

Rangeland Monitoring & Measurements

RS332

Lecture 1: Introduction to Monitoring & Adaptive Management

August 2007

Class Survey

- Name
- What year (freshman, soph, jun, sen, other?)
- Current and future major/focus in education.
- What do you want to be when you grow up?
- If you could define your best learning environment, what would it be?
- Name one cool thing you did this summer.

Readings/References

- Elzinga et al., 1998
 - Ch 1
 - Ch 2 (pages 13-16)
 - Ch 4

Outline

- Definition of monitoring
- Monitoring objectives
- Types of monitoring
- Types of data
- Uses for monitoring data
- Related disciplines
- Compare/contrast monitoring, inventory, and research

What is monitoring?



Monitoring is:

Collection and analysis of repeated measurements to evaluate changes in condition and progress toward meeting a management objective.

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Collection and analysis of repeated measurements to evaluate changes in condition and progress toward meeting a **management objective**.

- Driven by objectives
- Set within management context

Elzinga et al., 1998

Example

Objective: healthy riparian system

Indicator: diverse age classes of native riparian tree species

Monitor?

Example

Objective: healthy riparian system

Indicator: diverse age classes of native riparian tree species

Monitor: abundance (density) of trees in each age class (seedlings, poles, mature) at regular intervals

Another Example

Objective: healthy watershed function

Indicator: low soil loss, high infiltration

Monitor?

Another Example

Objective: healthy watershed function

Indicator: low soil loss, high infiltration

Monitor:

Percent of ground covered by vegetation
(as cover ↑, infiltration ↑)

What else?

Another Example

Objective: healthy watershed function

Indicator: low soil loss, high infiltration

Monitor:

Percent of ground covered by vegetation
(as cover ↑, infiltration ↑)

Stream sediment load

Objectives, Objectives, Objectives!

- Clearly stated
- As detailed as possible
- Describes prediction/estimates response

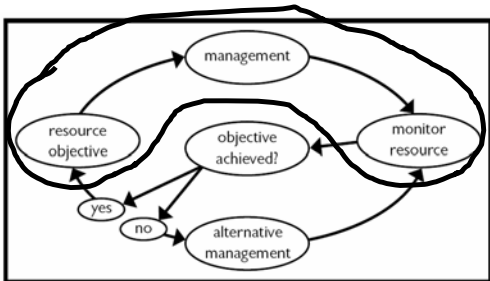
Realistic, Specific, Measurable

What is the advantage?

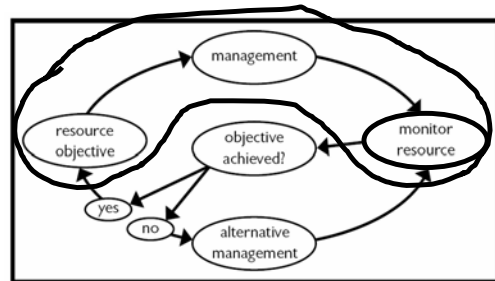
- Makes you think
- Allows clear communication with others
- Provides discrete, well-defined target
- Helps define degree of success

What is Adaptive Management?

