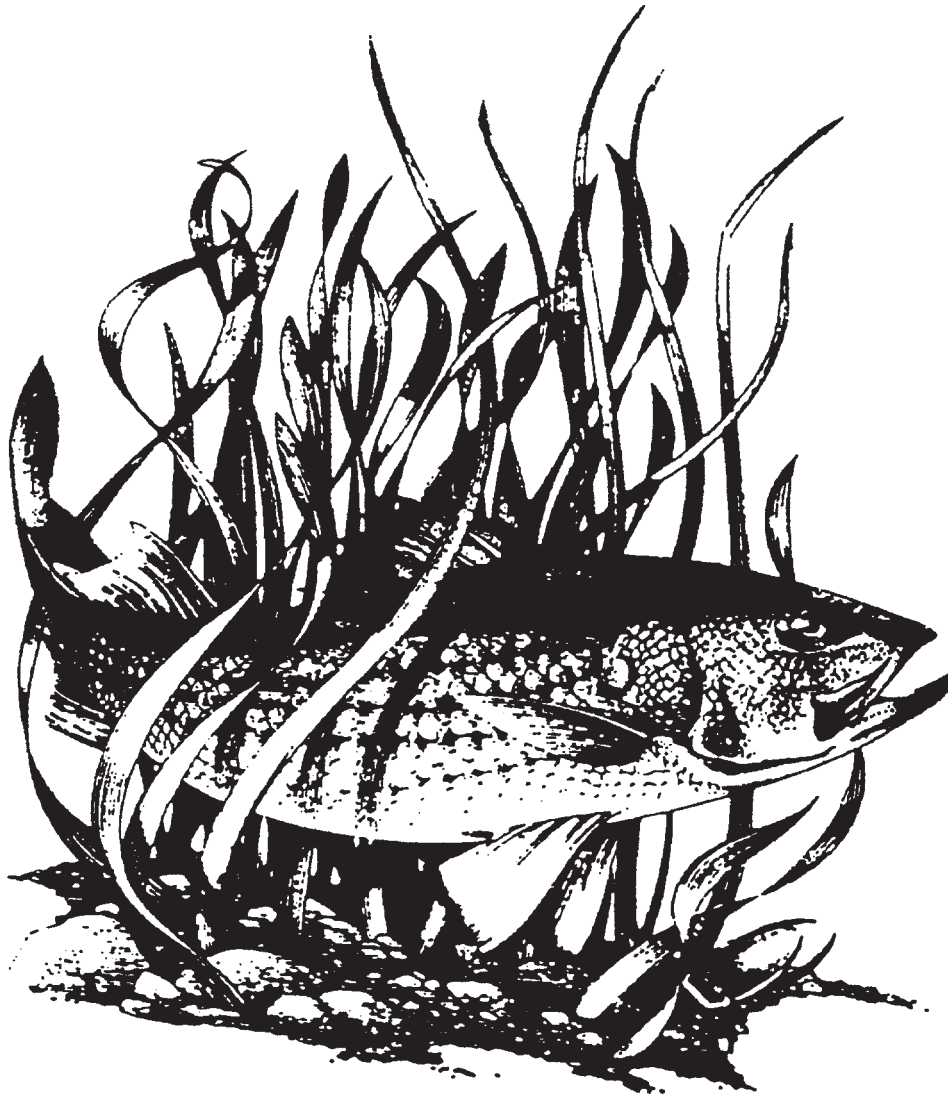


# MONITORING

# INDICATORS

*"When you  
try to change  
any single thing,  
you find it  
hitched to everything else  
in the universe."*

*JohnMuir*



# Monitoring Indicators

This unit will focus on the selection of variables to track trends in conditions. Examples of wilderness indicators will be provided. Ideas for development of a monitoring program will be discussed.

## Objectives

1. Participants can define the term “indicator” and can explain why monitoring is important.
2. Participants can identify three potential indicators to monitor progress toward desired conditions for their Wilderness.
3. Participants can give an example of a good indicator and a poor indicator and explain what makes them good or poor.
4. Participants can outline how to establish and implement a monitoring program.

