



Forest and Rangeland Ecosystem Science Center

How Do I Use My Monitoring Tools?

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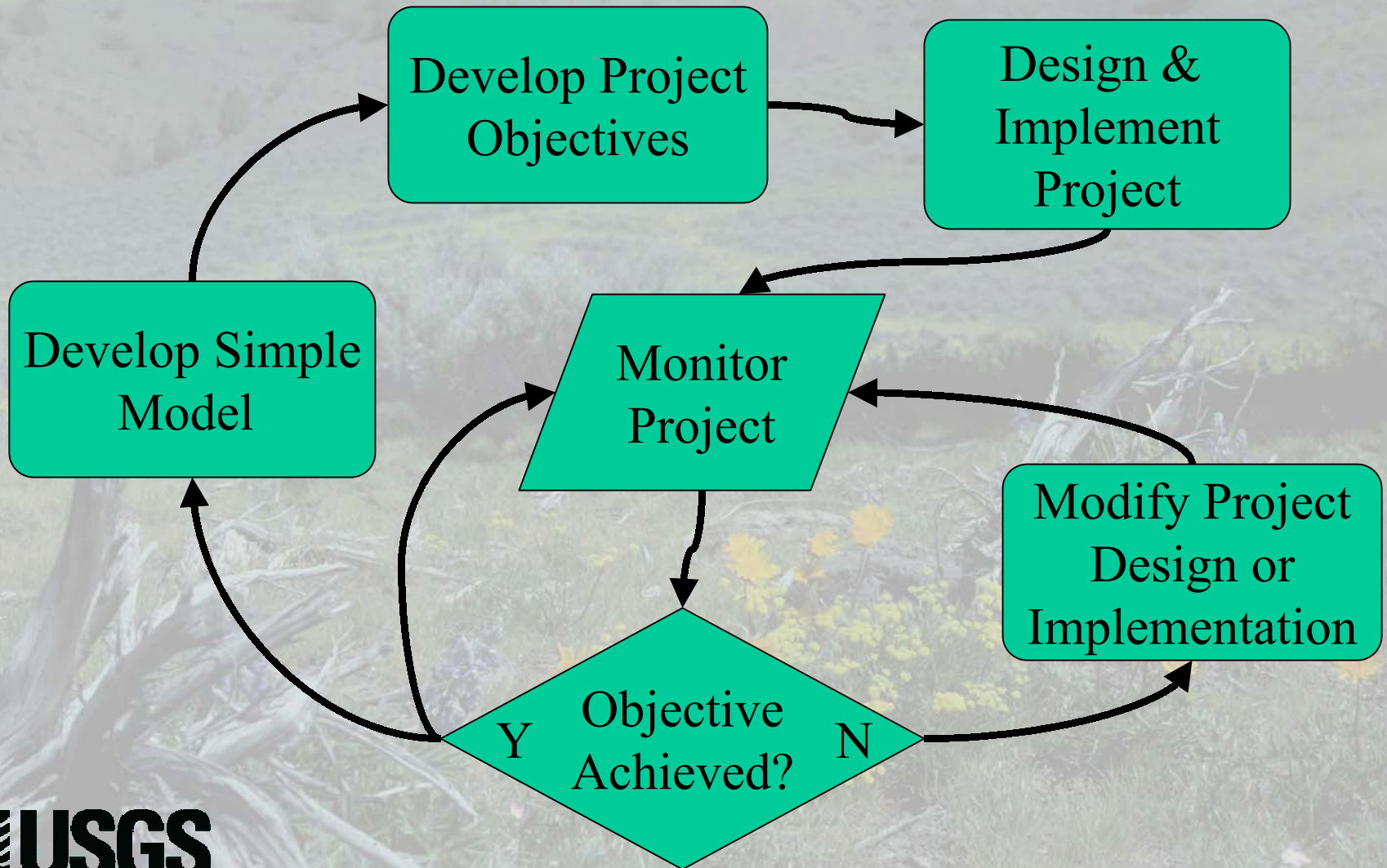
U.S. Department of Interior
U.S. Geological Survey

