

National Park Service  
U.S. Department of the Interior  
Southeast Coast Network  
Southeast Region



# Monitoring and Reporting Indicators in the National Park Service

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October, 2012  
Savannah, GA



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# NPS I&M Program in a Nutshell

- 13-year old program
- 32 groups of parks (networks) charged with identifying indicators of park ecosystem condition and designing & implementing plans to get it done
- NPS is decentralized: Parks are independent units with differing management directives
- I&M program includes parks traditionally managed for cultural resources

# Directive and Commitment

- 1998 NPS Omnibus Management Act
  - “The Secretary shall undertake a program of inventory and monitoring of National Park System resources to establish baseline information and to provide information on the **long-term trends in the condition** of National Park System resources...”
  - “The Secretary shall ... assure the full and proper utilization of the results of scientific studies for park management decisions.”
- 2000 Appropriations: Natural Resource Challenge
  - New permanent funding
  - New FTEs to do the work

# Condition-based Management

## Resource Condition

	Air	Water	Geology & Soils	Biological Integrity	Land-scapes
Park #1					
Park #2					
Park #3					
Park #4					

### Status

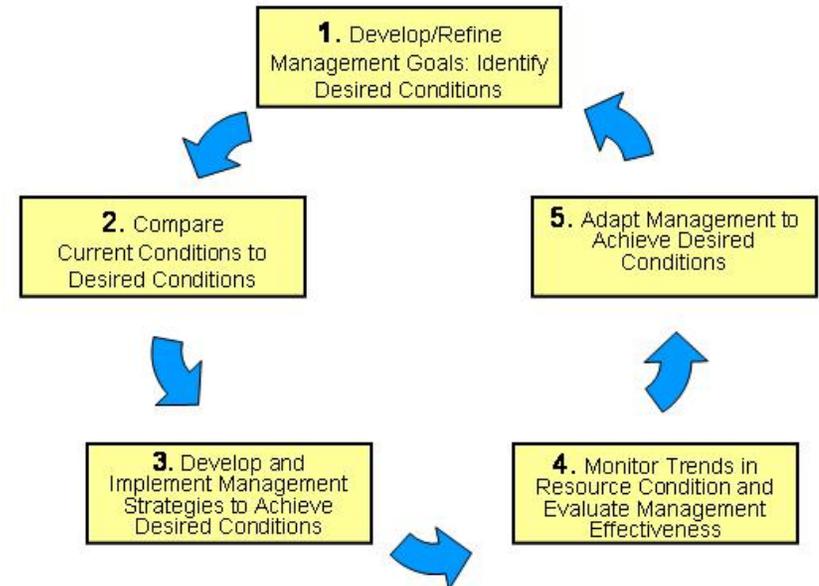
- Significant Concern
- Caution
- Good: Resources in good condition

### Trend

- Condition is Improving
- Condition is Unchanged
- Condition is Deteriorating

### Confidence

- High
- Medium
- Low



# Purpose of Monitoring Indicators

- Indicator data one of several science components of adaptive management cycle.
- Reduces uncertainty & risk
  - Improve near-term actions, programs, activities
  - Inform long-term planning (conservation design)
  - Inform definition of management targets
  - Inform appropriate condition assessment criteria
  - “Scenario Tracking”
    - Assess conditions
- Identify problems before they’re crises
- Track progress toward management goals

# Indicator Development Process

1. Clearly define goals and objectives
2. Compile and summarize existing information
3. Develop conceptual models
4. Prioritize and select indicators
5. Develop sampling design
6. Develop protocols
7. Develop the data management, analysis, and reporting tools.
8. *Then you monitor.*

# Lesson 1: Ecological Monitoring Framework

Ecological Monitoring Framework			
Level 1 Category	Level 2 Category	Level 3 Category	Comments

Level 1 Category	Ecological Monitoring Framework		
	Level 2 Category	Level 3 Category	Comments
Air and Climate		Marine Hydrology	
Geology and Soils	Water Quality	Water Chemistry	
		Nutrient Dynamics	
		Toxics	
		Microorganisms	
		Aquatic Macroinvertebrates and Algae	
Biological Integrity	Invasive Species	Invasive/Exotic Plants	
		Invasive/Exotic Animals	

Level 1 Category	Ecological Monitoring Framework			
	Level 2 Category	Level 3 Category	Comments	
Foc		Amphibians and Reptiles		
		Birds		
		Mammals		
		Vegetation Complex (use sparingly)	Catch-all category to be used in rare cases where no other community type can be used.	
		Terrestrial Complex (use sparingly)	Catch-all category to be used in rare cases where no other category can be used.	
		At-risk Biota	T&E Species and Communities	
	Human Use	Point Source Human Effects	Point Source Human Effects	
		Non-point Source Human Effects	Non-point Source Human Effects	
		Consumptive Use	Consumptive Use	
		Visitor and Recreation Use	Visitor Use	
Cultural Landscapes		Cultural Landscapes		
Landscapes (Ecosystem Pattern and Processes)	Fire and Fuel Dynamics	Fire and Fuel Dynamics		
	Landscape Dynamics	Land Cover and Use	Includes landscape pattern, fragmentation	
	Extreme Disturbance Events	Extreme Disturbance Events	Records of floods, windthrow, ice storms, hurricanes, etc., which might also be placed in Climate category.	
	Soundscape	Soundscape		
	Viewscape	Viewscape/Dark Night Sky		
	Nutrient Dynamics	Nutrient Dynamics		
	Energy Flow	Primary Production		

