Developing Monitoring Protocols for Vegetation Response to Watershed Restoration

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11/20/15

Overview

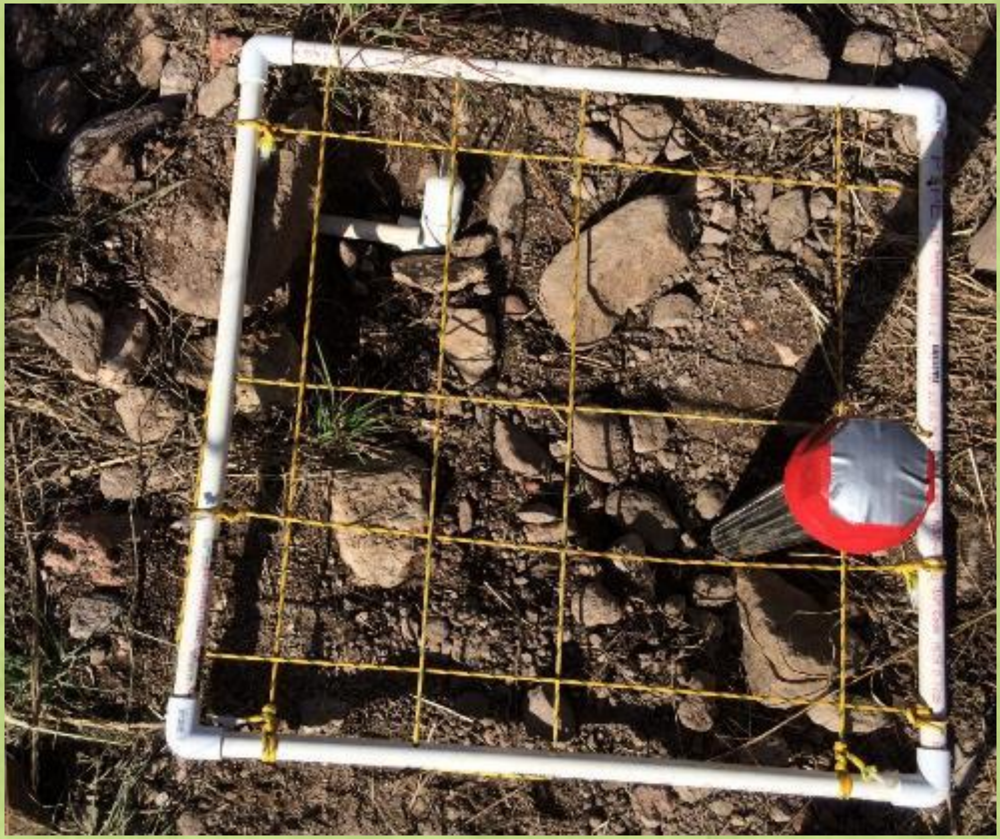
Watershed Restoration

Vegetation Monitoring

- Purpose
- Protocols
  - Long Term
  - Short Term

Remote Sensing

Preliminary Results



Watershed Restoration

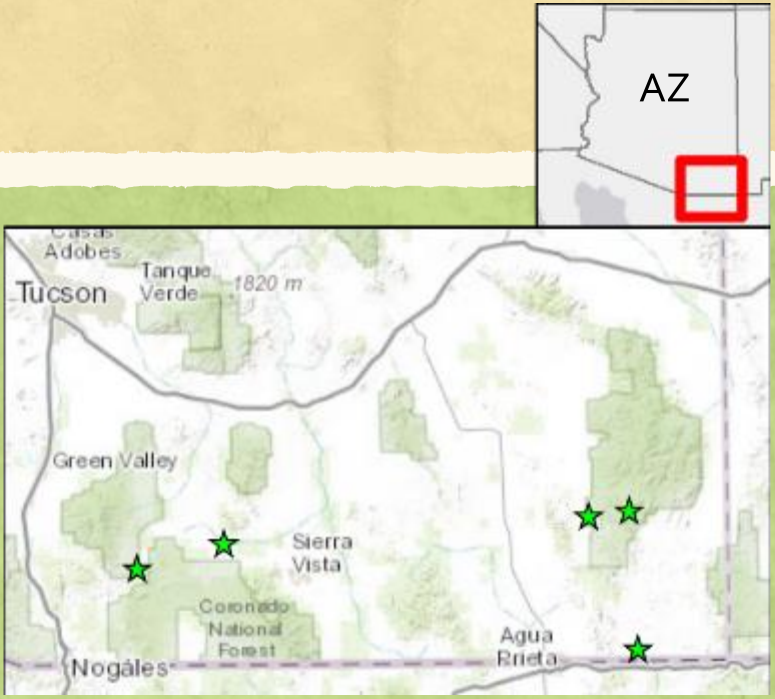
Why?

