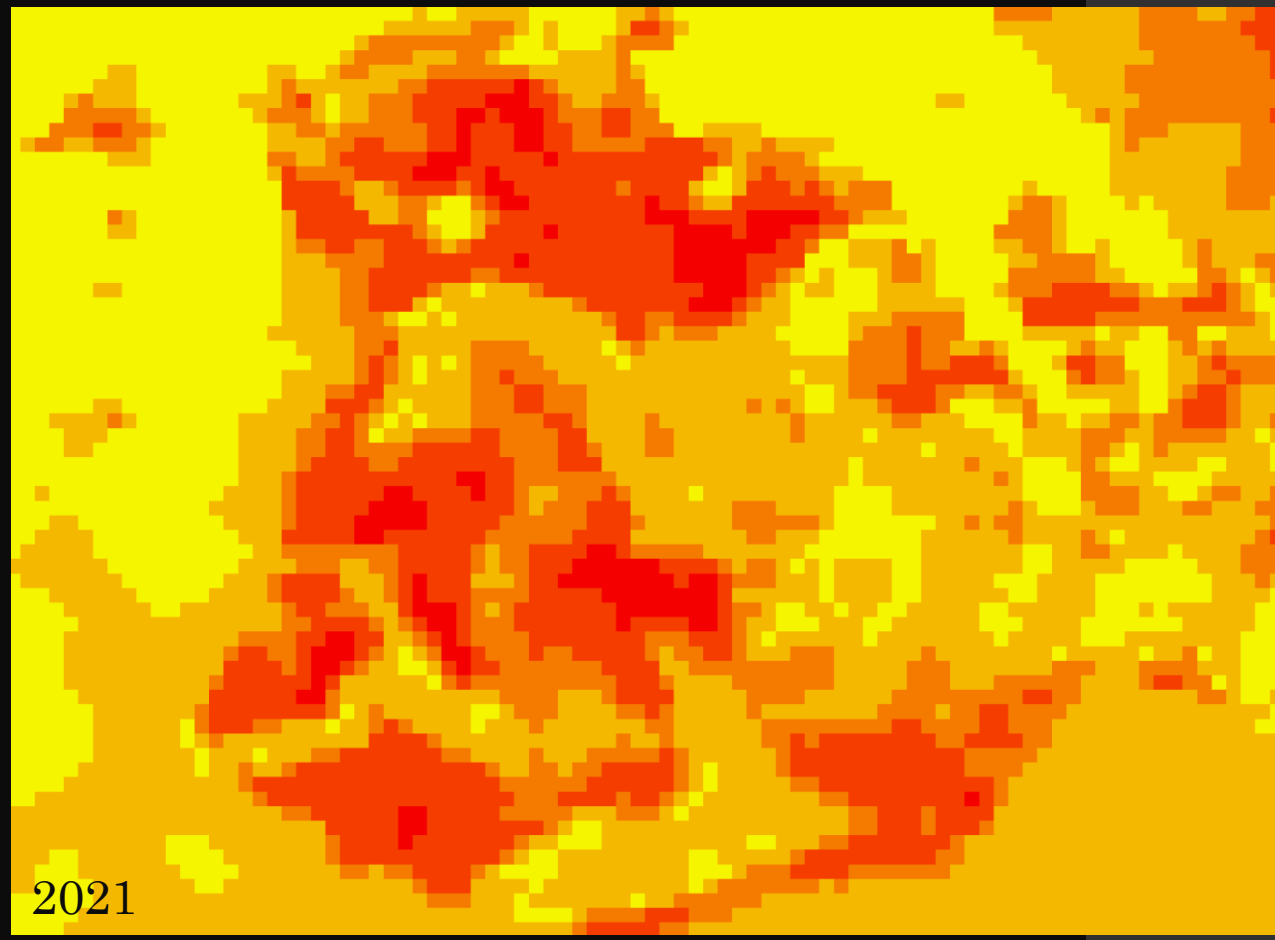
- Planned methods
  - Collect existing GIS and remote sensing products
    - Rangeland percent cover annual herbaceous, perennial herbaceous, bare ground, litter, shrub, tree
    - Climate data
    - Topographic data
    - Soil types and texture
    - Nitrogen deposition models
    - Fire perimeters and intensity
    - Drought indices

