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