An Integrative Approach to Restoration Performance Monitoring

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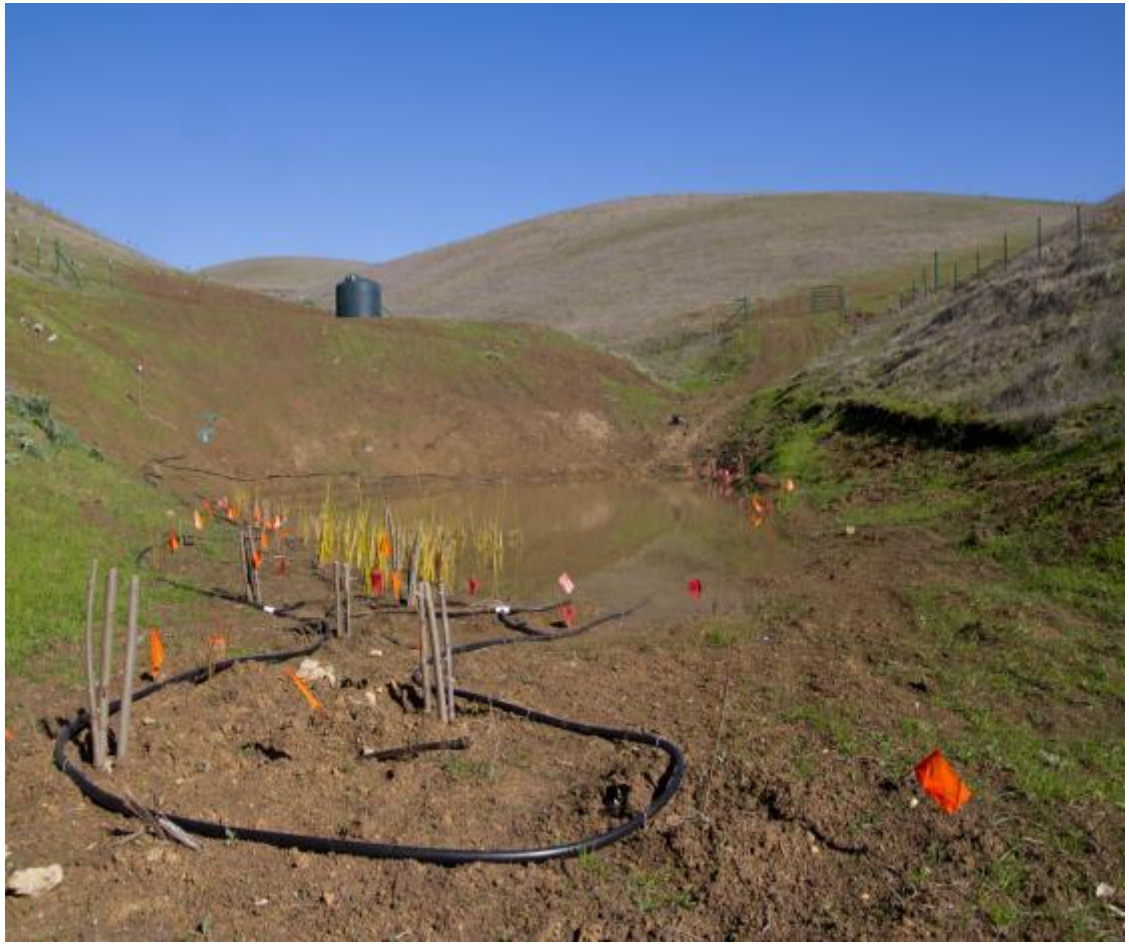
Company Overview

- Offices in Bay Area, San Diego, North Coast, and Denver
- WRA offers a unique blend of multidisciplinary professionals and use the latest technology to deliver innovative and creative mitigation solutions to our clients.
- Ecologists, regulatory specialists, GIS analysts, financial experts

Restoration and Monitoring

- Why?
- Meet regulatory requirements
- Meet environmental goals
- Ensure return on investment