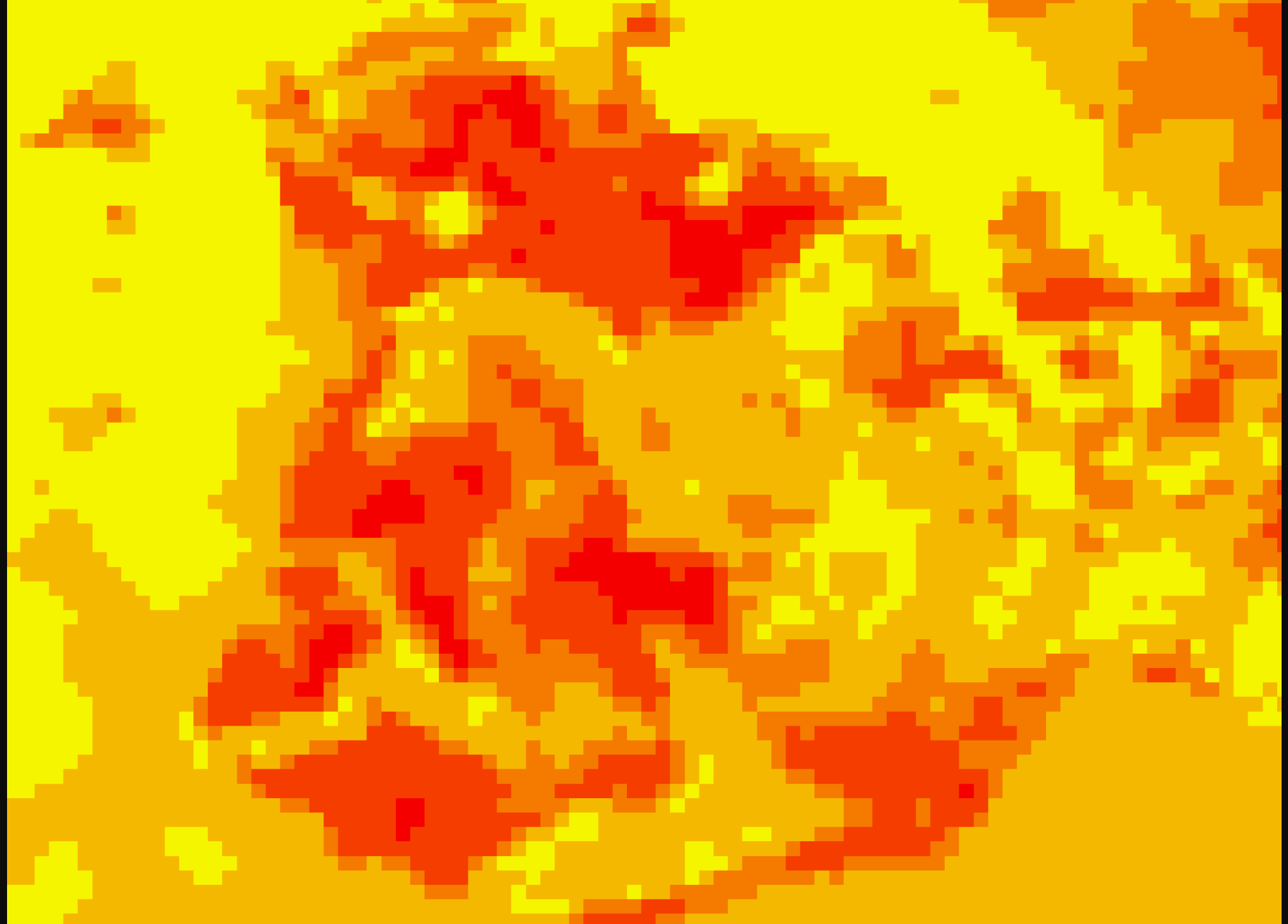
Percent cover data- Rangeland

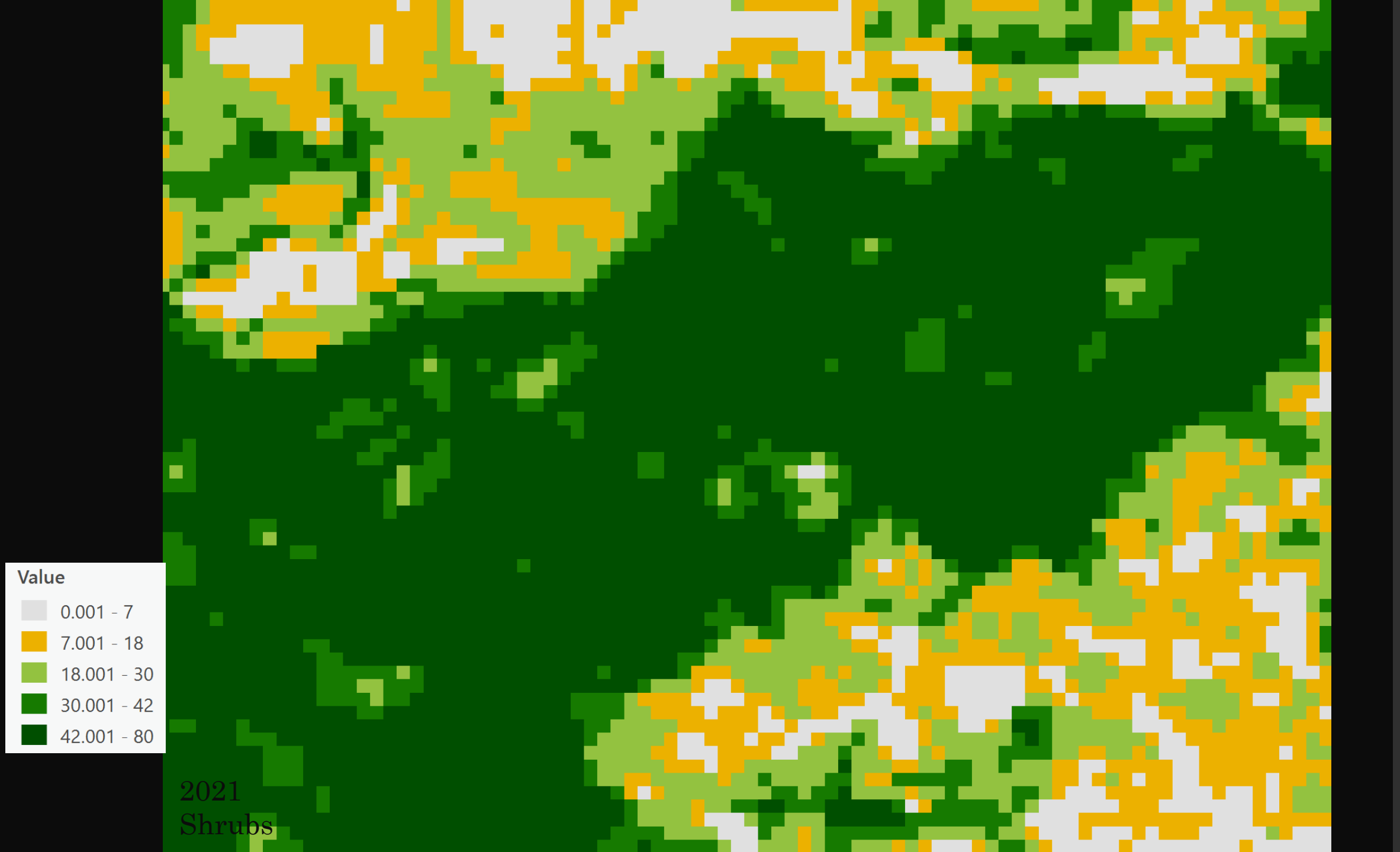
- LANDSAT-based product
- Annual outputs from 1985-present
- Provides percent cover for: annual herbaceous, perennial herbaceous, litter, bare ground, shrubs, trees
- Allred et 2021. Improving Landsat predictions of rangeland fractional cover with multitask learning and uncertainty - Allred - 2021 - Methods in Ecology and Evolution - Wiley Online Library

Annual Herbaceous








Value
0.001 - 7
7.001 - 18
18.001 - 30
30.001 - 42
42.001 - 80
2021
Shrubs

Core+
Permanent Field Plots

- Answers the questions:
  - 1. Validate and update remote sensing models and GIS
  - 2. What is the composition and structure of shrublands?
  - 3. How are changes in functional cover related to composition changes?
  - 4. What areas are changing in integrity and composition?
  - 5. What species are indicators of high or low integrity?
  - 6. What covariates are associated with changes?

Core+
Permanent Field Plots

- Planned methods
  - 2020 AECOM pilot study
  - Used UAS to collect very high-resolution imagery
  - Identified plant species from imagery on a SLATS transects design
  - 90m plots with 30m subplots

Core+
Permanent Field Plots

- Pros of UAS:
  - Less destructive to the site
  - Images are kept forever and can be classified in any pattern later
  - Faster and cheaper than traditional transects
  - Can provide height information across the plot
- Cons:
  - Only view the top of the canopy
  - Herbaceous cover is difficult to identify to species level

Top of canopy v total invasive cover

- Vegetation surveys from pitfall traps and CAGN plots
- Correlation between top of canopy and total invasive grass cover R=0.89

Addition of herbaceous quadrats

- 4 quadrats per 90m plot ($1m^2$ each)
- Species level identification and percent cover will be recorded

Core+
Permanent Field Plots

- Soil metrics
  - Soil color
  - Soil moisture and texture
  - Total N, Total C, NO_3, NH_4, pH, P, Ca, K
- Identification of cryptogamic crust in the field

Core++
Animal composition and target species surveys

- Answers the questions:
  - 1. How do animal species respond to changes in plant composition and integrity?
  - 2. How are animal communities changing over time?
  - 3. What indicator species are associated with high and low integrity?

