EXPERIENCE
YOUR
AMERICA

Monitoring Shrublands at Santa Monica Mountains National Recreation Area

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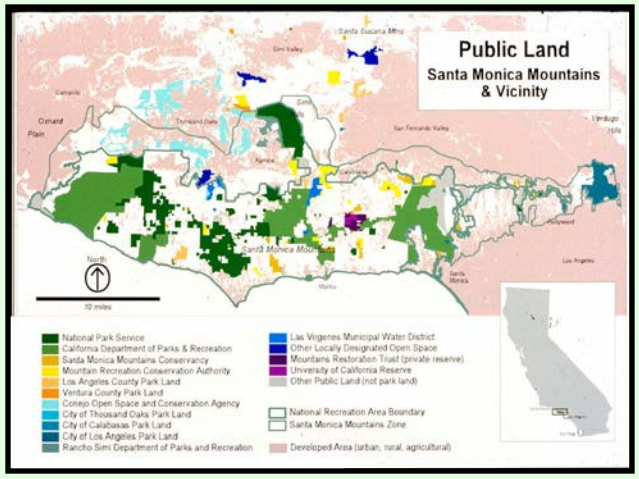
Goals, Efficiency and Scale in Monitoring

- Background on SMMNRA
- Range of goals
- Specific monitoring examples from SMMNRA

Santa Monica Mountains NRA



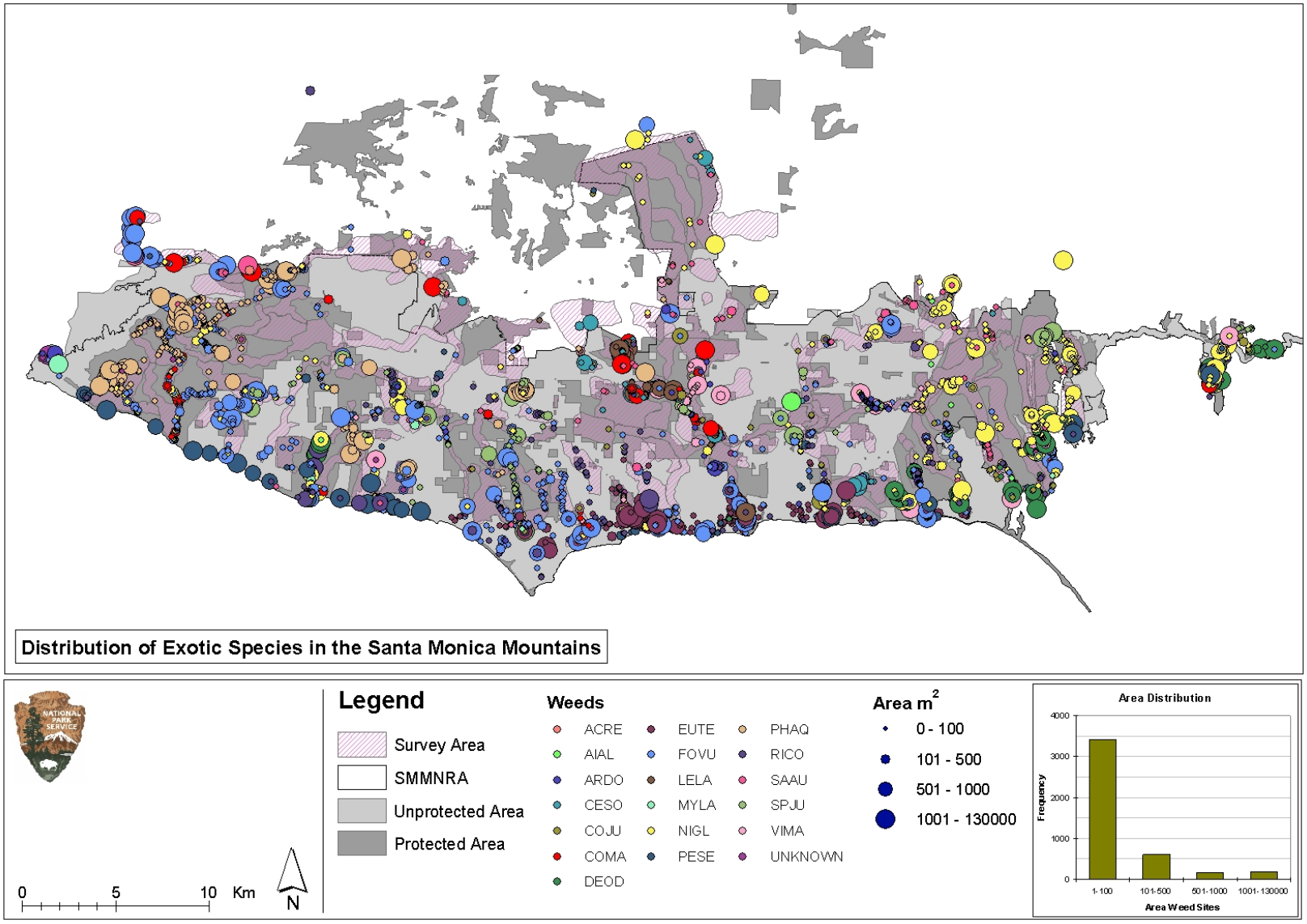
- 150,000 acres
- NPS lands = 23,000 acres
- 67 cooperating land management agencies
- Main habitats: coastal sage scrub, chaparral
- Also oak savanna, native grassland remnants, riparian