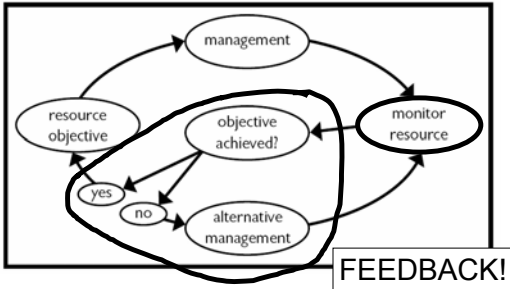
(Adaptive) Management Cycle



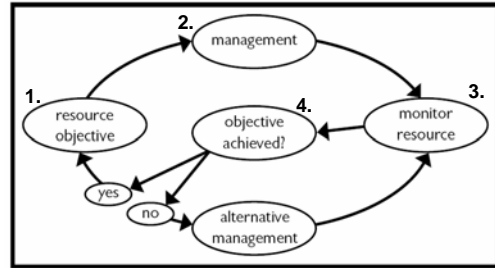
(Adaptive) Management Cycle



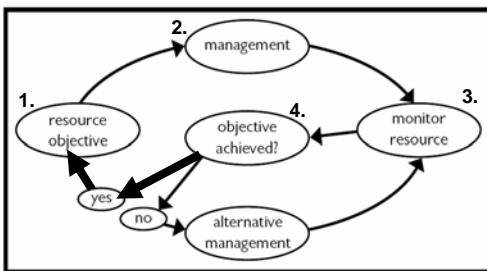
Adaptive Management Cycle



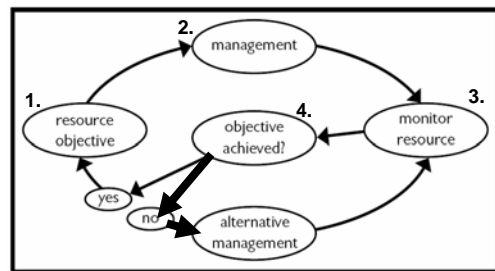
Adaptive Management Cycle



Adaptive Management Cycle

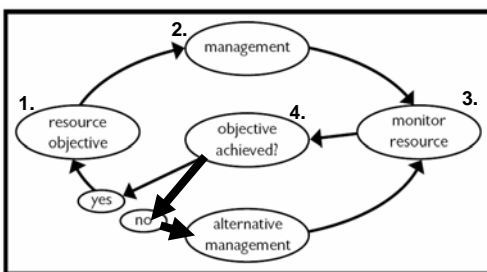


Adaptive Management Cycle

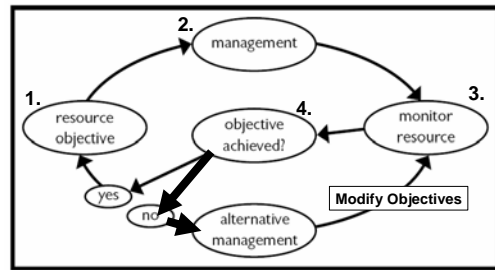


Adaptive Management Cycle

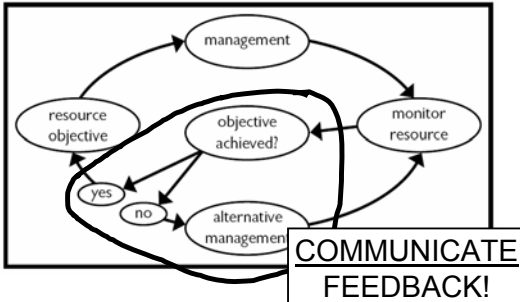
What happens if even given alternative management, objectives aren't met?



Adaptive Management Cycle



Adaptive Management Cycle



Adaptive Management Cycle

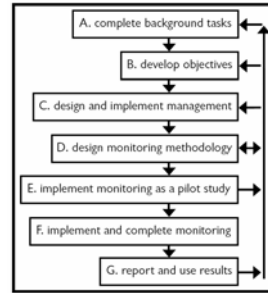


FIGURE 2.1. These seven major steps are broken into sub-steps and illustrated in figures 2.2 - 2.5.

What is Adaptive Management?

- A systematic process for continually improving management policies and practices by learning from the outcomes of previously employed policies and practices.

What is Adaptive Management?

- Two types
 - Passive
 - Active

Passive Adaptive Management

- One “best” management strategy
- Monitor outcome

Passive Adaptive Management

- One “best” management strategy
- Monitor outcome
- Change management based on outcome

Active Adaptive Management

- Multiple management strategies
- Monitor outcomes
- Discriminate between alternatives

Active Adaptive Management

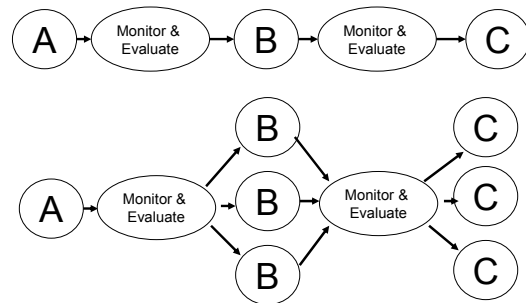
- Multiple management strategies
- Monitor outcomes
- Discriminate between alternatives
- Change management based on BEST outcome

Active Adaptive Management

- Multiple management strategies
- Monitor outcomes
- Discriminate between alternatives
- Change management based on BEST outcome

Involves EXPERIMENTATION
Results in accelerated learning

Passive vs. Active AM



What kind of information do we need to provide a reliable basis for management decisions?