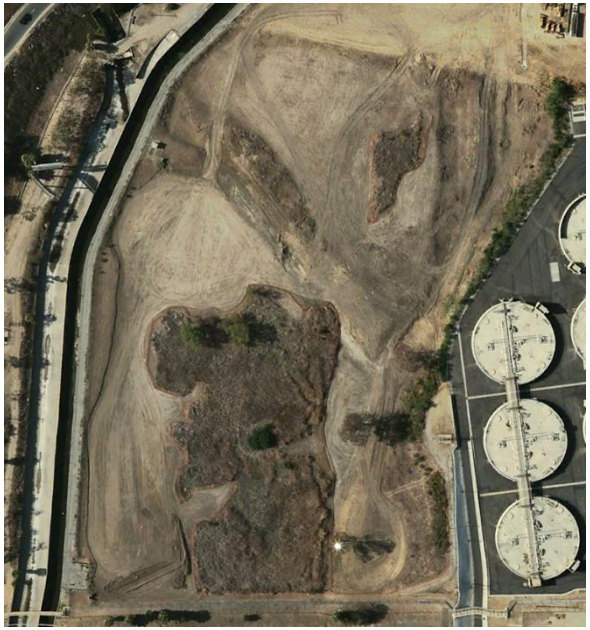
Restoration in Action



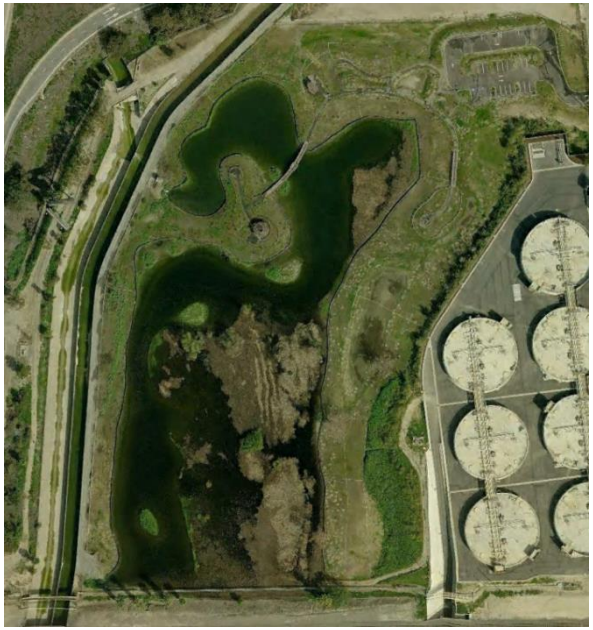
Restoration in Action

Bixby Marsh Restoration

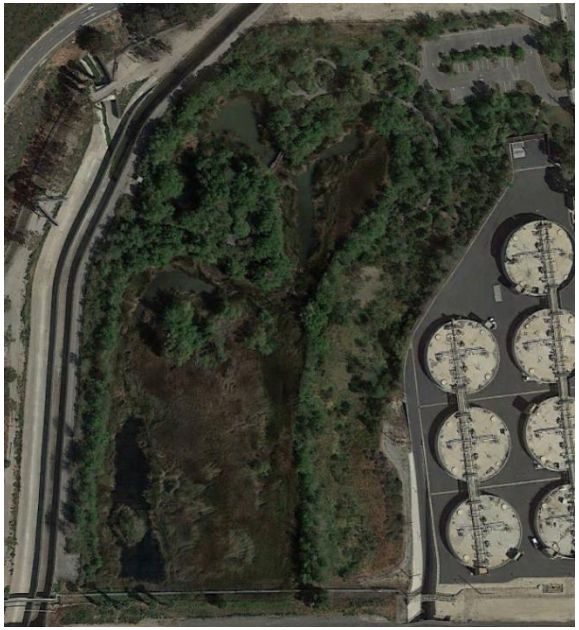
2007



2008



2015



Restoration in Action

Common Monitoring Objectives

- Erosion
  - Grading
  - Topography
  - Sediment
- Habitat Components
  - Plants/vegetation
  - Wildlife
  - Aquatic features
- Invasive Species Management
  - Presence monitoring
  - Treatment

Traditional Monitoring Approach

- Field Biology
  - Data collection
  - Photos
  - Reports
- Recurring annual reports
- Lots of valuable data
- Consistency?
- Efficiency?
- Effectiveness?

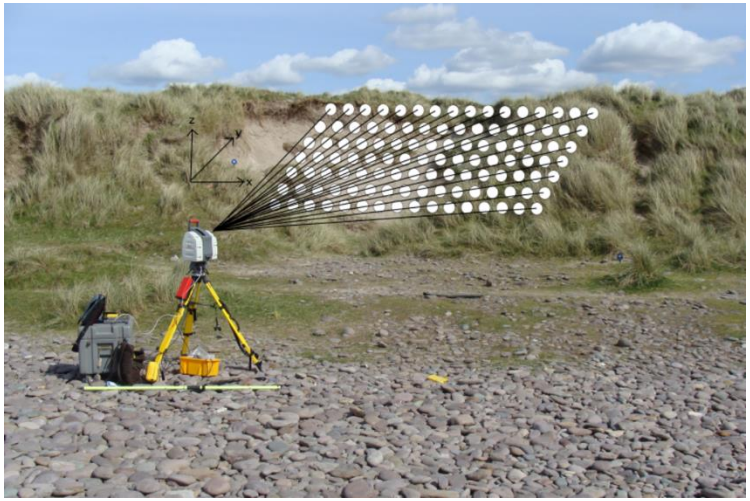
Integrative Approach

- Leverage technology for data collection
- Repeatable workflows
  - Remote sensing algorithms
  - Geoprocessing models
  - Scripting
- High resolution for advanced analysis
- Focus field bio efforts
- Obtain better monitoring results
- Hyper-local site characterization