SMMNRA Intro. Continued:

SMMNRA Intro. Continued: Major invasive species

- Ailanthus altissima
- Acroptilon repens
- Arundo donax
- Asphodelus fistulosus
- Centaurea solstistialis
- Cortaderia jubata
- Conium maculatum
- Delairea odorata
- Euphorbia terracina
- Foeniculum vulgare
- Lepidium latifolium
- Myoporum laetum
- Nicotiana glauca
- Pennisetum setaceum
- Phalaris aquatica
- Ricinus communis
- Salsola australis
- Spartium junceum
- Vinca major

Invasive species, cont.



Management Goals

- Park wide and site specific goals
- Invasive species control and/or eradication
- Ecological restoration
- Maintenance of ecological functioning
- Compatible recreation
- Both small-scale and landscape scale

Monitoring by Investment

- Experimental (High investment)
- Assess efficacy of known methods (intermediate investment)
- Track progress through time (low investment)
- Assess state of resources (high investment)

Monitoring by Goal

- Invasive species control
  - track reductions
  - Track herbicide use
  - Track plants or hours
- Ecological restoration
  - Track native species establishment (plant and animal)
- Ecological functioning
  - Track indicators
  - Track measures of function

General Positive Thoughts on Monitoring

- Often looking for big effects
- Often tracking impacts of major actions
- Often low variability in initial conditions

Monitoring in an Experimental Context (High)

- Testing untried methods or known methods in new context
- Trying to assign causality
- Often done on small scale prior to initiating more large-scale treatment
- One example: *Pentachaeta lyonii*

Making the world better for Lyon's Mini Daisy

- Restricted to Santa Monica Mountains
- Populations in decline
- Large scale habitat loss
- Unknowns

Photo courtesy of Michael Charters

Management Goals for Lyon's Pentachaeta

- **Increase population size of Pentachaeta at Rocky Oaks from 500 to over 5000**
- **To establish other populations at other sites**
- To accomplish this we need to know:
  - What factors are impacting Pentachaeta
  - How are these factors impacting Pentachaeta

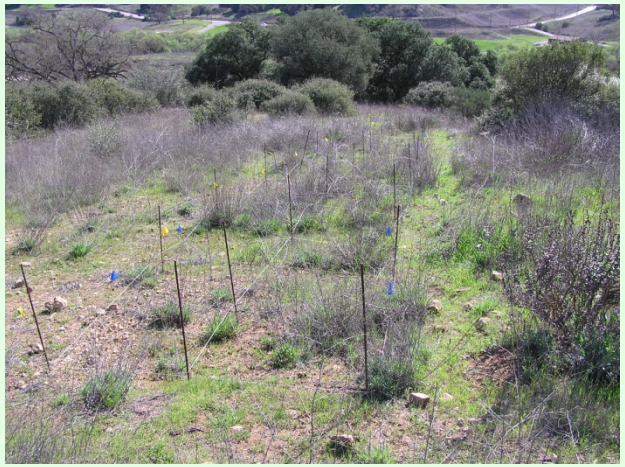
Basic question: what management actions should we take to accomplish our goals?
Scale: small

Team Pentachaeta

- Two sets of experiments
  - Population level
    - Control (no treatment)
    - Remove exotics
    - Remove exotics + scrape soil
    - Remove exotics + scrape + soil crust
    - 20 replicates per treatment at 3 sites
  - Individual
    - With and without competitors
    - 10 replicates per treatment

Monitoring Methods

- Community
  - 1m x 1m plots (240 plots total)
  - Each plot measured before and after treatment
  - Measurements include
    - Number of Pentachaeta plants
    - Species richness
    - Cover of each species, bare ground, and thatch
- Individual
  - 25cm x 25 cm plots (60 plots total)
  - Total cover target exotic
  - Number pentachaeta
  - Number of flowers per pentachaeta plant
  - Cover native species