- 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

Cover Class	Percent Cover
1	< 1%
2	1-5%
3	6-10%
4	11-25%
5	26-33%
6	34-50%
7	51-75%
8	76-95%
9	96-100%

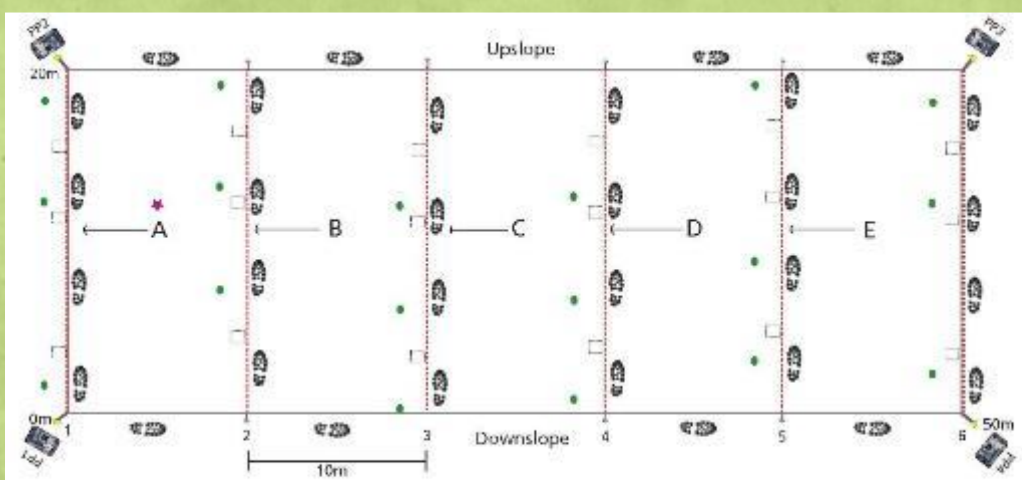
Turkey Pen

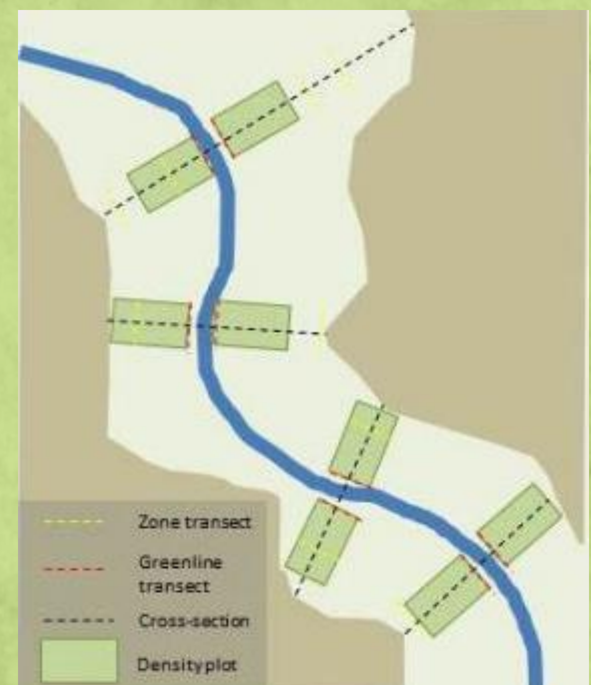
- Spatial scale: landscape level
- Temporal scale: decades
- Complex structural changes