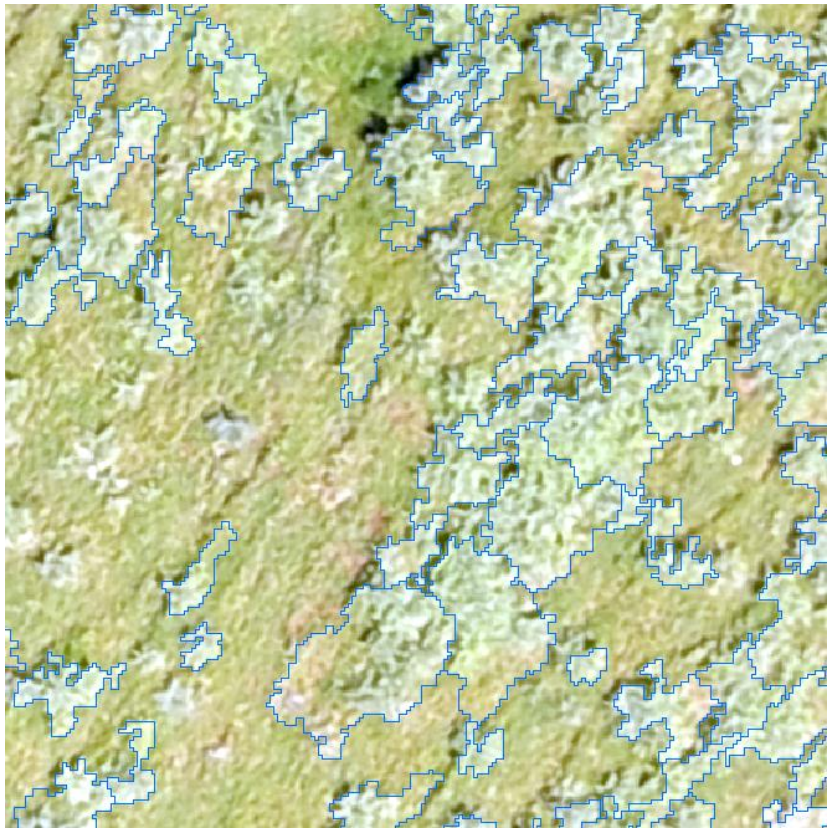
Integrative Approach Tools

UAVs

Terrestrial/Airborne LIDAR



Remote Sensing



Case Studies

- Yosemite Slough Tidal Restoration
  - Success criteria monitoring
- Dotson Family Marsh Restoration
  - Success criteria monitoring
- Ridge Top Ranch Wildlife Conservation Bank
  - Invasive weed management
- Petersen Ranch Mitigation Bank
  - Elizabeth Lake parcel dam restoration topography

Yosemite Slough Tidal Restoration

- Complex restoration and remediation project
- Highly degraded tidal marsh; restored 10 acres along the SF Bay
- SFO, BART, and grants funded project
- Currently moving forward with incorporation in to Candlestick Point State Recreation Area

Yosemite Slough Monitoring

- Monitor the growth of pickleweed
  - Restoration success criteria
- Integrative Approach pilot project for WRA
- Techniques
  - High-res UAV imagery
  - Side scanning LIDAR
  - Desktop spatial analysis
  - Remote sensing
  - Field cross-checks