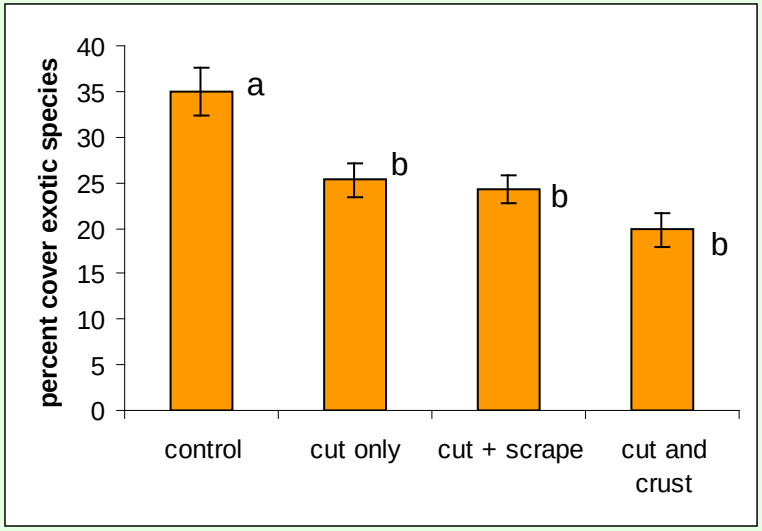


Measurement and Analysis

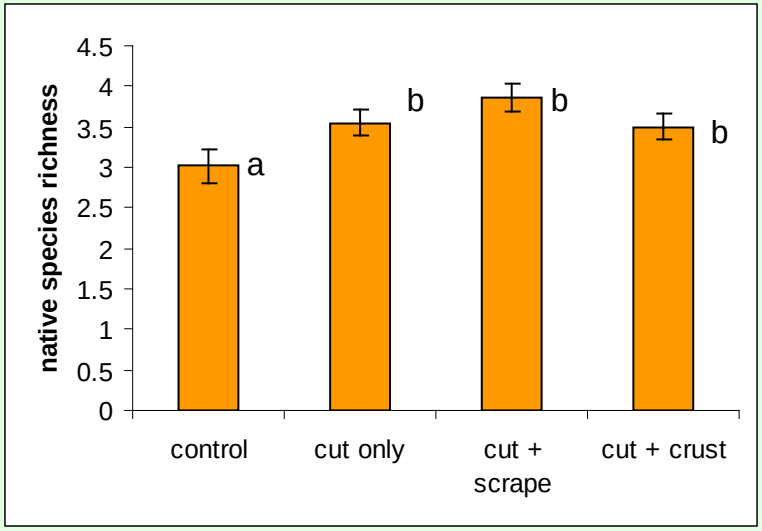
- Measured many metrics
- Identified statistical analyses we hoped to use before installing experiment
- Included controls