Core++
Animal composition and target species surveys

- Planned methods
  - First year will include pollinator surveys only
  - Future years-
    - Taxa-based rapid assessments
    - Target species-specific surveys
      - CA glossy snake
      - Blainville's Horned Lizard
      - SD Black-tailed Jackrabbit
      - Bell's Sparrow
      - Grasshopper Sparrow
      - Loggerhead Shrike
      - 12 rare plant species

Rapid Assessment Protocols

Bird point counts can generate big species list fast

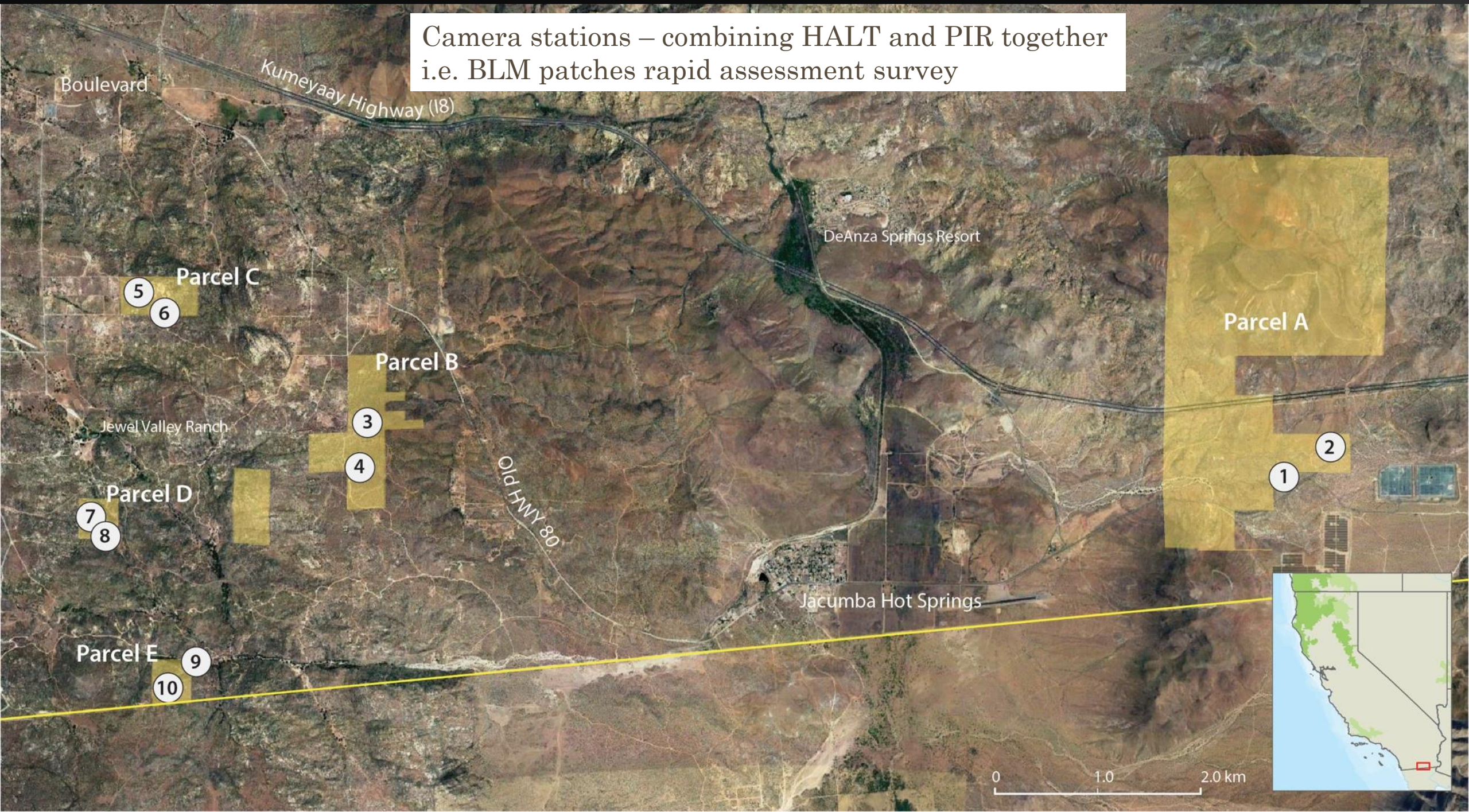
Camera stations – combining HALT and PIR together

Cover board surveys

Rapid Assessment Protocols

Avian point counts for target species such as:
Grasshopper sparrow, Bell's sparrow,
Loggerhead shrike

Camera stations – combining HALT and PIR together i.e. BLM patches rapid assessment survey