Site Overview

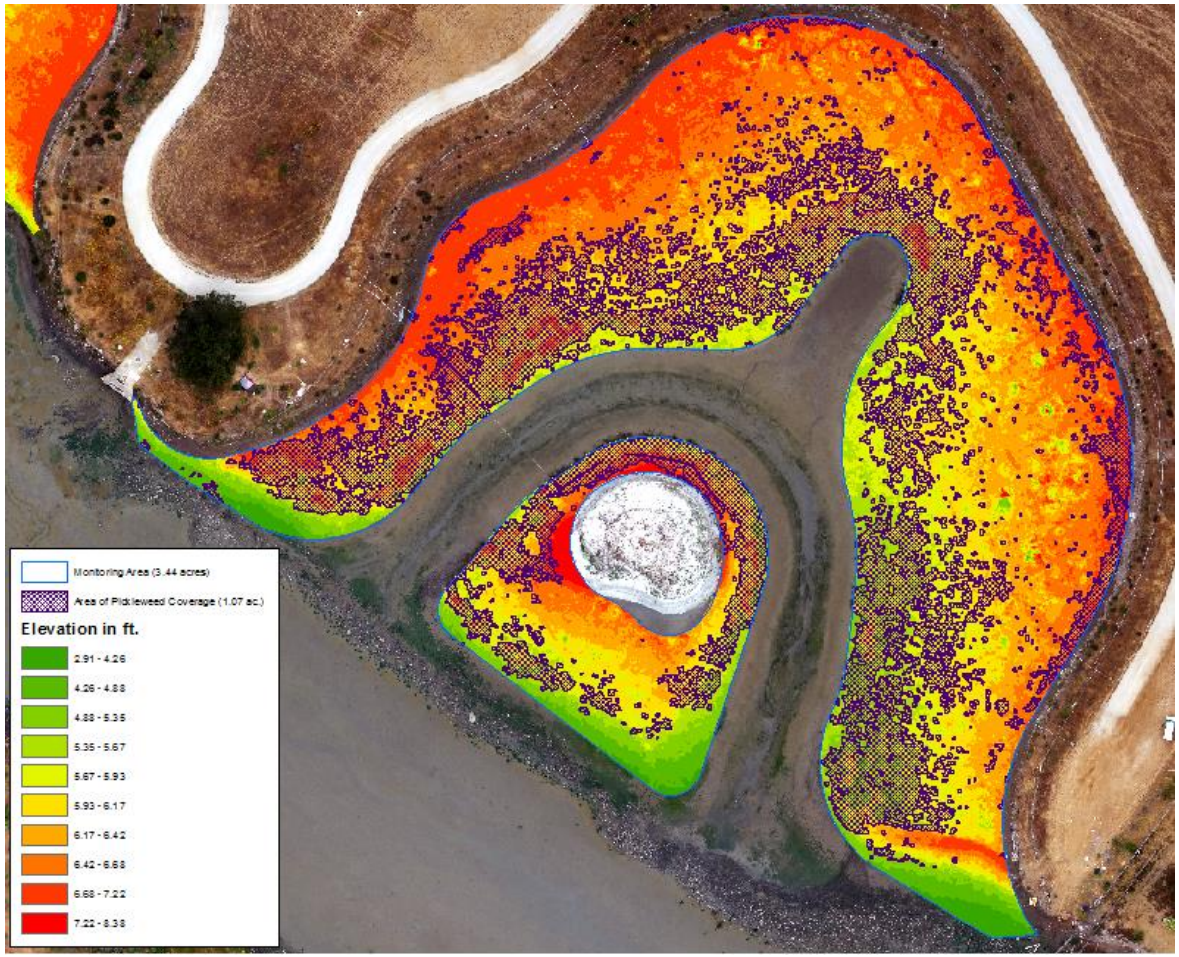
Traditional vs. UAV % Cover

Traditional Method

Computational Spatial Analysis Method

Yosemite Slough Results

- Characterize elevation zones for monitoring species
- Gain insight into future design
- Where does pickleweed best perform?



Dotson Family Marsh

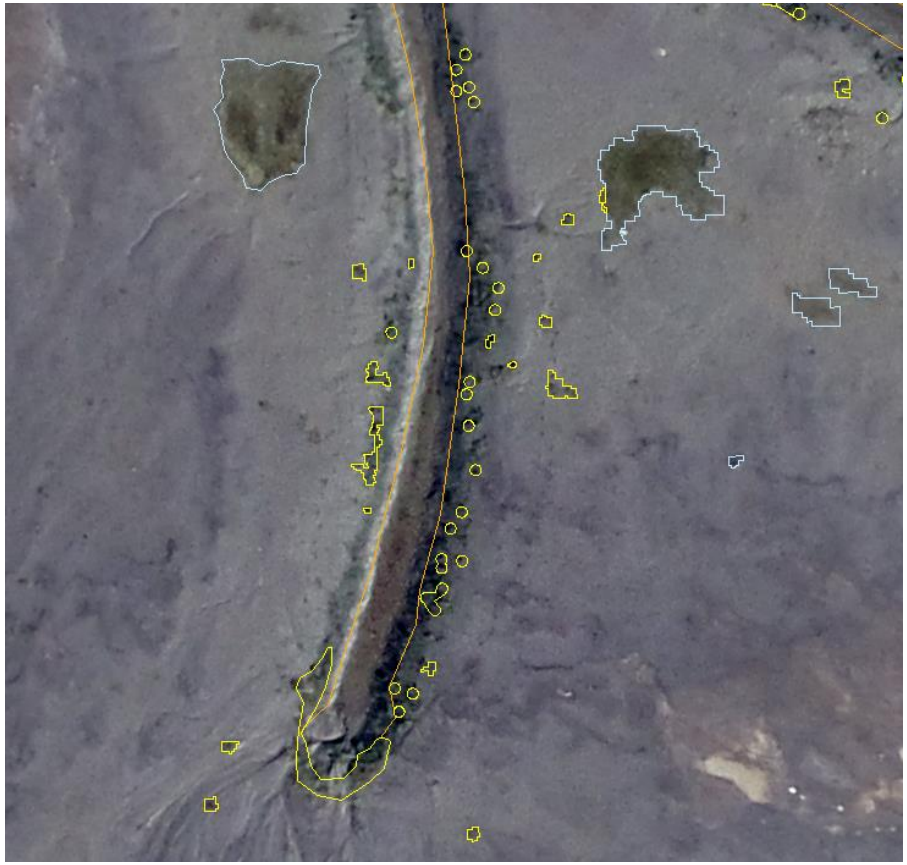
- Complex restoration along Contra Costa County shoreline
- Restored 30 acres of tidal marsh and seasonal wetlands
- Habitat for salt marsh harvest mouse and ridgway's rail
- First restoration project in the Bay Area to design for sea level rise