## Key points

- Indicators translate desired conditions into something measurable.
- Indicators help you track changes in wilderness conditions.
- In selecting indicators, run each indicator through the screening questions. Think through how you will measure the indicator, what information it provides and how you will use the information.

## Monitoring Indicators

### Definition

Variables which can be measured to track change in conditions caused by human activity so that progress toward desired conditions can be assessed.

Indicators can be viewed as a means to reduce a large amount of information down to its simplest form while still retaining the essential information needed to answer questions (Ott 1978). Indicators have been used in pollution assessment, range, economics (e.g. the gross national product), and social sciences (e.g. average life expectancy, crime rate, unemployment rate).

### Purpose

- Indicators help focus your data collection efforts on what is most important.
- Indicators are the elements for which objectives will be set. (They translate the description of desired conditions into something that can be measured.)
- The monitoring of indicators tracks whether or not you are making progress towards desired conditions.
- Interpretation of monitoring information helps assess the effectiveness of particular management strategies.

The importance of well-designed, long-term monitoring in Wilderness cannot be overemphasized. Typically, there is very little information available about conditions within Wilderness, especially with respect to ecological systems. We should draw upon already existing information collected elsewhere but we must recognize the limitations of such information. There is no substitute for information gathered from the area and the only way to obtain it is through the establishment of a long-term monitoring program.

### requirements

### Monitoring

One of the decisions made at the program level is monitoring and evaluation requirements. This requirement is met by identifying the elements to be monitored (indicators), monitoring techniques, expected precision and reliability, measurement frequency, and acceptable variation.

In the National Park Service, backcountry management planning and monitoring direction can be found in NPS-77 and NPS-75.

### Monitoring levels

Monitoring progress towards achievement of desired conditions occurs at three levels. The focus of all monitoring is to answer—So What? Are trends in conditions moving toward desired conditions.

**Implementation (Compliance) Monitoring:** purpose is to determine if programs, projects and activities are implemented as they were designed. Did we do what we said we would?

**Effectiveness Monitoring:** purpose is to determine if what we are doing is effective in making progress toward desired conditions. Are our actions accomplishing what we intended? The point here is to assess whether resource conditions are improving, staying the same, or getting worse.

**Validation Monitoring:** purpose is to determine if we are monitoring the right thing. This includes testing and evaluating predictive models such as wildlife habitat relationships or water quality models.

**Process:**

1. Review desired conditions and ask—what can we measure to track whether or not we are making progress toward these conditions?
2. Look at what has been measured in similar geographic areas and ask how it works and whether it applies.
3. Ask citizens, managers, scientists to suggest indicators (e.g. ask citizens what factors most influence their assessment of whether they had a quality experience or not; ask scientists what factors are most important in determining the health of riparian areas). Talk with resource specialists and review existing plans to find out what is already suggested to monitor such things as air quality, rangeland conditions. Review the literature.
4. Screen potential indicators to determine how useful they might be . Questions to ask....
  - What does this indicator indicate? Does it really provide the information we want to know? What question are we trying to answer?
  - Does this indicator directly relate to the condition of an important resource (i.e. the effect of human activities and management actions, not the activities or actions themselves)?
  - Does the indicator measure conditions which are resilient (i.e., conditions improve under proper management)?
  - Does the indicator measure conditions with minimal variability (so that observed changes can be related to management changes/visitor behavior rather than natural variability)?
  - Can the indicator be measured using field methods and sampling techniques (is it doable based on available expertise and technology)?
  - Can the indicator be measured accurately and reliably (with some training)?
  - Does the indicator act as an early warning, alerting managers to deteriorating conditions before unacceptable changes have occurred?
  - Can the indicator be measured without significantly detracting from the visitors' experience?
  - Can the indicator provide information which is worth the time and cost required?

It is unlikely that any one indicator will meet all of the criteria listed above. However, the bundle of indicators selected must give managers a clear picture of whether the overall trend in conditions is toward the desired condition. Generally, the indicator must provide information relative to questions you are trying to answer, it must be doable, and it must be able to be measured reliably.