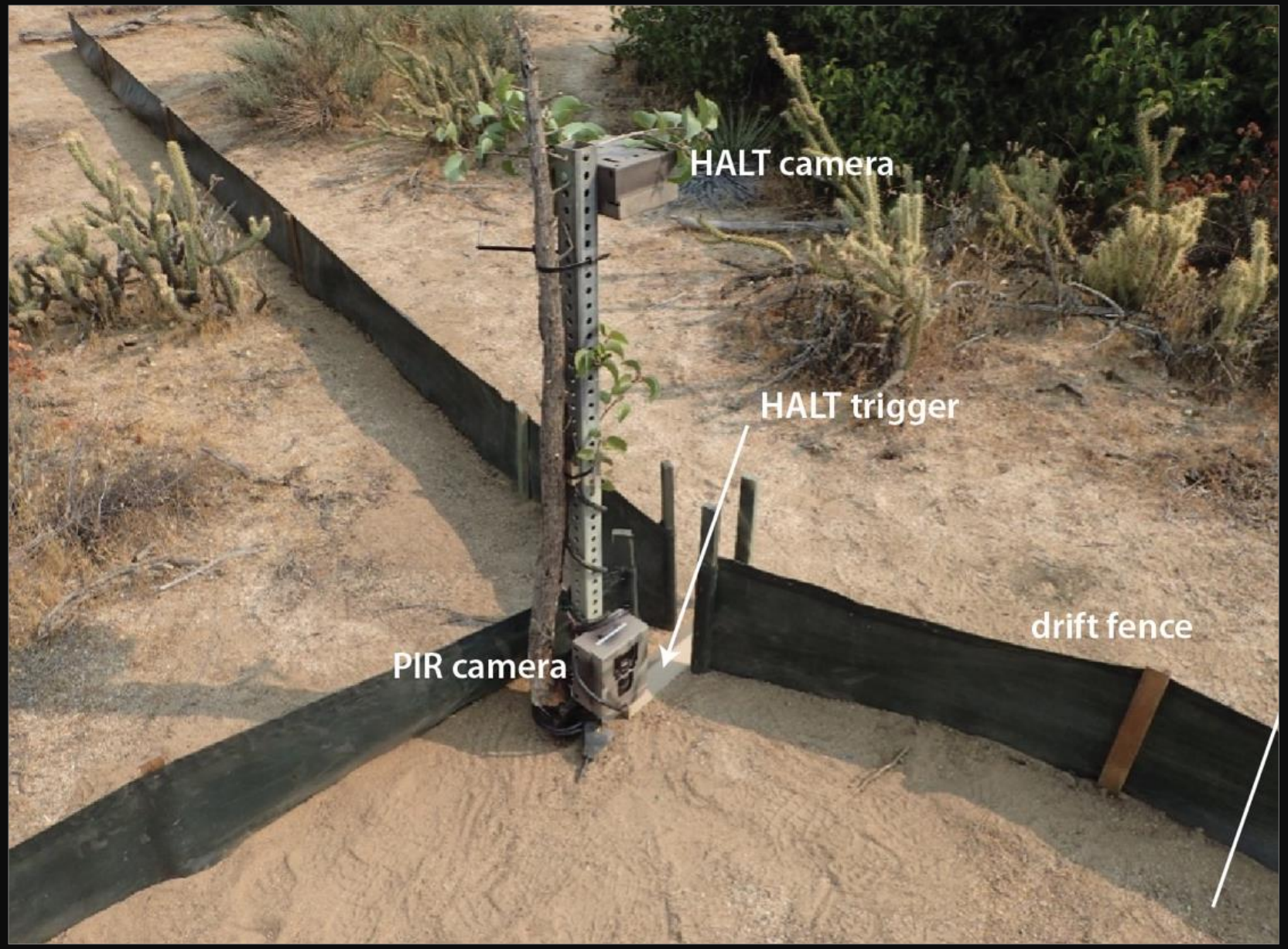

USGS

Rapid Assessment Protocols

Camera set up overview

Rapid Assessment Protocols

Camera set-up close-up



Rapid Assessment Protocols

Target species such as: Black-tailed jackrabbit

Rapid Assessment Protocols

Target species such as: Blainville's Horned Lizard

Rapid Assessment Protocols

Target species such as: California glossy snake

Rapid Assessment Protocols

Summary of camera type comparison for these BLM patches

Common Name	Genus	Species	PIR	HALT	Both
Bird					
Black-Throated Sparrow	*Amphispiza*	*bilineata*	-	-	X
California Quail	*Callipepla*	*californica*	X	-	-
Cactus Wren	*Campylorhynchus*	*brunneicapillus*	-	-	X
Greater Roadrunner	*Geococcyx*	*californianus*	X	-	-
California Towhee	*Melozone*	*crissalis*	-	-	X
Bewick's Wren	*Thryomanes*	*bewickii*	-	X	-
California Thrasher	*Toxostoma*	*redivivum*	X	-	-
Bobcat					
Bobcat	*Lynx*	*rufus*	-	-	X
Coyote					
Coyote	*Canis*	*latrans*	X	-	-
Deer					
Mule Deer	*Odocoileus*	*hemionus*	X	-	-
Fox					
Grey Fox	*Urocyon*	*cinereoargenteus*	-	-	X
Lizard					
Western Whiptail	*Aspidoscelis*	*tigris*	-	X	-
Western Banded Gecko	*Coleonyx*	*variegatus*	-	X	-
Cope's Leopard Lizard	*Gambelia*	*copeii*	-	X	-
Blainville's Horned Lizard	*Phrynosoma*	*blainvillii*	-	X	-
Desert Spiny Lizard	*Sceloporus*	*magister*	-	X	-
Granite Spiny Lizard	*Sceloporus*	*orcutti*	-	X	-
Side-Blotched Lizard	*Uta*	*stansburiana*	-	X	-
Rabbit					
Jackrabbit	*Lepus*	*californicus*	-	-	X
Desert Cottontail	*Sylvilagus*	*audubonii*	-	-	X
Brush Rabbit	*Sylvilagus*	*bachmani*	-	-	X
Rodent					
Pocket Mouse	*Chaetodipus*	spp.	-	-	X
Kangaroo Rat	*Dipodomys*	spp.	-	-	X
California Vole	*Microtus*	*californicus*	-	X	-
Woodrat	*Neotoma*	spp.	-	-	X
Southern Grasshopper Mouse	*Onychomys*	*torridus*	-	X	-
Pocket Mouse	*Perognathus*	*longimembris*	-	X	-
Deer Mouse	*Peromyscus*	*maniculatus*	-	X	-
White-footed Mouse	*Peromyscus*	spp.	-	-	X
Western Harvest Mouse	*Reithrodontomys*	*megalotis*	-	X	-
Shrew					
Desert Gray Shrew	*Notiosorex*	*crawfordi*	-	X	-
Skunk					
Striped Skunk	*Mephitis*	*mephitis*	-	-	X
Snake					
Southern Pacific Rattlesnake	*Crotalus*	*oreganus*	-	X	-
Red Diamond Rattlesnake	*Crotalus*	*ruber*	-	X	-
Baja California Coachwhip	*Masticophis*	*fuliginosus*	-	-	X
California Whipsnake	*Masticophis*	*lateralis*	-	X	-
Gopher Snake	*Pituophis*	*catenifer*	-	X	-
Lyre Snake	*Trimorphodon*	*lyrophanes*	-	X	-
Squirrel					
Antelope Ground Squirrel	*Ammospermophilus*	*leucurus*	-	-	X
California Ground Squirrel	*Spermophilus*	*beecheyi*	-	-	X