Dotson Marsh Monitoring

- Similar to Yosemite Slough
- Monitor the growth of pickleweed
  - Restoration success criteria
- Multiple years of monitoring
  - 3 years of UAV imagery
- Integrative approach allows quantification of growth change

Change Tracking

2015



2016

Dotson Marsh Results

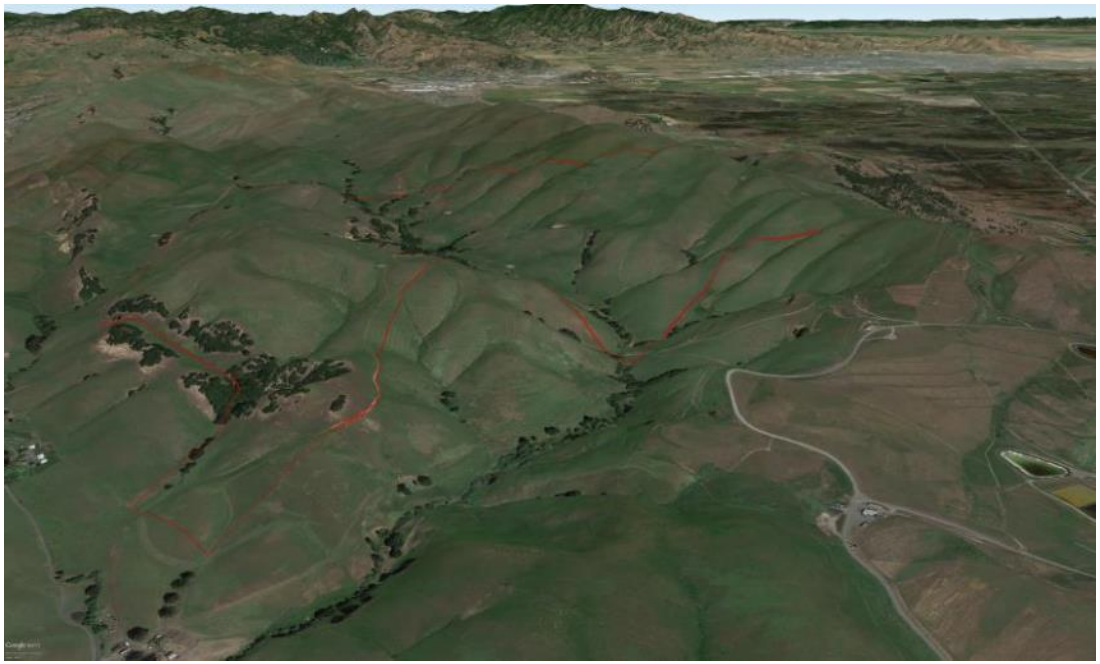
- Quantify success criteria
- Accumulate comparable results over time
- Identify strengths and weaknesses
- Target field work at reference sites

Ridge Top Ranch

- WRA-entitled wildlife conservation bank in Solano County
- Artichoke thistle management
  - Restricts overland movement of California red-legged frog
  - Outcompetes native vegetation that support Callippe silverspot butterfly
- Herbicide treatment program