5. In attempting to monitor the quality of a particular resource attribute, we ideally would like to find a simple, easy to measure element that is indicative of overall

## 8 Monitoring Indicators

quality. We can do this when we have good information about the correlation between the element we are measuring and what we are really trying to measure. For example, Salmonella is of concern in water quality but rather than measure Salmonella counts directly, we measure E. coli which is highly correlated with Salmonella counts and is easier and safer to measure. In wilderness, one attribute we try to measure is the quality of the experience. We know that the number of groups one encounters affects the experience. Ideally, it would be much easier to just count the number of cars at the trailhead, rather than try to count encounters. However, there doesn't appear to be a good correlation between car numbers and number of encounters and overall experience quality, thus we end up having to measure encounters directly.

6. Whether you choose to use an index rating or "lump" indicator versus a very specific indicator depends on how detailed you need your information to be. An example of lumping is "range conditions." This indicator can be split into many more specific indicators, one of which may be the one you're looking for. Example of splitting:

Range condition =

- Percent utilization of forage plants
- Amount of trampling
- Change in species mix
- Introduction of non-native plants
- Elimination of some native plants
- Loss of ground vegetation (percent soil exposed)
- Evidence of streambank erosion from livestock
- Loss of riparian shrubs
- Disturbance to aquatic environment, which can be split further:

- Change in water temperature
- Change in water chemistry
- Increase in siltation
- Change in aquatic vegetation
- Change in fish/insect populations
- Change in stream bottom conditions

So.... "range condition" may be too vague; In conjunction with your range specialists, you may want to select a few of the more specific ones to get at the key issues in your particular area.

7. Consider indicators to monitor the socio-political environment related to your Wilderness (e.g., trends in support of the concept of wilderness).

### Examples

Goal: Improve your physical health.... Good Indicators: Pulse rate recovery, body fat, HDL/LDL cholesterol level.... Poor Indicators: # of doctor visits, caloric intake

Explain why indicators on the first list are good and the indicators on the second list are poor using screening questions.

## Indicators

Another useful analogy is a car. How do you assess the quality of your car—you could focus on assessing how well it runs, how good it looks.... Specific indicators could be chosen depending on what question you are trying to answer.

**Wilderness monitoring programs**

Overall goal is to track change in natural conditions and processes caused by human activities and assess whether opportunities for solitude, self-reliance, challenge and inspiration are being provided.

Reasonably good indicators (assuming you are asking the questions these indicators can answer): Frissell Condition Class, # of campsites per drainage or area or river mile, time spent waiting at launch sites, # of other groups seen from campsite, forage utilization, lake alkalinity....

Poor indicators: number of trailheads, number of regulations, number of trails, total coliform, number of fish, number of law enforcement officers,

Explain why indicators on the first list are potentially good indicators and indicators on the second list are poor using screening questions.

**Examples based on desired condition descriptions in unit #7**

<b>Question</b>	<b>Indicator</b>
Is the threatened bald eagle recovering?	Number of nesting pairs Number of young fledged
Is fire suppression altering natural fire frequency in particular vegetation types?	Predicted vs. actual fire frequency for each vegetation type
Is air quality meeting Class I standards?	Visual range—extinction coefficient, lake alkalinity Presence/absence of foliose-fruticose lichens
Are known cultural resource sites being affected by human activities?	Evidence of human activity—camping, trails, graffiti.. at known sites—impact rating
Are visitors able to obtain campsite privacy and solitude?	Number of occupied camps within sight or sound of each other
Are campsite conditions meeting standards? Are site closures causing the total number of campsites to change?	Cole campsite assessment rating Number of sites per drainage

**Designing guidelines**

Four factors which contribute to the failure of a monitoring program are:

1. Abandonment of system—initial measurements are never repeated due to inconsistent funding or poor documentation of sample site locations (inconsistent field techniques, frequent staff turnover).
2. Sloppy techniques—poor measurement reliability.
3. Data pileup—collected information is never analyzed or stored in a usable form.
4. No manager action—information is never used in decision-making (Moir 1980).
5. Poorly selected indicators that are unreliable, not doable, or don't provide

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## Implementing

information to answer questions.