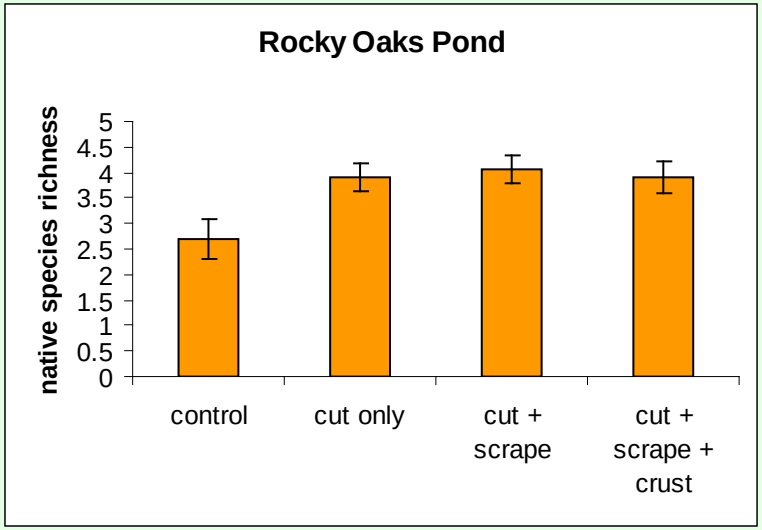
Results: Community Studies

Treatment Effects on Exotic Species Cover

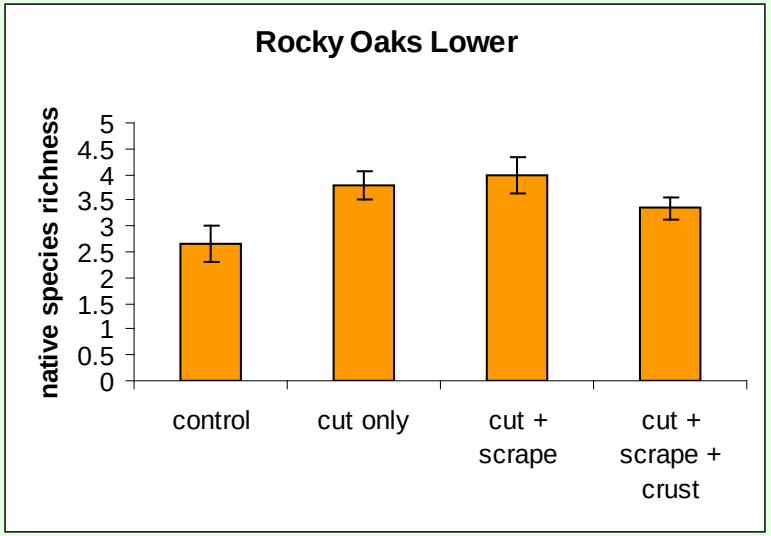


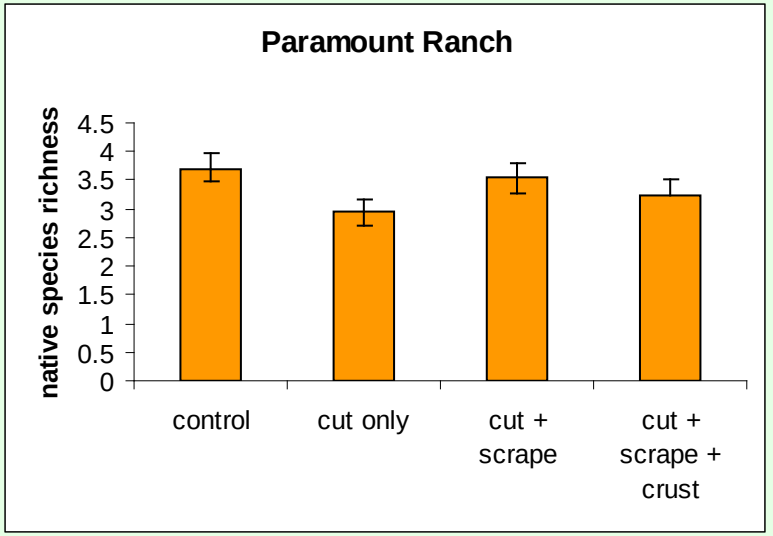
Treatment Effects on Number of Native Species





Variability in Species Richness Due to Site



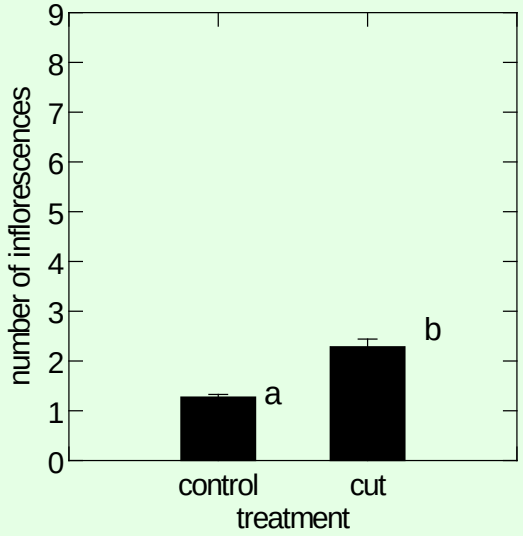


Data analyzed using ANOVA

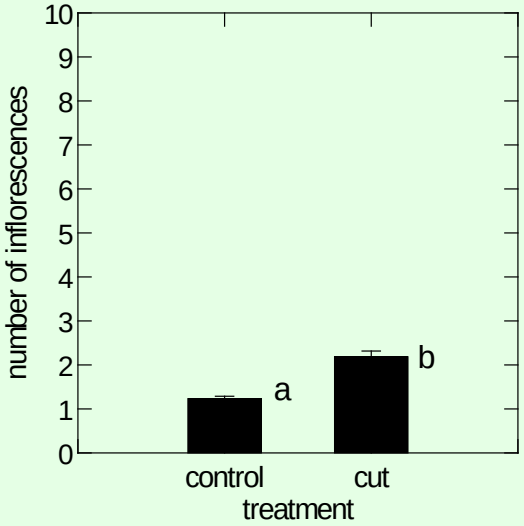
Results: Individual Plants

Exotic species impacts on the number of Pentachaeta flowers

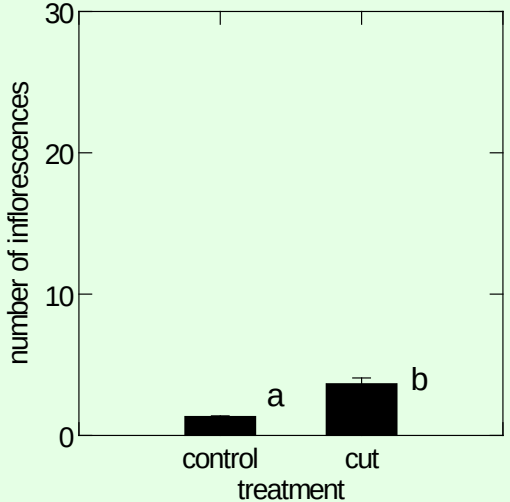
Effects of Erodium



Effects of grass sp.



Effects of Centaurea



Data analyzed with paired t-tests

Conclusions re: Lyon's Mini Daisy

- Invasive plants have negative impacts on both Pentachaeta and its community
- Sites differ in their response to treatments
- Simple removal of invasive species was as effective as other more complicated treatments
- Mowing, fire, soil scraping = possible management actions

Monitoring Conclusions

- Important to have more than one site
- Different scale of projects taught us different things
- Labor intensive
- Have we moved towards our management goal?
  - Yes
  - Bigger population
  - More sites, focusing on areas with little to no invasive species

Common Features of Monitoring in an Experimental Context

- Must have a control
- Must have sufficient replication
- Data is typically analyzed using statistics (ANOVA, t-tests, etc.)
- Is usually time and data intensive
- Think about how prospective management areas differ and incorporate this variability into design

Experimental Monitoring: Summary

- Goal: establish causality. Test management methods.
- Efficiency: Low. Requires high input of time to collect and analyze data.
- Scale: typically small although large-scale experiments are done.