Sonoran Desert Network

Inventory & Monitoring Program, NPS

Upland and Riparian Vegetation Protocols





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

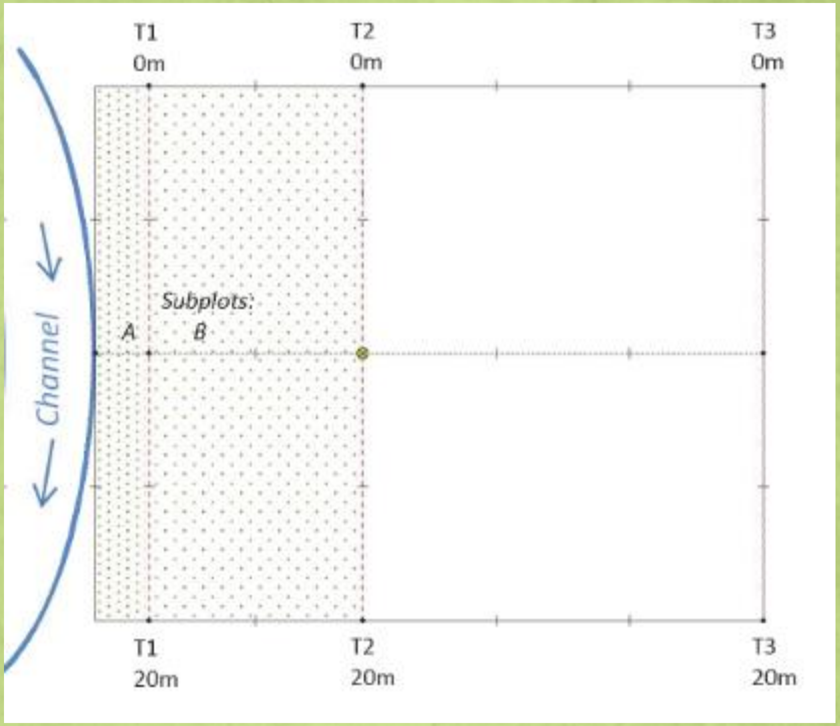
- Subplots: 2

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 m^2
  - 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

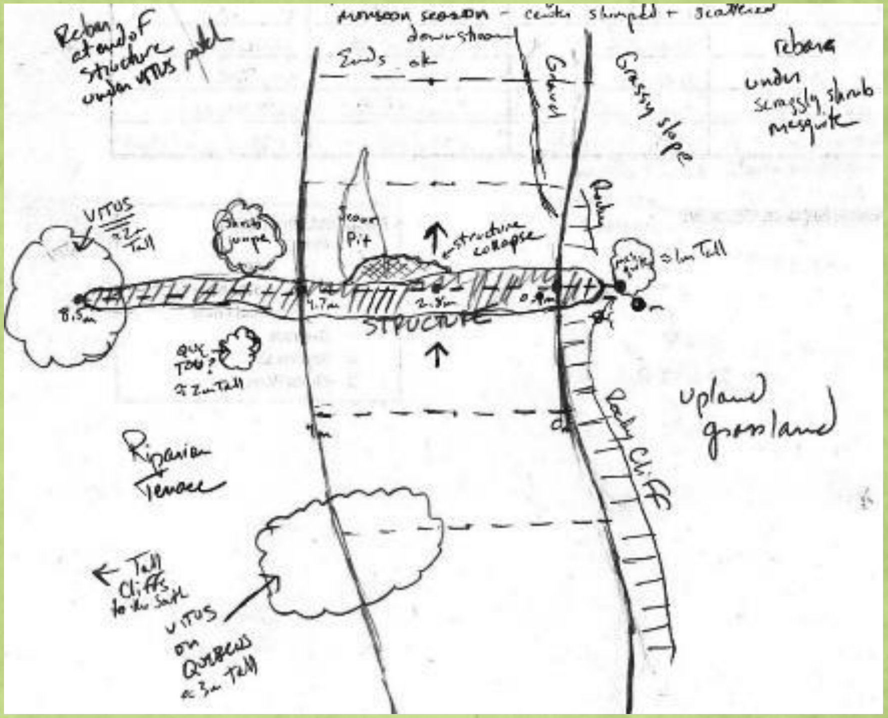
Protocol: Short Term Plots

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



Relocation diagram showing the stratified zones (dashed lines)

