How Do I Use My Monitoring Tools?

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You are the monitor!

• Oxford English Dictionary Definition
  – A person who admonishes, warns, or gives advise to another about actions.

• Was YOUR vegetation project a success?
  – Were weeds controlled?
  – Did desired plants establish?
  – Did the ecosystem recover?
Success, Warning & Adaptation

Develop Simple Model

Develop Project Objectives

Monitor Project

Design & Implement Project

Modify Project Design or Implementation

Objective Achieved?

Y

N
Objectives & Treatments
Dictate What is Monitored

- Invasive plant control
  - Invasive dominance
- Biological controls
  - Insect or microbe abundance
- Erosion control
  - Sedimentation
  - Aggregate stability
- Biological diversity
  - Relative dominance & Species Richness
Monitoring – Research Continuum

From Elzinga et al. 2001 Monitoring Plant & Animal Pop.
Monitoring vs.

- Inventories – moment-in-time status
  - No mgmt objectives or changes
- Natural History Studies
  - No mgmt objectives
- Implementation monitoring
  - Was the project conducted as designed?
- Surveillance or trend
  - Evaluate changes; No treatment or mgmt adaptation
- Baseline monitoring
  - Initial standard; No treatment
Validate & Improve Project

• Effectiveness Monitoring
  – Relative to
    • Objectives
    • Other treatments
    • No treatments; Controls
  – Requires
    • Adaptation alternatives
    • Basic Environmental Data
      – Soils, Climate, Elevation, Location, Mgmt.
Developing a Monitoring Plan
Phase 1

• Scale of the project
  – Soil units, Watershed units

• Objectives of project
  – What will be monitored
  – Short- and Long-term objectives

• First Reality Check
  – What resources are available to collect, analyze and report results?
Developing a Monitoring Plan
Phase 2

• Type of monitoring
  – Qualitative, Census, Quantitative sample

• Intensity of monitoring
  – How often?
  – How critical is timing?

• Data collection & metadata
  – Information to be collected
    • Basic site info plus specific data in a form ready for entry or analysis
  – How was data collected?
    • Details that allow future collections using same techniques and/or sites, and provide adequate analysis information.
Developing a Monitoring Plan
Phase 3

• Data analysis & interpretation
  – Summary statistics (mean and variation)
  – Comparative treatments (statistical comparisons)

• Final Reality Check - Field Tests
  – Do you still have the resources to accomplish all aspects of the monitoring plan.
  – If yes, then proceed
  – If no, then modify or simplify your monitoring plan.
Qualitative Techniques - Photo points

• Locations
  – Permanent
  – Both directions of transects or positions
  – Include horizon; Aids relocation

• Camera & Settings
  – 35mm w/ shutter speed & aperture control
  – Set lens size (focal length)
  – Use smallest aperture (f-stop) & slowest shutter speed possible for greatest depth of field
Qualitative Techniques - Estimating Pop. Size, Coverage & Biomass

- Provides gross index of measure and changes over time.
- Use density/cover classes
  - 1-3, 4-10, 11-30, 31-60, 61-100, 101-200, 201-500, etc.
  - Doubling series 1, 2, 4, 8, 16, 32, 64, 128 etc.
  - Cover classes 1-5, 6-25, 26-50, 51-75, 76-95, 96-100
- Biomass - visual estimates, reference units/plots, double sampling
- All require training
Study Monuments

• Permanent locations
• Fence or T posts; Bury deeply
• Rebar use caps
• Use landmarks with site and distance to relocate
• Insurance against theft - bury metal spikes 1-m from stake. Use metal detector.
Locating Sample Plots

• Stratify the site
  – Watersheds into land shape units (geomorphic units)
  – Land shape units into soil map units

• Disperse plots across unit
  – Randomly locate
What is the sample population?

<table>
<thead>
<tr>
<th>Objective</th>
<th>Sample Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Weed Control</td>
<td>1. Weed density or dominance</td>
</tr>
<tr>
<td>2. Revegetation success</td>
<td>2. Desirable species coverage</td>
</tr>
<tr>
<td>3. Species recovery</td>
<td>3. Desirable species coverage</td>
</tr>
<tr>
<td>4. Biodiversity</td>
<td>4. Species richness &amp; composition</td>
</tr>
<tr>
<td>5. Soil stability</td>
<td>5. Aggregate stability</td>
</tr>
</tbody>
</table>
Sampling Layout

- Cross-section Transects
  - Best for crossing boundaries; riparian zones, invaded vs. not invaded, etc.
  - Poor for row reseeding
- Spoke Transect set
  - 3, 50m transects provide an efficient cover of 1 ha area.
  - 5 m from the center at 120 degrees
Weed Control Success

• Measures
  – Coverage
    • Point intercept along the 3 lines; 150 - 300 points/rep.
    • Or
    • Cover class estimate
  And
    • Density classes
  – Why multiple measures
    • Anticipate weeds becoming rare if treatment worked
Restoration or Revegetation Success

- Density per 1-m² area
  - 50 1-m² plot per line
  - Count # of desirable plants per species
- Coverage by species
  - Cover Class estimates
- Why 2 measures?
  - Anticipate increases
    - Density for establishment - Short-term
    - Cover for dominance - Long-term
Reseeding Success?

- Grass success on Intermountain shrub grassland
  - Excellent - $>0.75 \text{ plants/ft}^2$
  - Good - 0.5 - 0.75
  - Fair - 0.25 - 0.5
  - Poor $< 0.25$
**Soil Stability**

- Measure soil exposure (% bare soil)
  - Only measure the exposed bare soil
    - Veg, litter, biotic crust, rocks are not soil and protect the soil from raindrop impact.

- Soil Aggregate stability

- Sedimentation
Common Failures of Monitoring

Technical Problems
• Poor design
• Observer error too high
• Data lost
  – Poor storage or documentation
  – Cannot decipher
• Lack analysis skills
• Natural fluctuations > project impacts

Institutional Problems
• Lack of support
  – Personnel, budget, priorities, politics
• Resources limit completion
  – Data collected, but not analyzed
• Data are questioned & never used
• Results-to-mgmt adaptation not applied
Future Needs

• Restoration Monitoring Repository
  – Deposit project information, monitoring data, reports and finding for particular projects
  – Include metadata
  – Allow us to investigate what has worked and not worked for others
Resources for Monitoring Design

  http://www.esf.edu/efb/gibbs/monitor/popmonroot.html

• BLM (1996) Sampling vegetation attributes. BLM/RS/ST-96/002+1730, Denver CO.