Ridge Top Ranch Monitoring

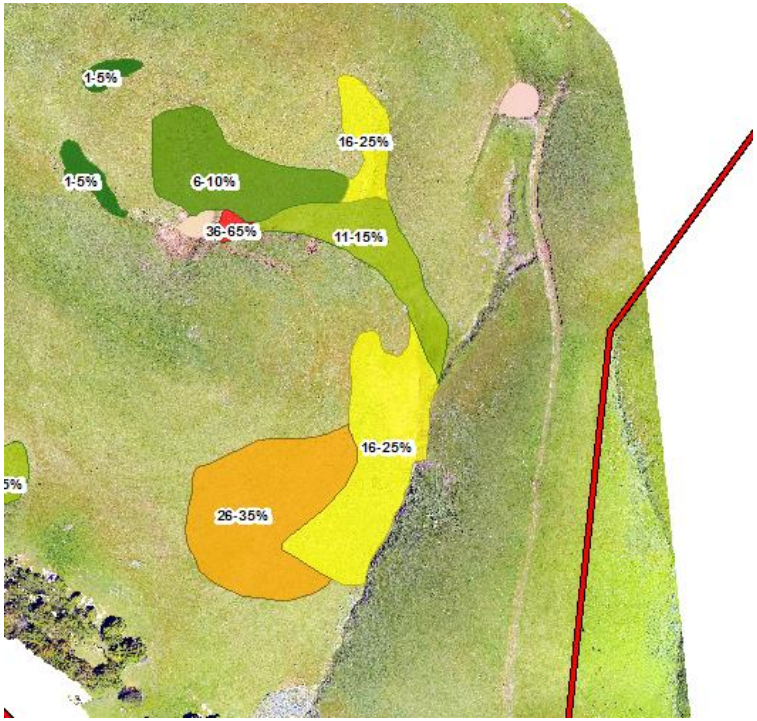
- Traditional Approach
  - Mapping done on foot
  - Steep topography
  - > 750 acres
  - Low res, outdated imagery
- Integrative Approach
  - UAV imagery and remote sensing
  - Identify exact treatment areas
  - Accurate assessment of individual plants



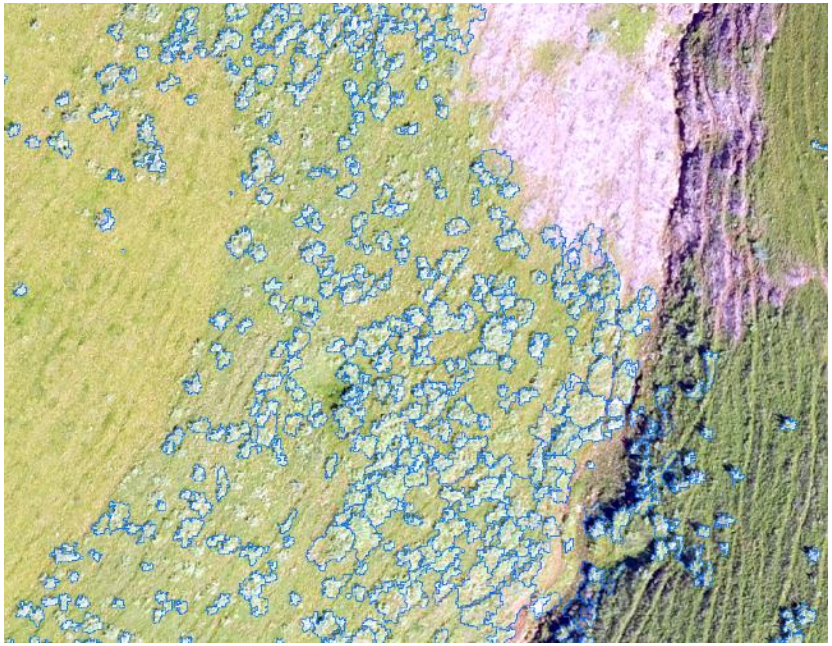
Our target… perfect for remote sensing!