Rapid Assessment Protocols

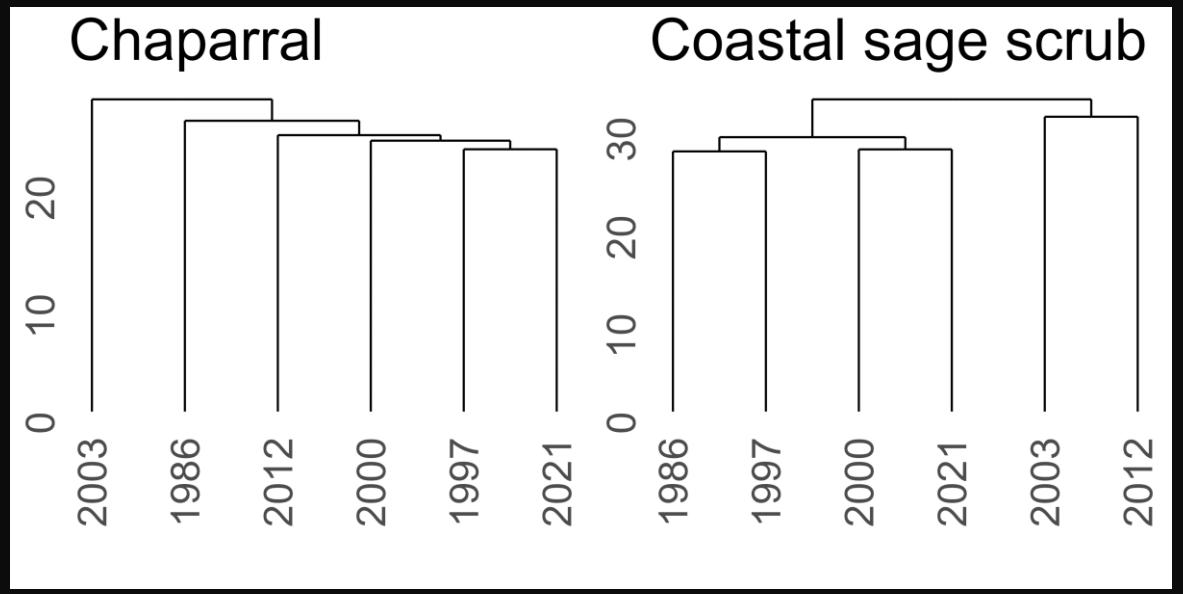
Possible use of cover boards at sites

TABLE 1—Summary data for reptile and amphibian captures in El Monte Valley, Lakeside, California (June 2015–May 2016). Columns indicate the number of captures based on the different survey methods (FLT = drift fence line traps; CB = coverboard; WT = walking transect; ND = night driving; INC = incidental sighting). "Section" indicates all sampling sections where a particular species was captured, including incidental sightings (INC).

Common name	Scientific name	FLT	CB	WT	ND	INC	Total	Section
Snakes								
Southern Pacific rattlesnake	*Crotalus oreganus helleri*	12	1	27	1	12	53	1–5
California glossy snake[a]	*Arizona elegans occidentalis*	3	9	3	0	8	23	1, 3–5
San Diego gopher snake	*Pituophis catenifer annectens*	6	0	4	6	6	22	1–5
California kingsnake	*Lampropeltis californiae*	9	1	1	2	1	14	1–5
Red racer	*Coluber flagellum piceus*	5	3	1	0	4	13	1, 2, 4, 5
California striped racer	*Coluber lateralis*	4	4	0	1	1	10	1–5
Southwestern threadsnake	*Rena humilis humilis*	0	0	3	0	3	6	1–3
Red diamond rattlesnake[a]	*Crotalus ruber*	0	0	0	1	2	3	1
Long-nosed snake	*Rhinocheilus lecontei*	0	1	0	0	1	2	2
San Diego nightsnake	*Hypsiglena ochrorhyncha klauberi*	0	1	0	0	0	1	4
Western black-headed snake	*Tantilla planiceps*	0	0	1	0	0	1	1
San Diego ringneck snake	*Diadophis punctatus similis*	0	0	0	0	1	1	1
Coast patch-nosed snake[a]	*Salvadora hexalepis virgultea*	0	0	0	0	1	1	2

Planned Analysis

- Vegetation – Annual Rangeland Data
  - Percent Cover Trends
    - Change in Percent Cover
    - Anova and PERMANOVA
  - MDS plots
    - Within year clustering
  - Cluster Dendrograms
    - Between year clustering

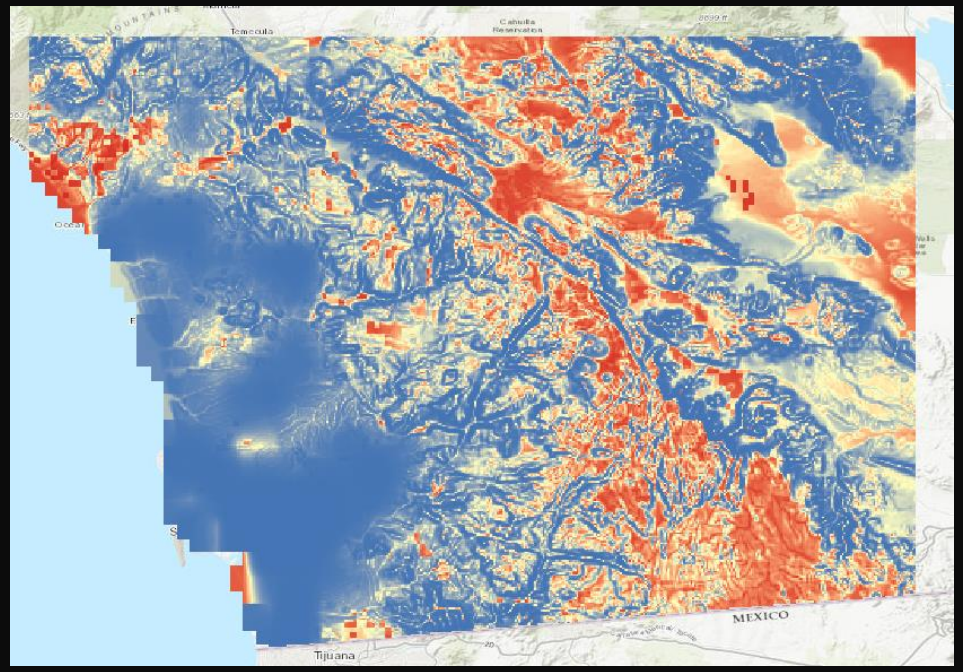


Planned Analysis

- Vegetation – Multi-Year Field data
  - Composition
    - PERMANOVA
      - Tests for difference between years in Multivariate data
    - BioEnv
      - Tests for environmental drivers associated with change
    - Indicator Species Analysis
      - Determines what species or communities indicate change
    - Geographic distributions
  - Structural Diversity
    - Report richness of species and traits over time