Monitoring a Known Technique to Assess Efficacy (Intermediate)

- Goal: track changes in response to a treatment
- Goal: assess movement towards a management goal
- Scale: can be large or small scale
- Examples: Harding grass and poison hemlock treatment and BAER veg. work

Treatment of Harding Grass

- Management Goal: eradicate Harding grass infestations at two park sites: Rocky Oaks and Rancho Sierra Vista
- 2 acre infestation at Rocky Oaks divided into four 0.5 acre treatment areas
- Treatment selected based on TNC ESA
- Treatment:
  - Cut to remove accumulated biomass
  - Spray re-sprouts with 2% glyphosate

Monitoring Methods

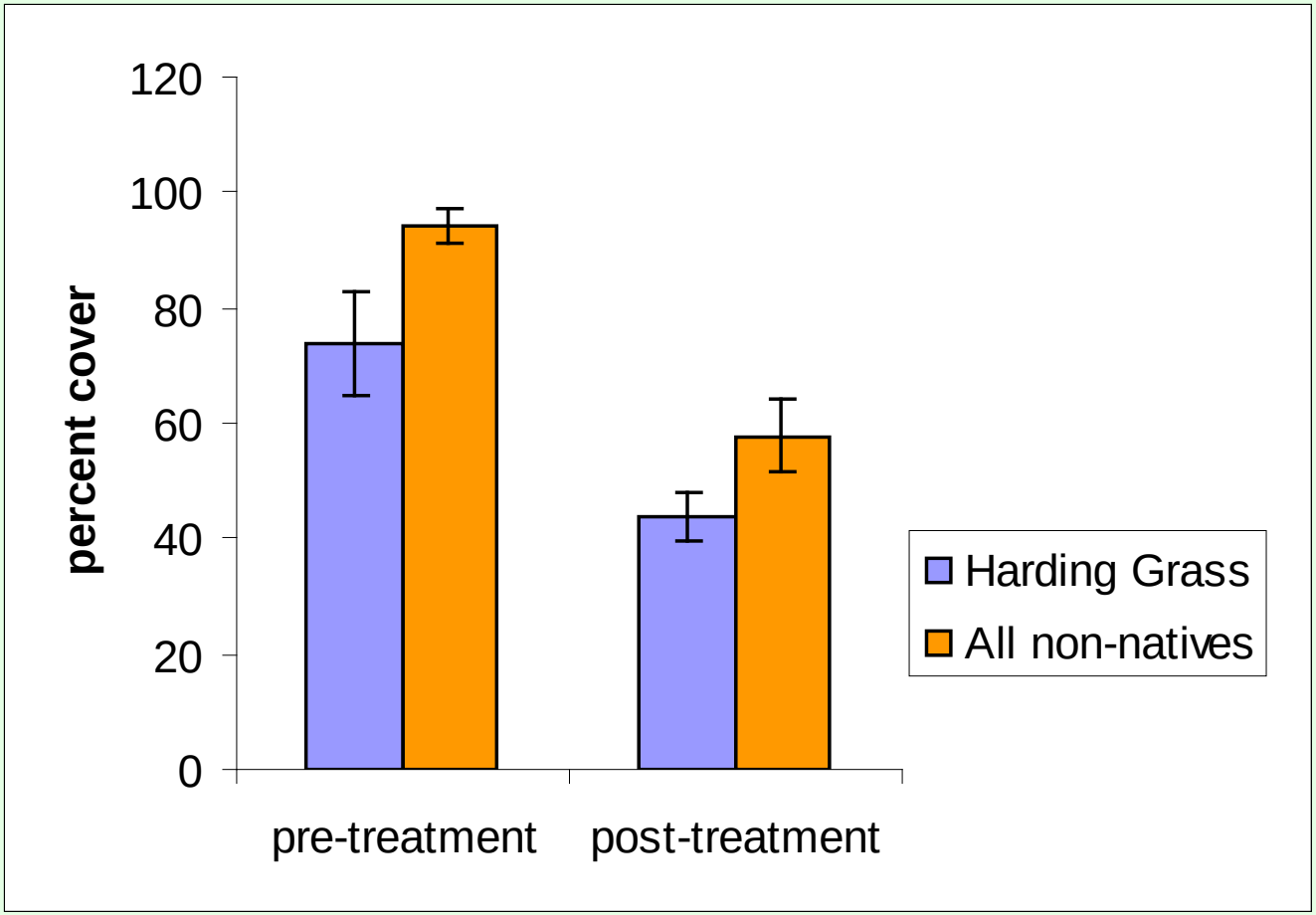
- Assessment of percent cover Harding grass using randomly placed plots
- 15 one meter square plots measured before and after treatment
- Plots are stratified random, temporary
- Photopoints
  - Photos taken before and after treatment

