Developing Monitoring Protocols for Vegetation Response to Watershed Restoration

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11/20/15
Overview

Watershed Restoration

Vegetation Monitoring
  - Purpose
  - Protocols
    - Long Term
    - Short Term

Remote Sensing

Preliminary Results
Watershed Restoration

Why?
- Repair degraded hydrologic processes
- Restore ecological processes
- Conserve productive landscapes for people and wildlife
- Support climate change resiliency

What?
- Slow the Water
- Check Dams, Trincheras, Gully Plugs, Gabions, Cross Vanes, Plug and Pond, Media Lunas, Pole Planting, One Rock Dams, Etc.
Watershed Restoration

Project Sites

- Wildcat Canyon, Silver Creek (BLM)
- Tex Canyon, Chiricahua Mountains (CNF)
- Barboot, Chiricahua Mountains (CNF)
- Vaughn Canyon, Babocomari (privately held)
- Deep Dirt Farm, Patagonia (privately held)
Vegetation Monitoring

Why?

- Quantify anecdotally reported effects
- Determine the effectiveness of different restoration techniques at different sites
- Analyze interactions between hydrologic response and ecological response
- Integrate remote sensing (T-LiDAR, sUAS imagery) and vegetation field data

Photo: Laura Norman
Vegetation Monitoring

Quantify Change
- Species Abundance
- Species Composition

Species
- Perennial Species
- Wetland Species: Obligate/Facultative
- Invasives

Scale
- Spatial
- Temporal

Sorghum halepense photo: Patrick Alexander, SEINet
Protocol: Long Term Plots

Turkey Pen
- Spatial scale: landscape level
- Temporal scale: decades
- Complex structural changes

Sonoran Desert Network
Inventory & Monitoring Program, NPS
Upland and Riparian Vegetation Protocols

<table>
<thead>
<tr>
<th>Cover Class</th>
<th>Percent Cover</th>
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<tbody>
<tr>
<td>1</td>
<td>&lt; 1%</td>
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<tr>
<td>2</td>
<td>1-5%</td>
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<tr>
<td>3</td>
<td>6-10%</td>
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<tr>
<td>4</td>
<td>11-25%</td>
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<td>8</td>
<td>76-95%</td>
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<tr>
<td>9</td>
<td>96-100%</td>
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</table>

Images: Sonoran Desert Network
Protocol: Long Term Plots

Species Abundance: Cover
- Point-line intercept
  - 2(3) 20m transects, sampled every 1 m
  - 3 height strata (field, subcanopy, canopy)

Species Composition
- Subplots: 2

Photo Points
- 7+ points for every plot

Relocation
- GPS
- Diagram
- Permanent rebar monuments

Derived from NPS Inventory & Monitoring, Upland and Riparian Protocols
Protocol: Short Term Plots

Deep Dirt Farm
- Spatial scale: in channel
- Temporal scale: 1-2 years
- Herbaceous vegetation

Considerations
- Efficiency
- Responsive to restoration implementation
- Methodologies
  - Nested quadrats
  - Modified Whittaker
  - Sample design

Testing a field protocol at Deep Dirt Farms
Protocol: Short Term Plots

Species Abundance: Frequency
- Frequency
  - Nested quadrats (NQ), 0.5 m²
  - Flexibility: analysis, scale
- Cover
  - Visual estimate, basal and foliar
  - Cover classes

Species Composition
- NQ
  - Species list (not exhaustive)

Photo Points
Relocation

Derived from methods developed by The Nature Conservancy, USFS, and BLM
Protocol: Short Term Plots

Plot Stratified
- Hydrology
  - Upstream
  - Downstream
- Proximity
  - Near zone: 0 - 2 m
  - Far zone: 2 - 4 m

NQ Placement
- 1 predetermined
  - Center of channel, at edge of zone closest to structure
- Additional: Randomized within zones
- NQ/zone
  - Min: 2
  - Max: variable by site, based on channel width
Field Data Collection

Long Term Plots
- 4 Project Sites
- 15 collocated; 12 control
- 27 Total

Short Term Plots
- 4 Project Sites
- 13 collocated; 12 control
- 25 Total
  - NQs: 294 Total
Remote Sensing

Data Sources
- sUAS (Vogel, Bauer)
- High-res Satellite Imagery (Worldview 2)
- Terrestrial LiDAR

Future Analysis
- Remote Sensing Indices
  - Normalized Difference Vegetation Index
  - Normalized Difference Infrared Index (MIR ~1640nm)
- Classification Analysis -> Vegetation Community Map
- Canopy Height Model

Image: Whitney Henderson
## Preliminary Results: Long Term Transect

### Long Term Transects: Species Identified

<table>
<thead>
<tr>
<th>Site</th>
<th>Field</th>
<th>Subcanopy</th>
<th>Canopy</th>
<th>Total</th>
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<td>10</td>
<td>9</td>
<td>4</td>
<td>12</td>
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<tr>
<td>Wildcat/Silver Creek</td>
<td>16</td>
<td>8</td>
<td>2</td>
<td>18</td>
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<td>Tex Canyon</td>
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<td>All Sites</td>
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<td>20</td>
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<td>41</td>
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### Long Term Transects: Percent Cover

<table>
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<th>Field</th>
<th>Subcanopy</th>
<th>Canopy</th>
<th>Total</th>
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<td>26%</td>
<td>14%</td>
<td>23%</td>
<td>50%</td>
</tr>
<tr>
<td>Wildcat/Silver Creek</td>
<td>38%</td>
<td>23%</td>
<td>6%</td>
<td>46%</td>
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<tr>
<td>Tex Canyon</td>
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<tr>
<td>Vaughn Canyon</td>
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<td>11%</td>
<td>4%</td>
<td>48%</td>
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<tr>
<td>All Sites</td>
<td>38%</td>
<td>18%</td>
<td>9%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Photo: Carianne Campbell
Preliminary Results

Overview

▪ Short-term local response at structures
  ▪ Vegetation at/within rock structures
▪ Species introduction (Vaughn)
  ▪ Native: *Cyperus*
  ▪ Non-native: *Sorghum halepense*, Johnson grass
▪ Impacts of restoration at project site (Wildcat)
  ▪ Initial decrease in vegetation
  ▪ Continued monitoring

Wildcat: before (above) and after (below)
Next Steps

Field Data Analysis
- Develop Baseline Results
- Initial Statistical Analysis
- Collocated v. Control
- Site by Site

Remote Sensing

Continue Monitoring Effort

Jessica Walker at previous headcut restoration done by the CCC, Tex Canyon
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