1. Institutionalize the monitoring plan; don't do it *ad hoc*—dedicate the necessary funding. Tie in with monitoring programs with other government agencies, non-governmental organizations, and other resource areas. For example, inventory and monitoring for wildlife species often covers large areas. Work with others to make sure Wilderness is included. Include accountability for monitoring in performance elements.
2. Clarify the purposes and levels of monitoring. State the questions you are trying to answer.
3. Gather available data. Review what has already been done.
4. Select monitoring indicators. Determine priorities for where to monitor. Identify when monitoring will be done—remember that time of year can affect measurements such as those for water quality and vegetation.
5. Describe the measurement methods to use for each selected indicator.
6. Develop sampling scheme unless all sites will be monitored.
7. Set up data storage and management system.
8. Develop monitoring field sheets.
9. Train field personnel. Training guides with photos of different conditions are very helpful. Coordinate data collection with other agencies and programs where possible.
10. Analyze collected data.
11. Report results in a way that clearly illustrates trends and is easy for people to understand. Make presentations to decision-makers. Show how trends in conditions compared with standards and use information to adjust management actions.
12. Evaluate and refine indicators, measurement methods and standards.

# MONITORING INDICATORS

## **Definition:**

Variables which can be measured to track change in conditions caused by human activity.

## **Purpose:**

- \* Focus data collection efforts on what is most important.
- \* Track progress toward achieving desired conditions.
- \* Evaluate effectiveness of management.

## **Process:**

- \* Review desired conditions and ask; what can we measure?
- \* Look at usefulness of indicators being used in similar areas.
- \* Review research and ask people what variables would be most meaningful.
- \* Screen potential indicators to determine usefulness.

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# SCREENING QUESTIONS FOR INDICATORS

- \* Does the indicator tell you what you want to know? What question are you trying to answer?
- \* Does the indicator directly relate to condition of an important resource?
- \* Can the indicator be measured?
- \* Can the indicator be measured using simple equipment? Is it feasible.
- \* Can the indicator be measured reliably?
- \* Does the indicator alert managers to declining conditions before unacceptable changes have occurred?
- \* Can the indicator be measured without detracting from the visitors experience?
- \* Does the indicator provide information which is worth the time and cost required to get it?
- \* Does the indicator measure conditions which are resilient?
- \* Does the indicator measure conditions with minimal natural variability?

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# MONITORING PROGRAMS

## MONITORING LEVELS

### **Implementation**

Did we do what we said we would?

### **Effectiveness**

Did our actions accomplish what we intended?

### **Validation**

Are we monitoring the right thing?

## WHY DO MONITORING PROGRAMS FAIL?

- \* Meaningless data
- \* Abandonment
- \* Sloppy techniques of poor reliability
- \* Data pileup
- \* No manager action
- \* Poorly selected indicators

## WHERE TO FOCUS EFFORTS

- \* Where standards are close to being exceeded.
- \* Where there has been a recent or expected change in human uses.
- \* Where there have been recent significant ecological or physical changes (fire, avalanche, etc.)
- \* Rate of change is rapid.
- \* Quality of existing data is poor.

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# WORKSHEET

## WRITING INDICATORS

Select one of your desired condition statements from previous worksheet. Then ask yourself—what should we measure to assess whether we are making progress toward these conditions? What problems are we most concerned about? For example, if you have a desired condition statement about campsites, what is it about them that is the problem—their location? Density or number? Amount of bare ground around them? These are the parameters which need to be considered in order to write useful indicators. Try some below.

Select one of your desired condition statements and write it below:

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What can we measure? What aspect of the desired condition are we concerned about?

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Indicator to measure:

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For each indicator identified, test its usefulness. Answer YES, NO, or MAYBE

What does this indicator indicate? Does it really provide the information we want to know? What question are we trying to answer?

- Does this indicator directly relate to the condition of an important resource (i.e. the effect of human activities and management actions, not the activities or actions themselves)?
- Can the indicator be measured?
- Can the indicator be measured using field methods and sampling techniques (is it doable based on available expertise and technology)?
- Can the indicator be measured accurately and reliably (with some training)?
- Does the indicator act as an early warning, alerting managers to deteriorating conditions before unacceptable changes have occurred?
- Can the indicator be measured without significantly detracting from the visitors' experience?
- Can the indicator provide information which is worth the time and cost required?
- Does the indicator measure conditions which are resilient (will respond to changes in management action)?
- Does the indicator measure conditions with minimal natural variability?