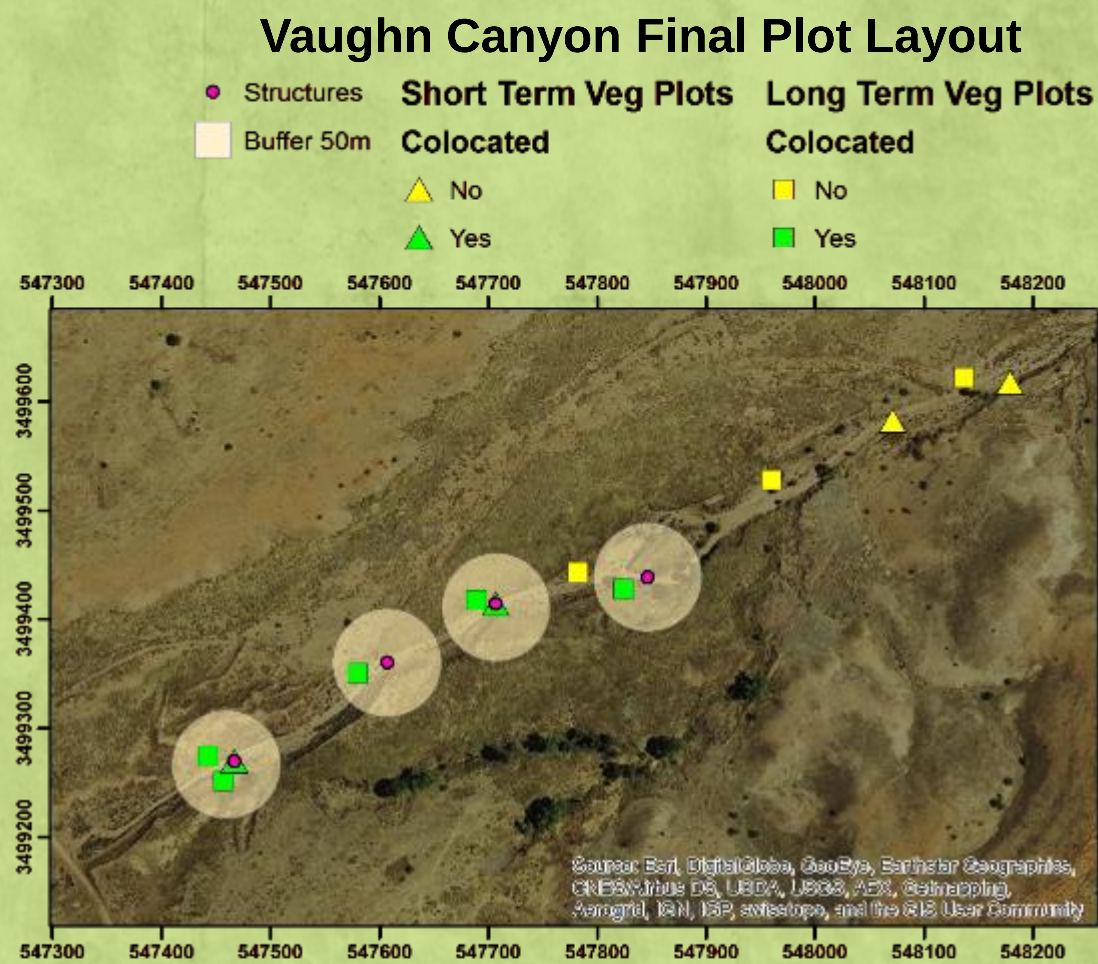
Field Data Collection

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**



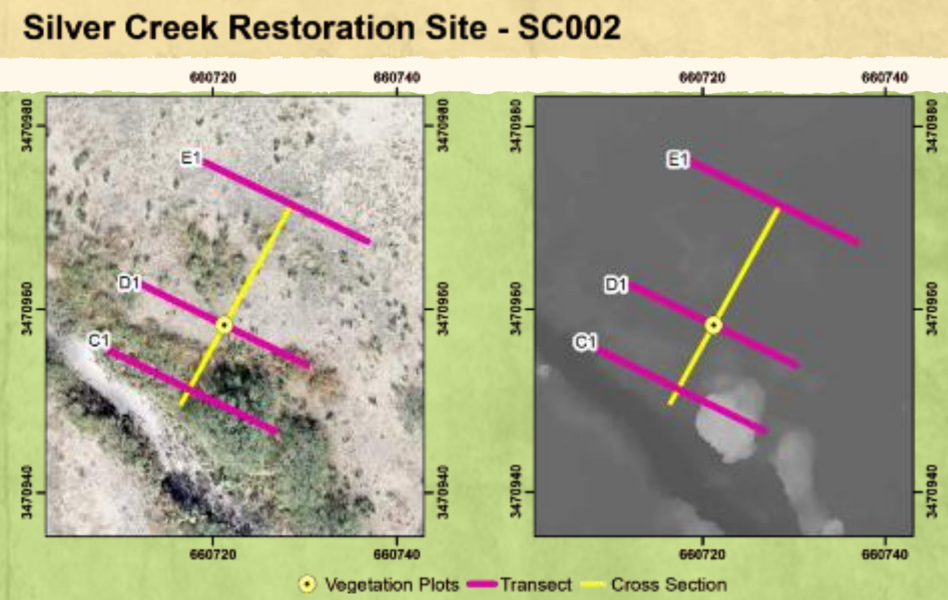
Remote Sensing

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



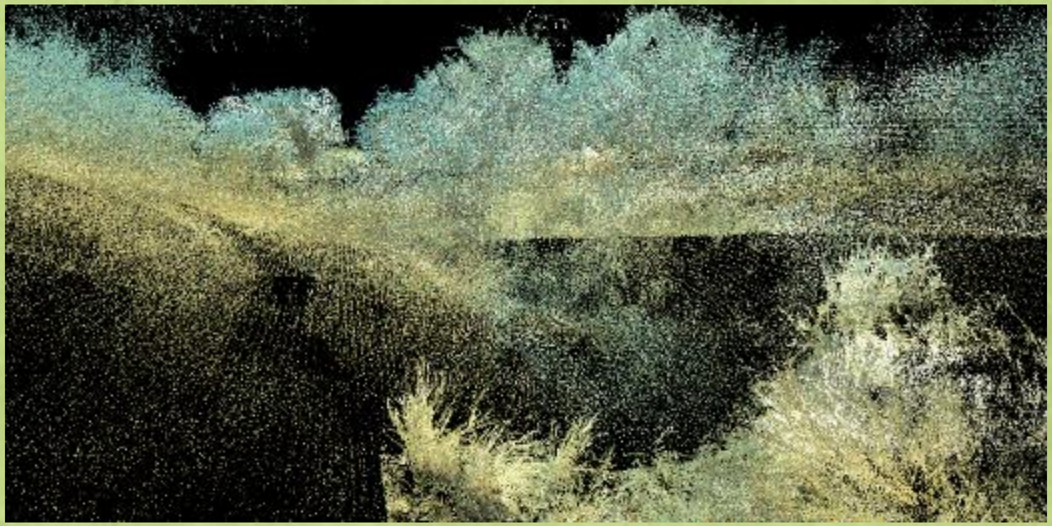


Image: Whitney Henderson

Preliminary Results: Long Term Transect

Long Term Transects: Species Identified				
Site	**Field**	**Subcanopy**	**Canopy**	**Total**
Barboot	10	9	4	12
Wildcat/Silver Creek	16	8	2	18
Tex Canyon	7	3	1	6
Vaughn Canyon	13	3	2	14
All Sites	35	20	8	41

Long Term Transects: Percent Cover				
Site	**Field**	**Subcanopy**	**Canopy**	**Total**
Barboot	26%	14%	23%	50%
Wildcat/Silver Creek	38%	23%	6%	46%
Tex Canyon	60%	17%	5%	67%
Vaughn Canyon	41%	11%	4%	48%
All Sites	38%	18%	9%	50%

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

Questions?

Photo: Bethany Brandt

Thanks and Appreciations to:

Steve Buckley, Carianne Campbell, Houston Harris, Miguel Villarreal, David Dean, Jeff Conn, Lance Brady, Kate Tirion, Ron Pulliam, Valer Austin, David Seibert, Julian Heilman, Jessica Walker, Bethany Brandt, Angela Barclay, Molly McCormick, Evan Gwilliam, Jim Malusa, Gita Bodner, Juliet Stromberg & Andrea Hazleton!

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This research supported by the Land Change Science Program under the Climate and Land Use Change Mission Area of the USGS.