Photopoints

April 2004, before treatment

January 2005, after cutting and spraying

Plot Data



Treatment = Cutting followed by spraying 2 months later with 2% glyphosate

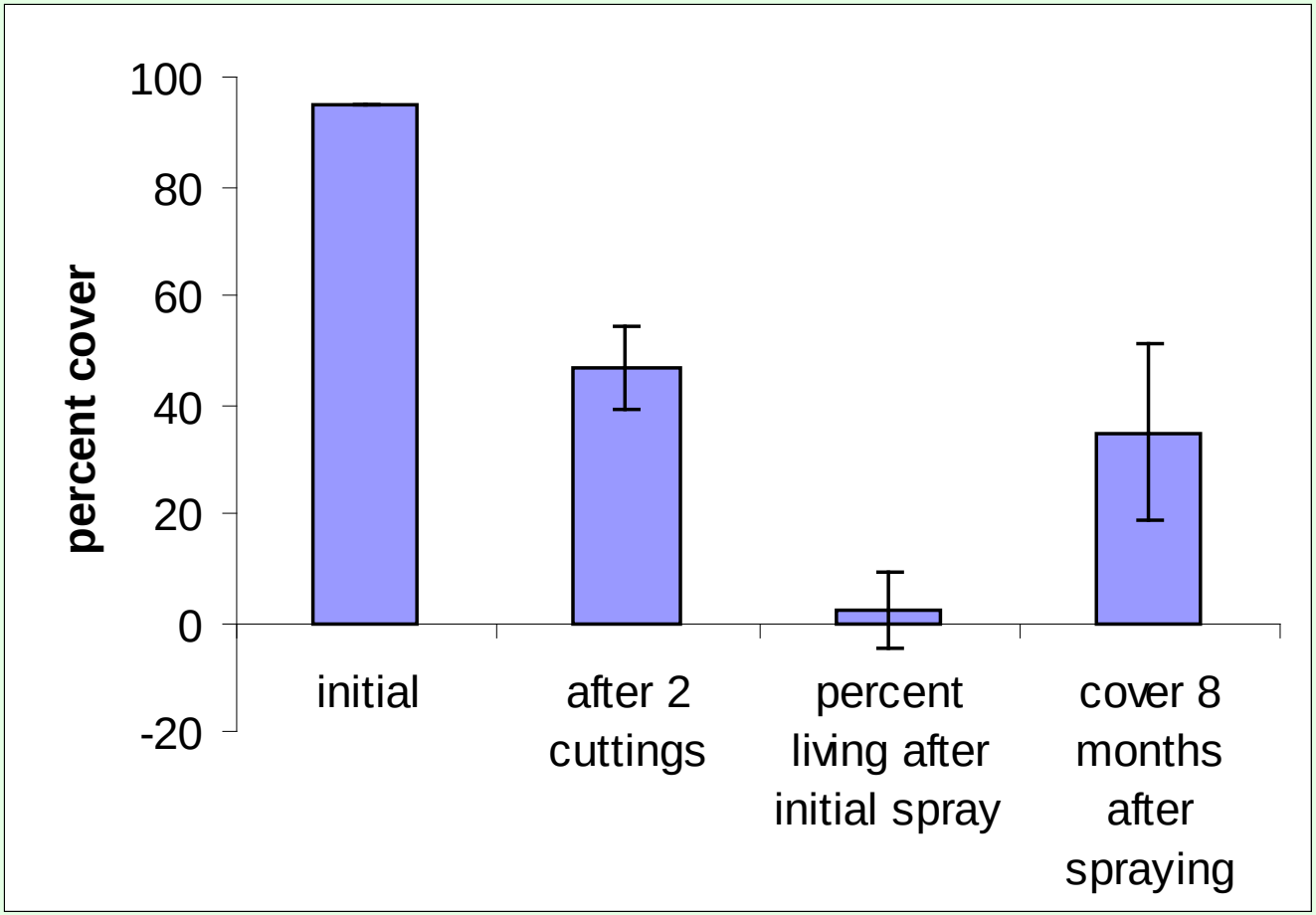
What we learned from monitoring

- Treatment reduced Harding grass by 20% but did not achieve goal (0% Harding grass)
- Another treatment is necessary
- Questions:
  - Is this a typical response?
  - Is limited efficacy due to missing plants at time of application?
  - Is limited efficacy due to timing of spraying?