Planned Analysis

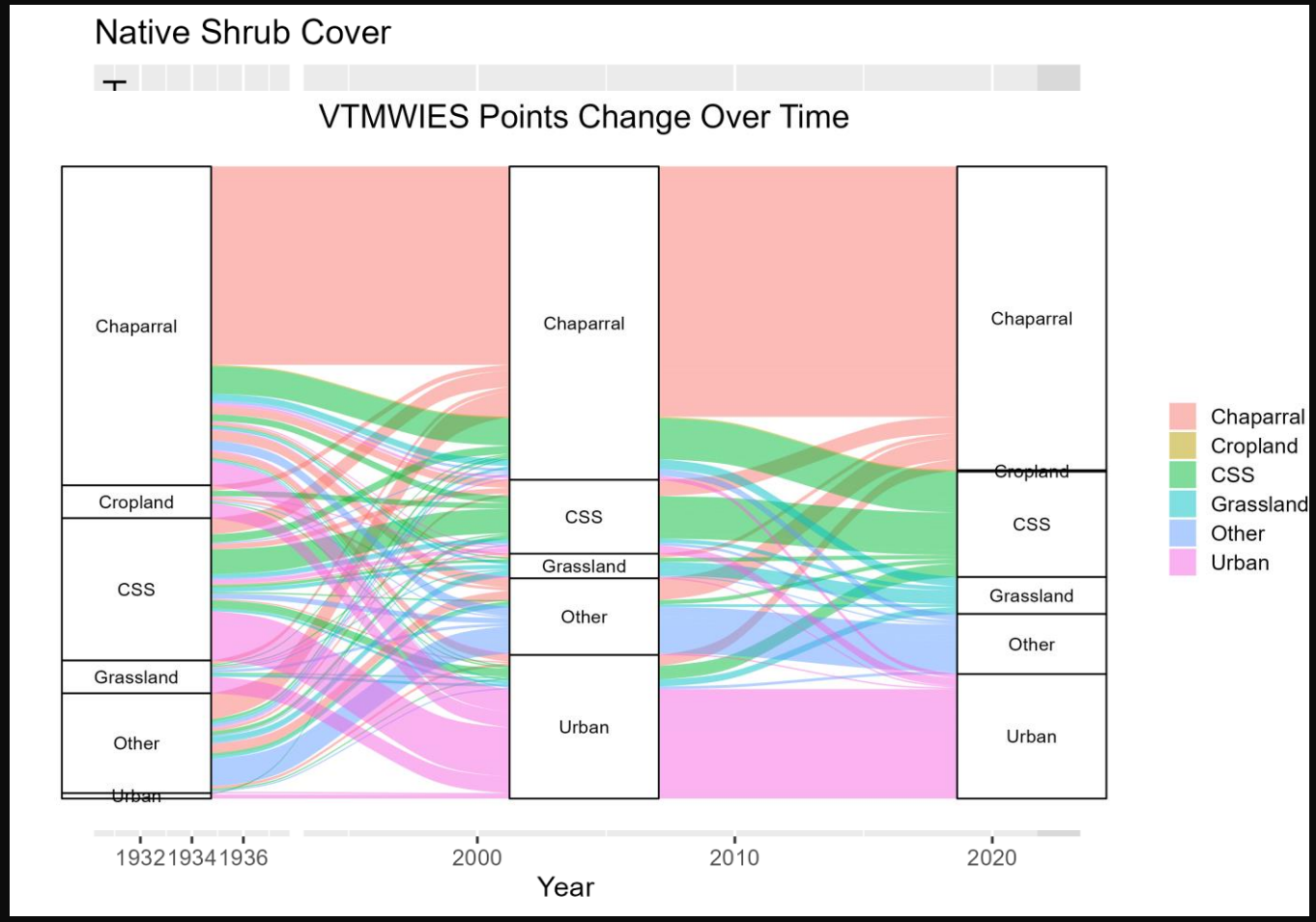
- Animal – Multi-Year Field data
  - Species richness
  - Geographic distribution
    - Joint-Species Distribution



Ex: American Badger

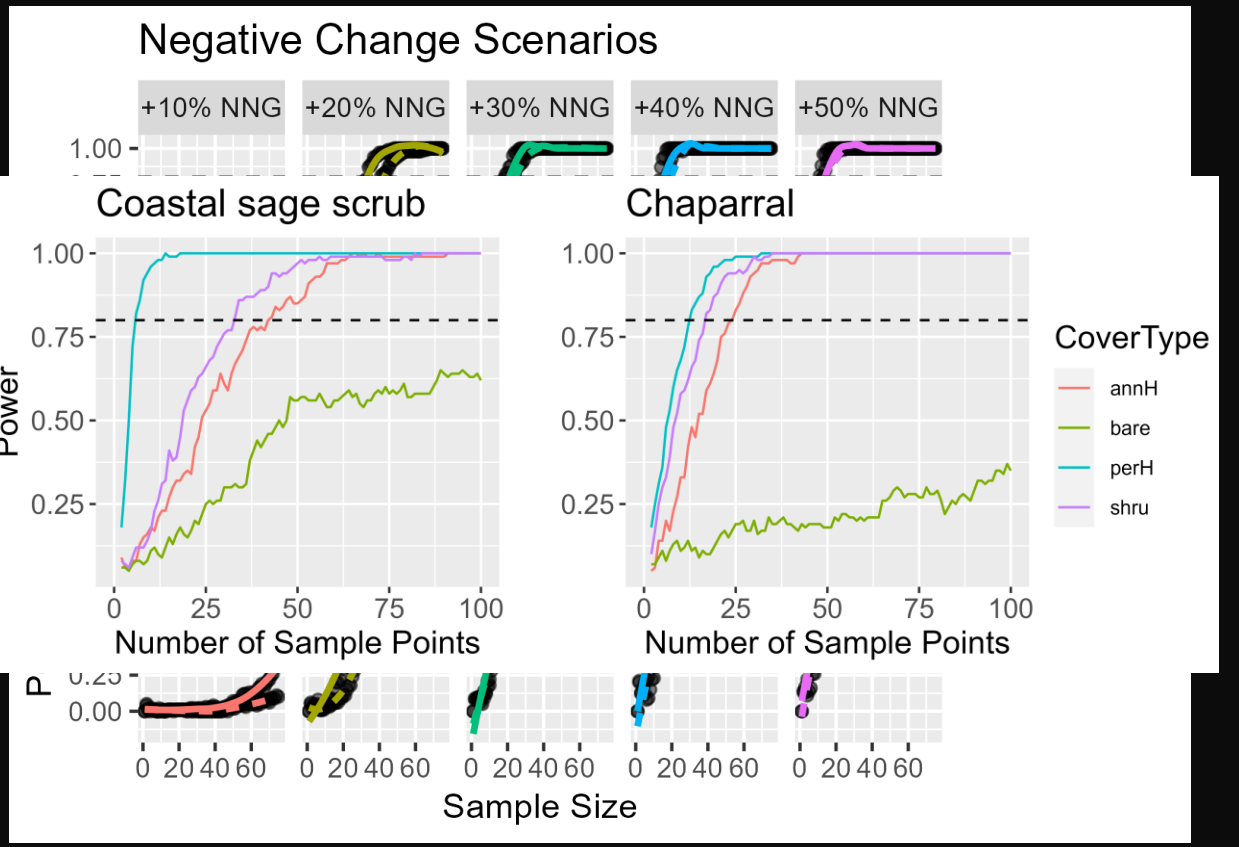
Historical Analysis

- Datasets
  - VTM:
    - 1931 – 1937; ~350 site visits
  - USGS Pitfall:
    - 1995 – 2012; 6 – 48 sites per year
  - USGS Gnatcatcher:
    - 2016 and 2020; ~330 sites each year
  - Rangeland Data