Qualitative vs. Quantitative

Qualitative:

Quantitative:

Qualitative vs. Quantitative

Qualitative:

- Descriptive info, photos, categories, ranks.
- Example: rangeland health checklist

Quantitative:

Qualitative vs. Quantitative

Qualitative:

- Descriptive info, photos, categories, ranks.
- Example: rangeland health checklist

Quantitative:

SEMI-quantitative data



Qualitative vs. Quantitative

Qualitative:

- Descriptive info, photos, categories, ranks.
- Example: rangeland health checklist

Quantitative:

- Measured, enumerated
- Example: counts of plants; weighing biomass

SEMI-quantitative data



Subjective vs. Objective

Subjective:

Objective:

Subjective vs. Objective

Subjective:

- Based on personal judgment, expertise
- Example: rangeland health checklist

Objective:

Subjective vs. Objective

Subjective:

- Based on personal judgment, expertise
- Example: rangeland health checklist

Objective:

- Repeatable:
 - different observers
 - over time
- Example: counts of plants; weighing biomass

Why monitor?



Monitor to:

- Determine effectiveness of management
 - Learn what works, what doesn't
 - Justify making changes
- Document system variability
- Meet regulatory requirements

Monitoring may also:

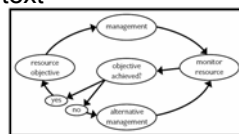
- Establish a record of trends
- Reveal potential problems early
- Save money and time

Monitoring may also:

- Help different interests arrive at a shared understanding of the ecosystem
- Build community—trust, reciprocity, ability to work together
- Improve permittee-agency relationships

What ISN'T monitoring?

- Inventory
- Natural history studies
- Research
- Anything not driven by objectives and set within management context



What is inventory?



Inventory is:

- Point in time measurement
- Determine location and condition of resources
- Used for planning
 - Distribution of resources
 - Identify resource concerns
- Identify potential monitoring locations
 - = Baseline monitoring data

Example

Ranch planning:

- inventory ecological sites
 - Note productivity
 - Note condition
- inventory for improvements
 - Locations
 - Conditions and goals

Another Example

Conservation planning:

- The Nature Conservancy inventory tasks
 - Classify ecological types
 - Analyze spatial distribution and abundance
 - Prioritize conservation efforts

Inventory	Monitoring
Point in time, "snapshot"	Repeated measures over time
More measurements	Fewer measurements
Cruder measurements	More precise measurements
Characterize total area	Attributes related to management objectives

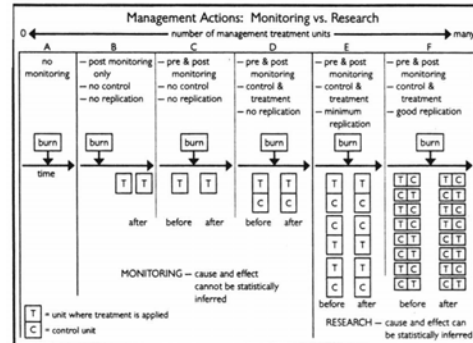
Monitoring-research continuum

What is the difference between monitoring and research?

Scientific Research

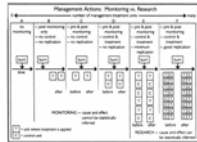
- Conceptual model of system
- Alternative hypotheses
- Experimental design
 - Treatments randomly assigned
 - Controls
 - Replication (in space and time)
- Analysis using statistics
- Results more broadly generalized
- May advance theory
- Peer reviewed

Research-monitoring continuum

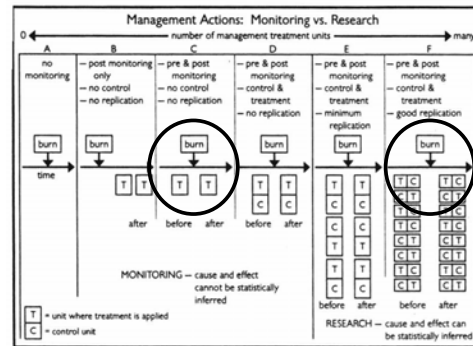


Research-monitoring continuum: Summary

- As move from monitoring to research
 - Add controls
 - Increase replication
 - More plots
 - More sites
 - More time
 - Assign treatments randomly



Research-monitoring continuum



Monitoring ≠ Research!

(but monitoring can be a subset of research)