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

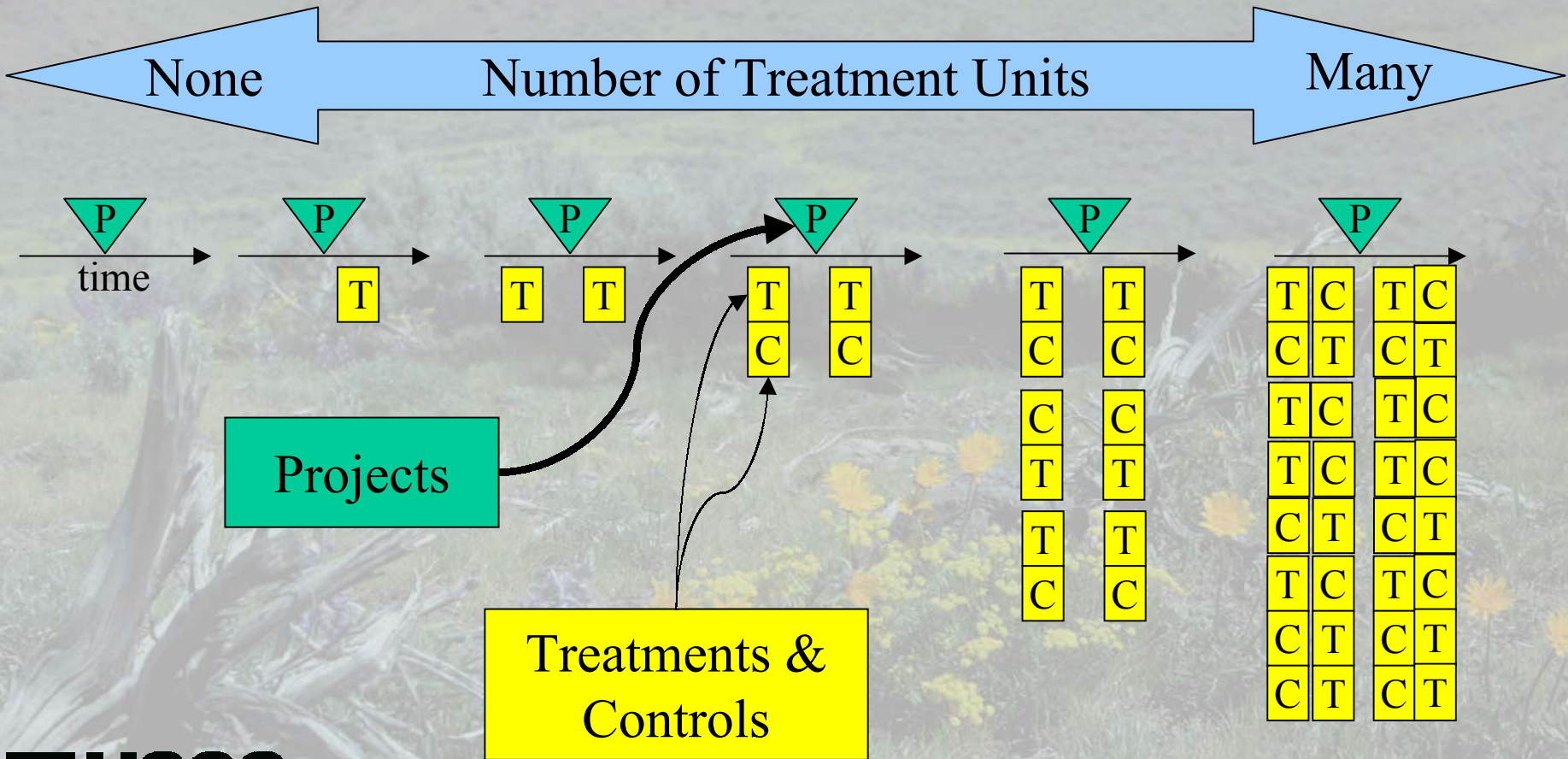


Objectives & Treatments Dictate What is Monitored

- 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

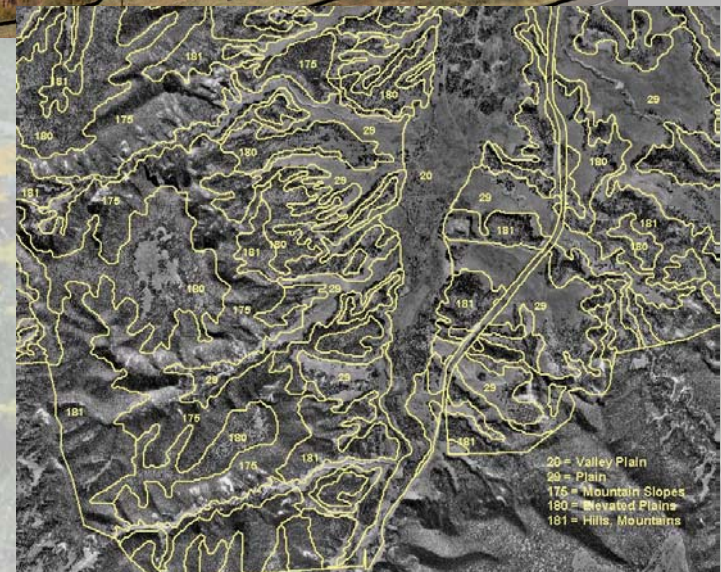
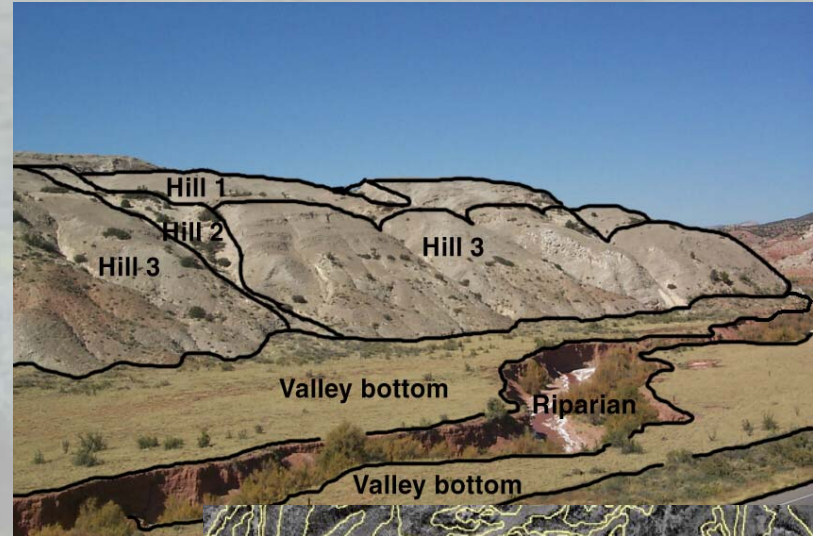
- Provides gross index of measure and changes over time.
- Use density/cover classes
 - 1-3, 4-10, 11-30, 31-60, 61-100, 101-200, 201-500, etc.
 - Doubling series 1, 2, 4, 8, 16, 32, 64, 128 etc.
 - Cover classes 1-5, 6-25, 26-50, 51-75, 76-95, 96-100
- Biomass - visual estimates, reference units/plots,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

Objective

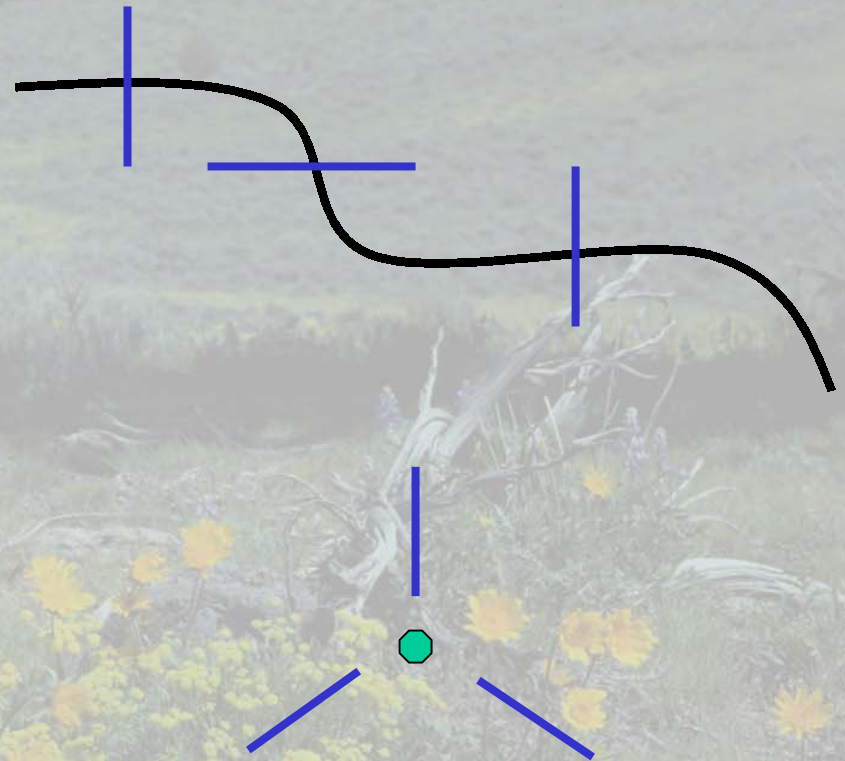
1. Weed Control
2. Revegetation success
3. Species recovery
4. Biodiversity
5. Soil stability

Sample Population

1. Weed density or dominance
2. Desirable species coverage
3. Desirable species coverage
4. Species richness & composition
5. Aggregate stability

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 plants/ft²
 - 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 findings for particular projects
 - Include metadata
 - Allow us to investigate what has worked and not worked for others

Resources for Monitoring Design

- Elzinga C, Salzar D, Willoughby J, Gibbs J (2001) Monitoring plant & animal populations. Blackwell Sci.
<http://www.esf.edu/efb/gibbs/monitor/popmonroot.html>
- BLM (1996) Sampling vegetation attributes. BLM/RS/ST-96/002+1730, Denver CO.