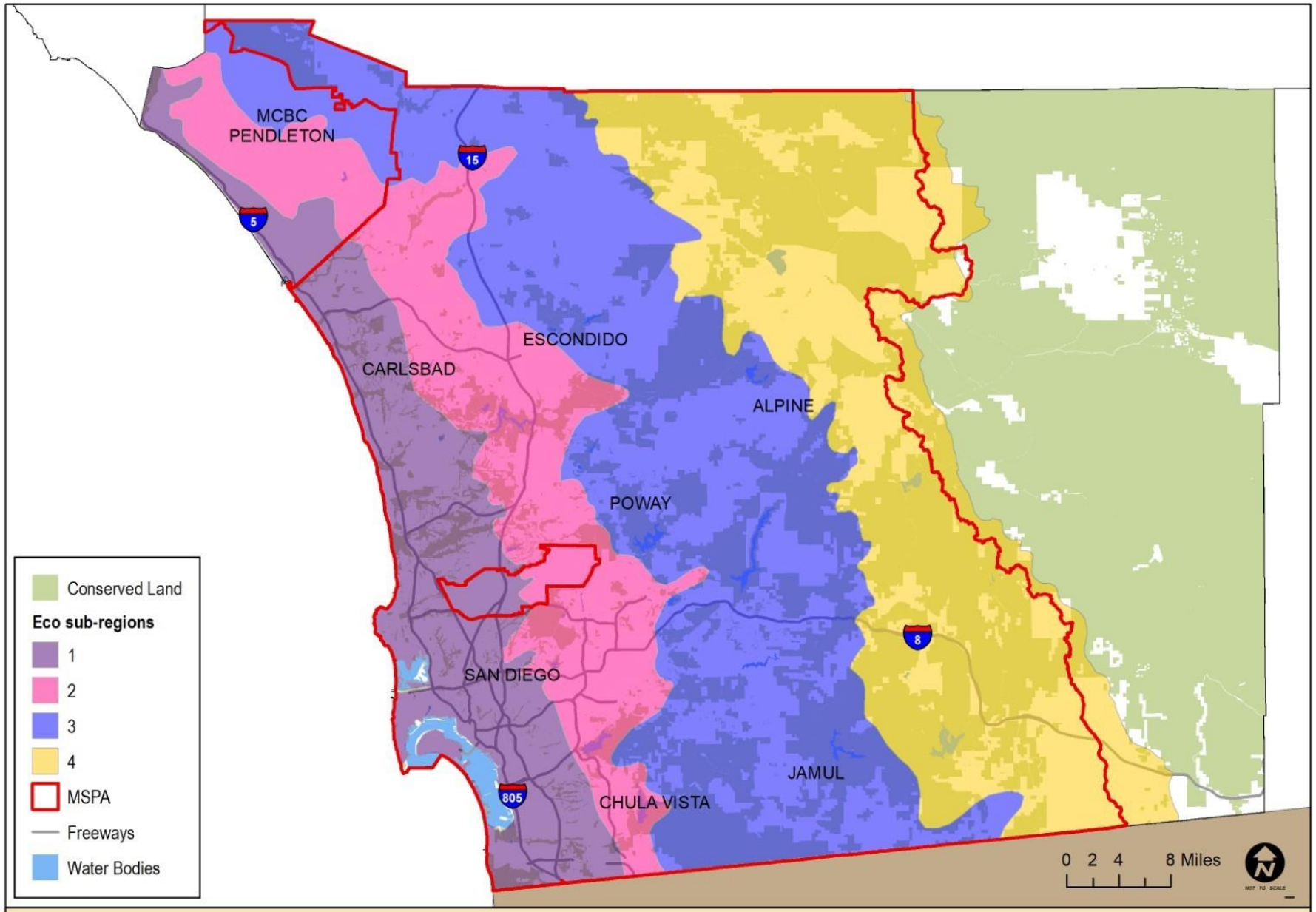
Plot selection

- Power Analysis
  - Simulation
    - Historic Rangeland Data
      - Mean Non-native Grass Cover
    - ANOVA
      - **What % of simulations detect difference between 2 years?**
  - Real Data
    - Rangeland: 1986 v. 2003