Monitoring *Conium maculatum* treatment at Upper Zuma Falls

- 1 acre infestation of poison hemlock
  - Impacts on riparian system
  - Potential for spread into pristine canyon
- Goal: reduce to 0% cover
- Allow natural regeneration of native species
- Cut in spring and summer
- Sprayed with 2% glyphosate following spring (one year after cutting)
- Monitoring: 10-15 randomly located one meter squared plots

Treatment Results



Conclusions from Monitoring

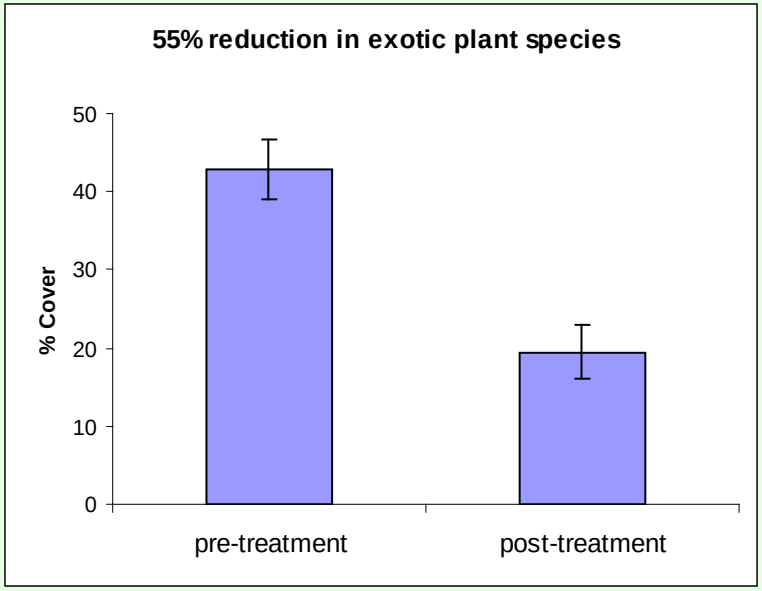
- Treatment reduced Conium cover
- Spraying killed adult plants but seedlings have sprouted from seedbank
- Another treatment is necessary to continue reduction and achieve management goal (0%)

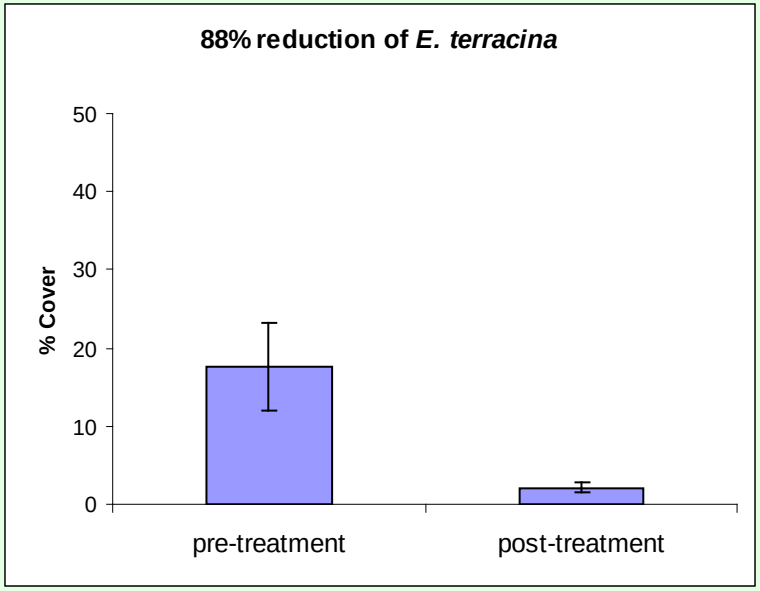
Intermediate in Scale and Investment Monitoring: BAER

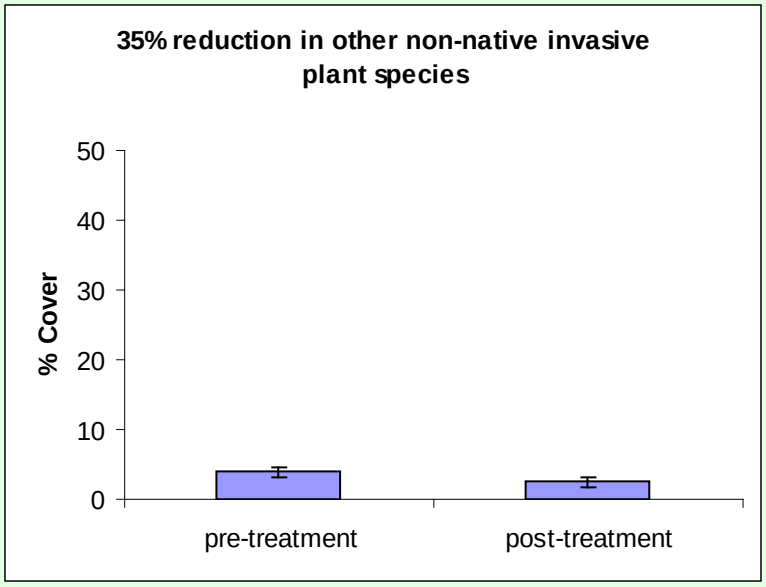
- Goal: track postfire invasive species control efforts
- Goal: track postfire native vegetation recovery
- Monitoring tools:
  - Maps
  - Plots
  - Visual assessments