Traditional Monitoring

- Traditional approach
- Low res, old imagery
- GPS and field notes

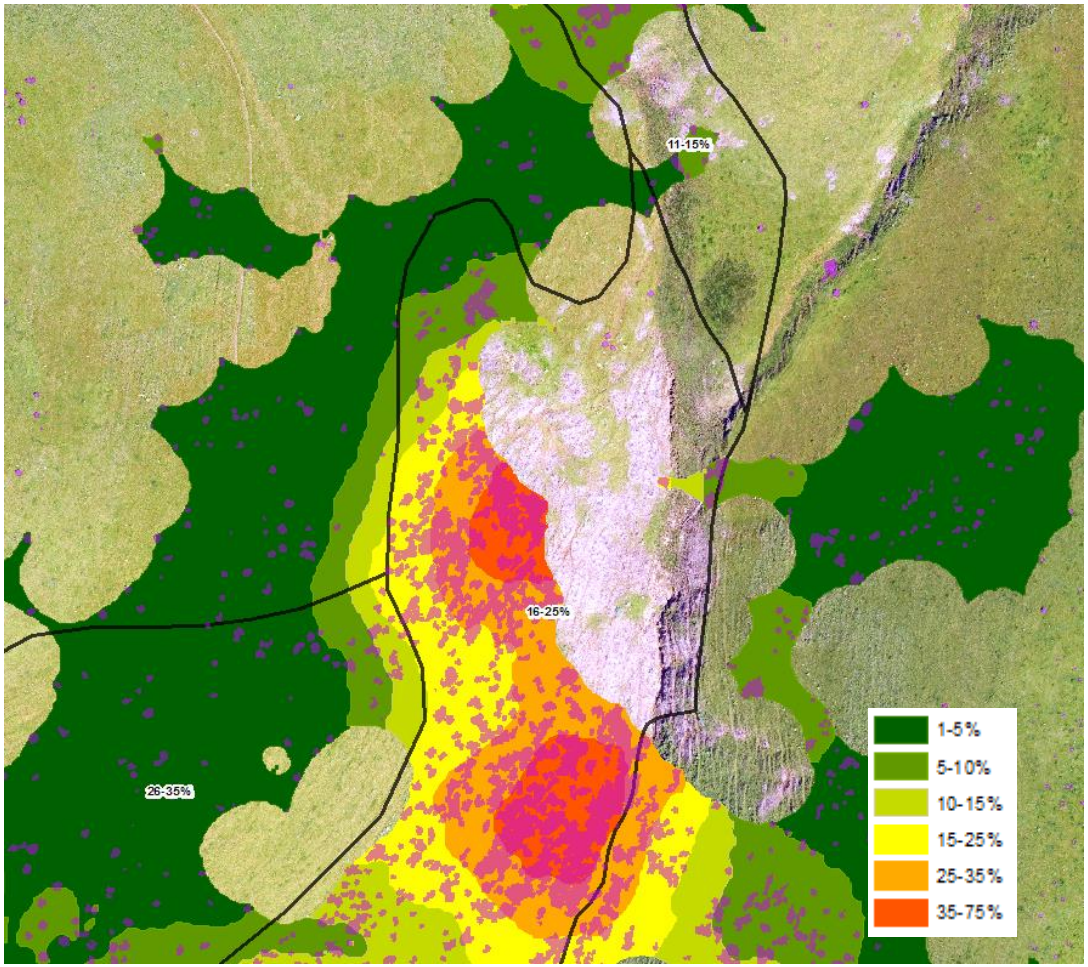


- Integrative approach
- Remote Sensing
- On-demand imagery



Ridgetop Ranch Results

- Accurate % cover
- Hyperlocal analysis
  - Individual plant level
- Provide guidance to treatment team
  - Where and how much
- Much more effective and efficient

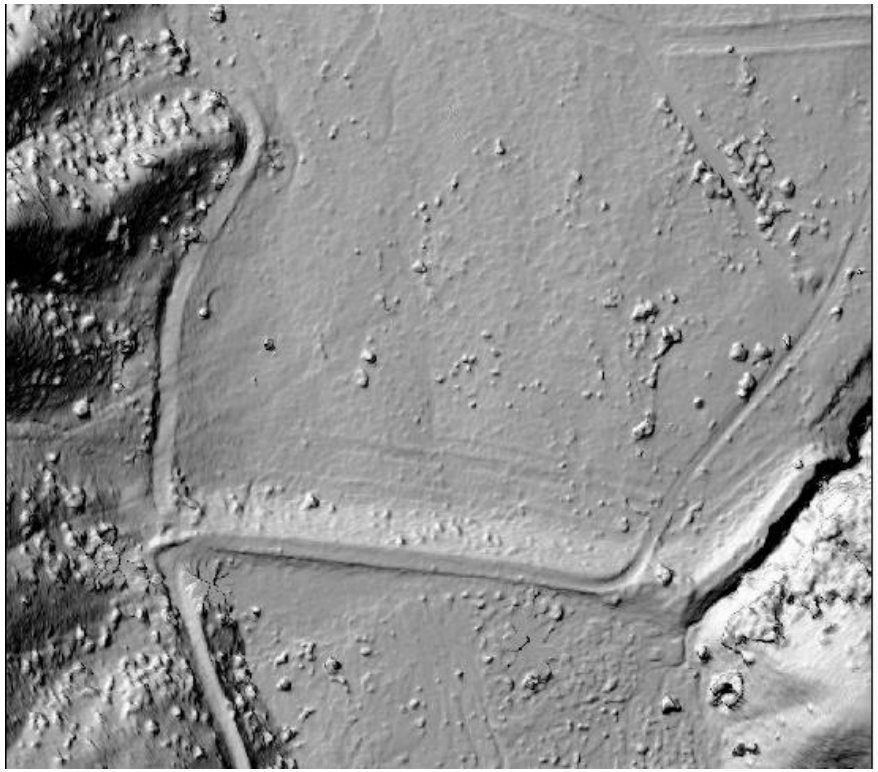


Petersen Ranch Dam Restoration

- Portion of WRA-entitled Petersen Ranch Mitigation Bank
  - Currently the largest mitigation bank in California
- Restore degraded dam
  - To allow for natural alluvial fan process
- Construction/as-built monitoring