Water

# Connecting the Dots

- **Natural Resource Condition Assessments**
  - For fundamental resource values, identifies indicators and condition criteria
  - Reports condition
- **Resource Stewardship Strategies**
  - identifies and tracks indicators of desired resource conditions
  - recommends comprehensive strategies to achieve and maintain desired conditions and to manage natural and cultural resources
- **State-of-the Park Report Card**
  - Reports status and trends of condition of park resources

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## State of the Park Report

**Big Hole National Battlefield**  
Montana



December, 2011

## State of the Park Summary Table

Resource or Value	Condition Status/Trend	Rationale
<b>Natural Resources</b> <a href="#">web</a> ▶		
Climate		Precipitation and temperature are key drivers of natural resources conditions at BIHO, which is characterized by long, cold winters and cool summers. Above-average spring rainfall and moderate temperatures, particularly in 2010, have provided favorable growing conditions for focal species such as Lemhi penstemon and camas lily. No trends away from long-term averages are discernible.
Air Quality		Air quality in Wisdom, Montana is 99 on a scale of 1 (worst) to 100 (best) as reported by the Environmental Protection Agency. Beaverhead County ranks among the best 20% of counties in the U.S. for emissions of sulfur dioxide and volatile organic compounds, and among the best 30% of counties for emissions of carbon monoxide, nitrogen oxide, and fine particulate matter.
Water Quality		The Upper Columbia Basin I&M Network recently began to monitor water quality at BIHO. Water temperature and pH were within State standards. Dissolved oxygen levels fell below the regulatory threshold (8.0 mg/L) on 97 of the 106 monitoring days (92% exceedance). A Hilsenhoff Biotic Index of 4.23 for aquatic macroinvertebrates indicates that water quality is good.
River Channel		In summer 2012, the Network monitoring program will implement monitoring of river channel characteristics in the North Fork Big Hole River as well as of the riparian plant community. A natural resource condition assessment conducted in 2009 provided evidence that the channel and riparian vegetation is in good condition.
Vegetation Communities		The willow-dominated riparian zone and adjacent floodplain meadow, and the open steppe hillslopes and pine forest overlooking the Battlefield, are key cultural landscape plant communities. Overall condition of these 3 communities is good, but worrisome trends in invasive weeds have been reported. Lodgepole pine encroachment into the open hillslopes is an ongoing cultural landscape issue.

Status		Trend		Confidence	
	Significant Concern		Condition is Improving		High
	Caution		Condition is Unchanging		Medium
	Good Condition		Condition is Deteriorating		Low

# Integrated Planning & Reporting

Fundamental and Other Important Resources and Values	Desired Conditions	Attributes	Beneficial Influences	Detrimental Influences	Indicators	Reference Condition	Management Target	Current Condition	Target Met?
<b>Air Quality</b>	Denali will achieve the highest attainable air quality levels and visibility standards consistent with the applicable Clean Air Act designations and the mandates specified by ANILCA and the NPS Organic Act; Denali is designated as a Class I airshed.	Visibility	<ul style="list-style-type: none"> <li>◇ Remoteness</li> <li>◇ Distance from industry</li> <li>◇ Prevailing wind patterns</li> <li>◇ Clean Air Act protection</li> <li>◇ Improving emission standards</li> <li>◇ Low human population density in Alaska</li> <li>◇ Transportation system in Denali</li> </ul>	<ul style="list-style-type: none"> <li>◇ Coal-fired and other types of power</li> <li>◇ Intercontinental contaminant transport</li> <li>◇ Increasing size and frequency of wildland fires in North American and Asia</li> <li>◇ Prevailing wind patterns</li> <li>◇ Increasing global development</li> <li>◇ Increasing global human population</li> <li>◇ Local development (shallow gas, etc.)</li> </ul>	Visibility on clearest and on haziest days, as measured through the Interagency Monitoring of Protected Visual Environments (IMPROVE) program	Visibility on clearest and haziest days – remains stable or improves, as measured for PMDS Goal 1a3	Visibility on clearest and haziest days – remains stable or improves, as measured for PMDS Goal 1a3	<p>Visibility on clearest days – improving</p> <p>Visibility on haziest days – stable</p>	<p>Yes</p> <p>Yes</p>
<b>Wildlife populations, habitat, ecosystems</b>	The natural abundance, behavior, diversity, and ecological integrity of native animals as part of their ecosystems will be maintained	Natural regulation of animal numbers and distribution	<ul style="list-style-type: none"> <li>◇ Size of protected area</li> <li>◇ Lack of human disturbance</li> <li>◇ Protection from hunting</li> </ul>	<ul style="list-style-type: none"> <li>◇ Possible loss of habitat due to climate and vegetation change</li> <li>◇ Potential for increased harvest in certain areas</li> <li>◇ Disturbance in wintering areas</li> <li>◇ Inhibition of normal migration patterns</li> </ul>	<ul style="list-style-type: none"> <li>◇ Numbers, demography, &amp; distribution of caribou in the Denali Caribou Herd</li> <li>◇ Numbers, demography, and distribution of moose</li> <li>◇ Numbers and distribution of Dall's sheep</li> </ul>	Herd size and demography of each species remains within the range observed 1987-2007	Herd size and demography of each species remains within the range observed 1987-2007	<p>Caribou – Slowly increasing</p> <p>Moose – decreasing</p> <p>Dall's sheep – unknown</p>	<p>Yes</p> <p>Yes</p>