Plot Selection

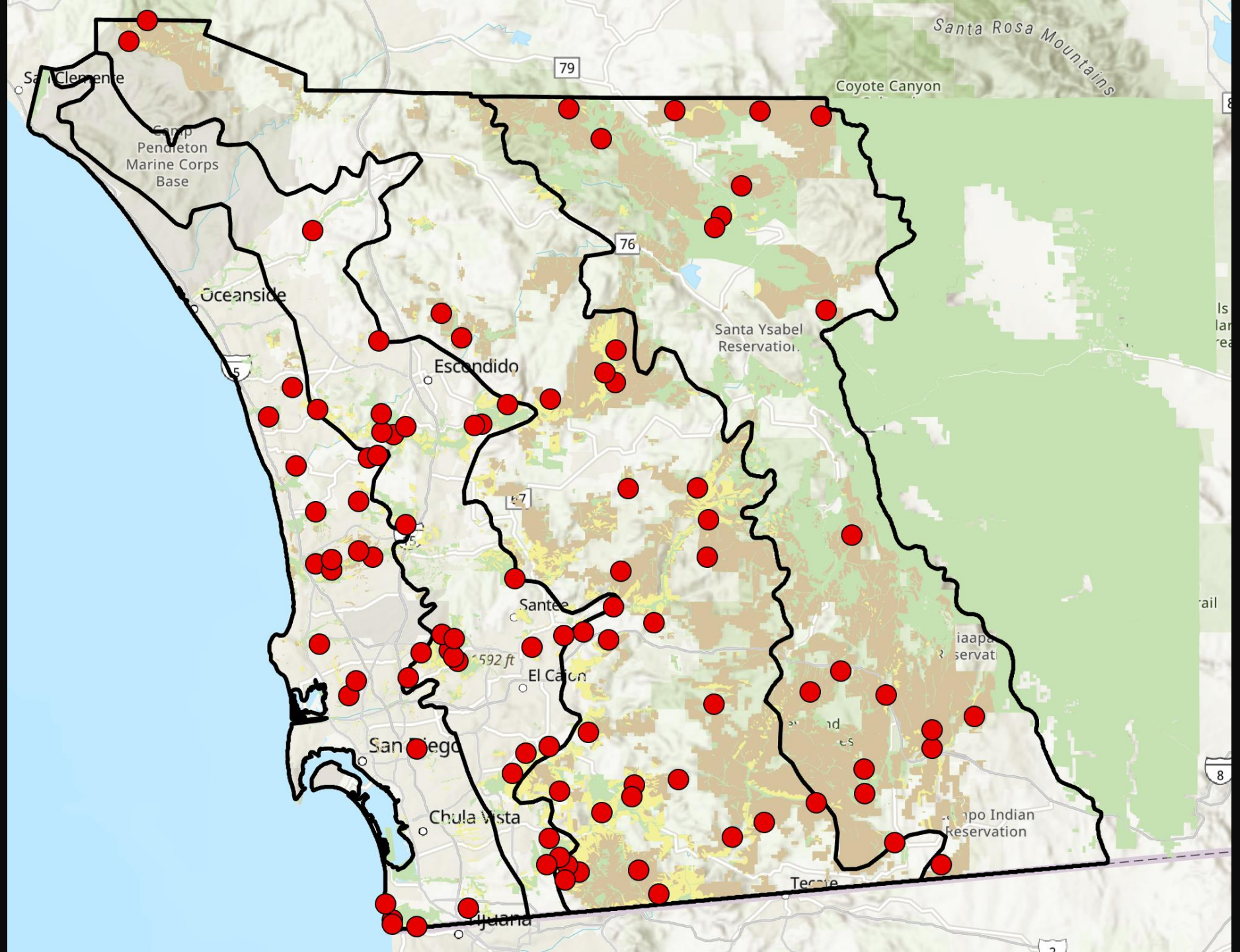
- Sampling Frame and Sampling Design
- Vegetation communities taken from 1930s map of CSS and chaparral to capture any sites that have already type-converted
- Limited to conserved lands with willing partners
- 60 CSS plots and 40 chaparral plots



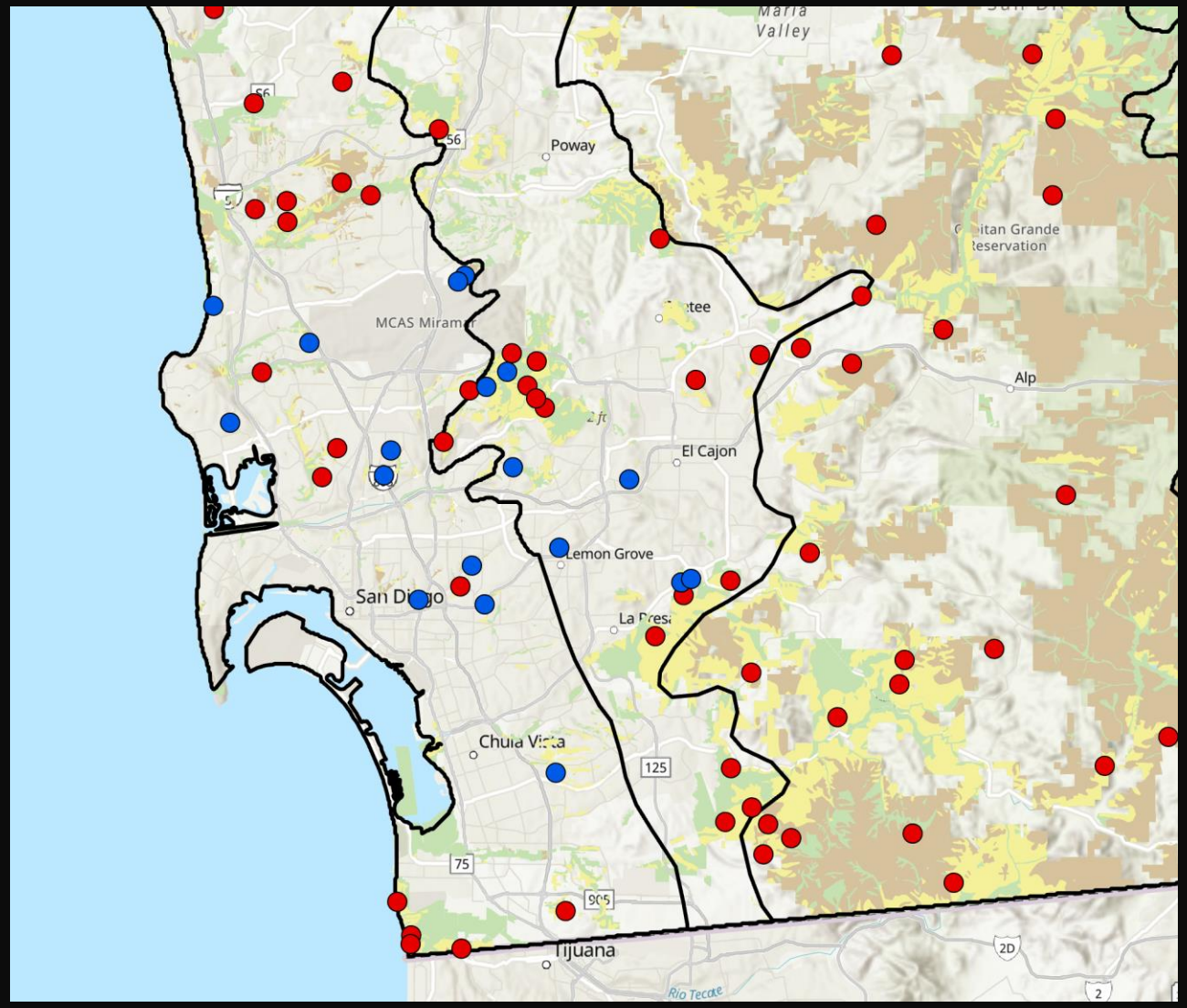
Eco sub-regions in the MSPA

Plot Selection

Vegetation Community	Subregion 1	Subregion 2	Subregion 3	Subregion 4
CSS	17	18	18	7
Chaparral	5	9	13	13


Santa Rosa Mountains
Coyote Canyon
79
Camp Pendleton Marine Corps Base
76
Oceanside
Santa Ysabel Reservation
Escondido
5
67
Santee
592 ft
El Cajon
San Diego
Chula Vista
Indian Reservation
Tecate
Tijuana
8

Pollinator Sites (blue)



Summary

- A combination of methods are proposed to answer various aspects of all the questions
- Methods will take place in phases
- Historical analysis of GIS and field data will guide decisions
- Spring 2024- first field plot surveys

- Please send any additional comments or questions to Emily Perkins
- eperkins@usgs.gov