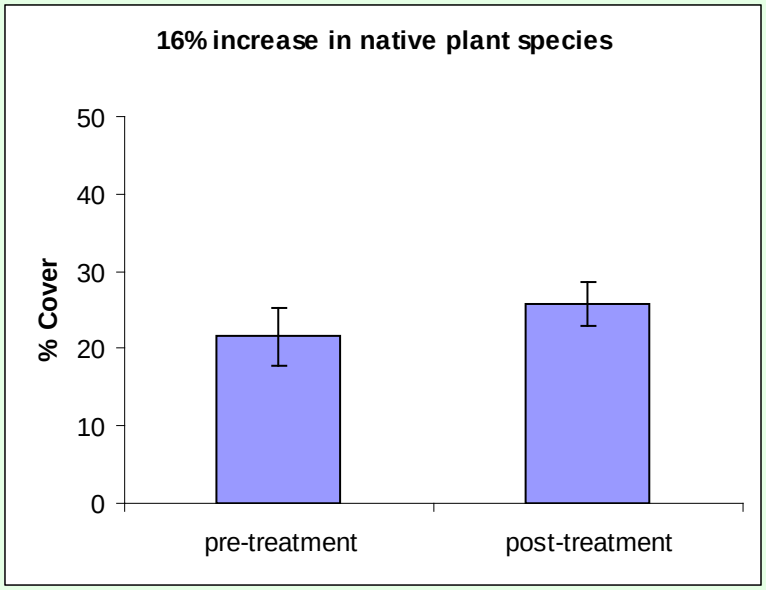
maps

BAER Photopoints


55% reduction in exotic plant species
% Cover
50
40
30
20
10
0
pre-treatment
post-treatment


88% reduction of E. terracina
% Cover
50
40
30
20
10
0
pre-treatment
post-treatment


35% reduction in other non-native invasive plant species
% Cover
50
40
30
20
10
0
pre-treatment
post-treatment


16% increase in native plant species
% Cover
50
40
30
20
10
0
pre-treatment
post-treatment

Intermediate Level of Monitoring Summary

- Uses combination of photopoints and plots
- Plots are placed quickly and a small number is used
- Good for assessment of large changes
- Provides sufficient data for analysis
- Quick and dirty
- **If samples have high variability (due to scale or heterogeneity), may not work**

Track Progress Through Time (Low):

- Goal: track major changes over time
- No need for quantitative analysis
- Example: tracking restoration efforts at Solstice Canyon

Before and After Weed Removal

BEFORE

AFTER

Progress at Solstice

Before

After

Low-Level Monitoring Summary

- Use of photopoints can be quick and effective
- Good at showing radical change
- Can indicate problems
- Must be done on a regular basis

Assessing status and trends over large scales (high investment)

- Requires inference
- Requires statistical rigor in sampling design
- May be labor intensive to generate results
- Example: monitoring spread of invasive species across the Santa Monica Mountains

Mountains-Wide Weed Monitoring

- Management goals:
  - Maintain diversity of coastal sage scrub, chaparral, riparian habitats
  - Preserve or increase abundance of listed species
- Monitoring goals:
  - Track spread of invasive species mountains-wide
    - Detect 25% increase in species range or species abundance within range
  - Assess impacts of exotic species establishment on native communities (diversity)
    - Detect 20% reduction in diversity within community types

Sampling Needs

- Sampling on a regular basis must be achievable by limited staff
- Methodology must be robust to observer error
- Within sample type variability must be low (so power will be high without 10,000 samples)

Sampling Approach

- GRTS selected sites for mountains-wide inference
- Sampling along invasion corridors
- Rotating sample frame (2 years on, 5 years off)
- Will require large number of samples due to variability
- Impacts on native vegetation covered under separate protocol

Landscape-Scale Considerations

- Limit variability of samples
- Stratify if possible
- Make methods as robust as possible to observer error (between years and between individuals)
- Preliminary sampling followed by power analysis

High Investment, Landscape-Scale Monitoring Summary

- Can be difficult:
  - Large scale = high variability
  - People taking data change over time
  - Expected change is small
- Requires good design and forethought
- Good to test out these methods

Monitoring Grab Bag!

- Google earth images useful tool
- Assessing survivorship in restoration projects
- Tracking function over time – insects, birds
- Re-sampling old maps (VTMs, other vegetation maps)
- Using satellite imagery

Monitoring Summary

- Monitoring does not have to be time intensive
- Type of monitoring used depends on goal
- Consider your ability to detect change based on your monitoring methods
- Trade-off between time required and information gained
- Make management and monitoring goals as specific as possible

Monitoring Mistakes I Have Made…

- Collect pre-treatment data
- Collect data in the same way repeatedly (if possible)
- Don’t have too many photopoints
- Make sure to re-visit sites and collect data on a regular basis
- Make sure scale of monitoring fits with natural variability and management goals and actions