# It's okay to not know everything.

Priority or Resource Value	Indicator of Condition (Vital Sign)	Specific Measure	Condition Status / Trend	Rationale for Resource Condition	Reference Condition and Data Source	Notes
Air and Climate	Air Quality	Ozone	↓	Ozone concentration has decreased from 71.8 to 67.1 ppb <sup>1</sup>	61-75 ppb considered of moderate concern <sup>1</sup>	Based on five-year rolling averages beginning 2001-2005
		Total-N Wet Deposition	↔	Total N Deposition has varied from 3.1 to 2.7 kg/ha/yr <sup>1</sup>	>3 kg/ha/yr <sup>1</sup>	Based on five-year rolling averages
		Total-S Wet Deposition	↔	Total S Deposition remained steady for the first three rating periods and then decreased from 4.5 to 4.1 kg/ha/yr <sup>1</sup>	>3 kg/ha/yr <sup>1</sup>	Based on five-year rolling averages
		Group50 Visibility	↓	Group 50 visibility has been diminishing since the 2003-2007 rating period from 12.3 to 11.1 dv <sup>1</sup>	>8 dv <sup>1</sup>	Based on five-year rolling averages
	Weather & Climate	Growing Season Length	↑	All 3 stations relevant to FOSU had a longer growing season in 2011 compared to 2010 <sup>2</sup>		2010-2011 data only
		Maximum Temperature	↑	Maximum temperature at all 3 stations relevant to FOSU increased in 2011 compared to 2010 <sup>2</sup>		2010-2011 data only
		Number of Extremely Hot Days (> 90F)	↓	All 3 stations had fewer extremely hot days in 2011 compared to 2010 <sup>2</sup>		2010-2011 data only
		Number of Days Below Freezing	↓	All 3 stations relevant to FOSU had fewer days below freezing in 2011 <sup>2</sup>		2010-2011 data only
		Average Annual Temperature	↑	Two stations relevant to FOSU had higher average annual temperatures in 2011 than 2010 (the other station had inadequate data to calculate the average). 2011 average annual temperature was higher than the 30 year average at the both stations with a long-term record <sup>2</sup>		
		Average Annual Precipitation	↓	When compared to 2010, both stations had lower precipitation in 2011. When compared to the 30 year average total precipitation was less than average <sup>2</sup>		
Water Resources	Groundwater Dynamics	Groundwater Level Trends	↓	Daily measurements collected since 1990 indicated an overall decline in water level although levels appear to be increasing since 2005 <sup>3</sup>		
Biological Integrity Amphibians		Native vocal Anuran Species richness	↔	n=2 <sup>4</sup>		
		Native amphibian Species richness	↔	n=2 <sup>4</sup>		

# Lessons Learned

- Goals & Objectives need to be clear and agreed on first
- Conceptual Modeling is critical
- Prioritization and selection of indicators are two different steps.
  - Different partners have different priorities
  - Prioritization driven by who is doing the prioritizing
  - Selection is driven by who is responsible for the monitoring
- Southeast is highly diverse. Hard to standardize indicators and methods, with a few notable exceptions
- Data management can't be an afterthought; 1/3 Rule
- Monitoring is a secondary to management. It has to be somebody's Job #1 or it won't always happen.
- Start small, get it right, build from there.

# Food for thought 1

- **Conceptual Ecosystem Model**
  - Formalizes a shared understanding of the system's key components, natural processes, interactions, and anthropogenic stressors
  - Explains the system as it is now; not where we want it to be.
  - *Developing it is a consensus-building exercise that facilitates communication among stakeholders*
- **Two competing models of “the landscape” in conservation:**
  - The landscape as a whole with all of its parts, interactions, agents of change, processes, and functions, or
  - A collection of parts, habitats, or processes considered and managed at the landscape scale
  - Not a new dichotomy:
    - *Conservation: In Whole or in Part, Leopold (1944)*
  - LCC partners are built around different views of the landscape

## Food for thought 2

- What are the goals of the LCC with regard to indicators? Are indicators intended to...
  - Track status and trends of high-priority conservation targets of value in and of themselves?
  - Track progress of the overall conservation community in progress toward a shared outcome?
  - Provide the LCC with defensible means for prioritizing resources?
  - Track progress of specific management actions toward meeting project-level goals?
  - Develop a landscape-scale context within which partners can make coordinated decisions?
  - Track a response to landscape-scale drivers of ecosystem change?

# Questions/discussion



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