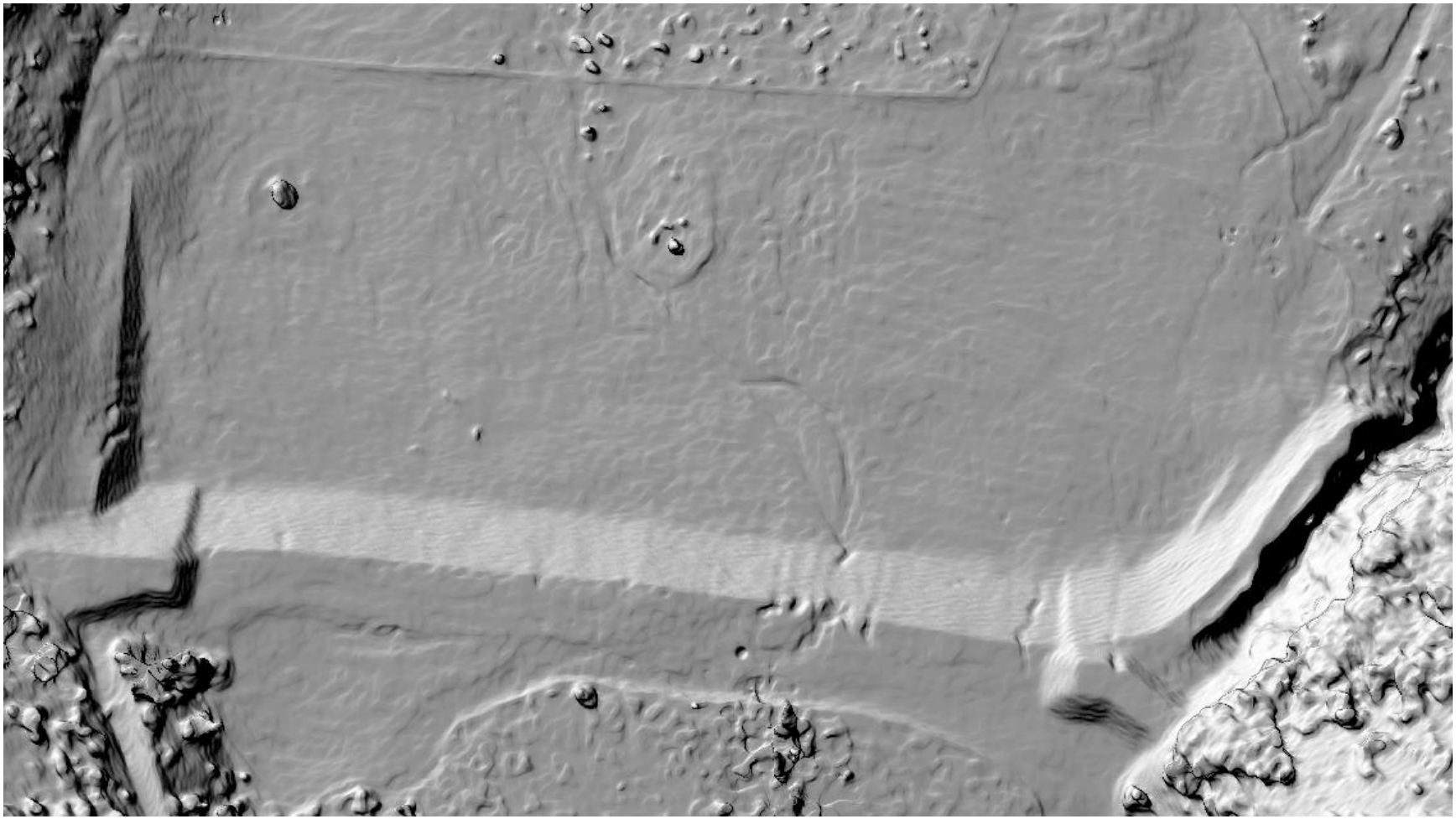
Petersen Ranch Monitoring

Elizabeth Lake, cont.



Dam Erosion

Dam Erosion



Results

- On-demand data and observation of infrastructure
  - Pre- and post-construction
- Allows quick response to events and impacts
- Provides additional layer of oversight to contractors
- Supplements traditional survey data

Summary

- Technology and data give us opportunities
- Synergy with traditional techniques
- Hyperlocal characterization
- Make budgets go farther
- Benefits compound into the future
  - Ongoing monitoring using integrative approach

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