

The NPS Inventory & Monitoring Initiative

A Hierarchical Strategy

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Units of the National Park System are described by park management and scientists as diverse, often unique, and having many individual resource information requirements. The often discussed Inventory and Monitoring (I & M) initiative is meant not to answer every individual park resource question, but to provide a level of management knowledge Servicewide that will allow for more directed study, problem analysis, and problem solution.

Today a number of persistent and troubling concerns exist at the park level that require us to develop a hierarchical strategy for obtaining information about processes important to resource decisions. If we examine the threats identified in the State of Parks Report 1980 and its 1987 successor, the Natural Resources Assessment Action Program, and then combine this information with a cursory review of programs in parks, we find a number of broad resource management issues that contribute to the structure of park I & M efforts:

1. life zone or biogeographic changes (viz. grizzly bear in Greater Yellowstone Ecosystem)
2. human encroachment (viz. recreation, industrial development, resource exploitation)
3. biogeochemical changes (viz. acid rain, carbon dioxide, the carbon cycle, trace elements)
4. global climate change, including
 - a. temperature change (viz. life zone changes, melting snow fields and glaciers)
 - b. mean sea level change (viz. shoreline erosion)
 - c. precipitation change – patterns and amounts (viz. flooding, drought)

Within this context, all parks, while not having identical information needs, do have some commonalities. We should observe and document those common "elements of change" for park systems or ecosystems to the degree necessary to interpret and analyze the cause or causes of change. Inventory of biotic and abiotic elements and documentation of important ecosystem processes and perturbations (viz. succession, floods, fires, wind, earthquakes, volcanoes, species migrations, biogeochemical cycle changes, etc.) precedes any understanding of how park resources may change. These required data are highly variable over time and space, primarily because the issues or questions driving Servicewide long-term inventory, monitoring and research programs have differing scales, such as local, regional and global.

Consequently, the complete I & M data set is difficult to define in advance. It is clear though that not all areas should be geo-observatories (or intensive study sites as part of a global network), but that all areas will have a data collection scheme to provide park management the information needed to understand, interpret, and manage effectively individual park "natural" resources within a regional and global framework.

The broad objectives articulated in the July 1987 "NPS National Resource Inventory and Monitoring Initiative," acknowledge the high level of uncertainty in planned data collection activities and establish the need for a "minimal" working program. Servicewide I & M of necessity reflects knowledge obtained from a number of additional programs (viz. UNESCO's Man and Biosphere program, National Science Foundation's Long Term Ecological Research program, the interagency National Atmospheric Precipitation Assessment Program), ongoing monitoring and inventory experiences (both within and outside NPS), and knowledge being obtained from a systematic implementation of the pilot NPS Inventory and Monitoring Program. In theory, this concept of park I & M might follow a 10-step process.

Steps 1-5 lead to completion of an inventory program:

- 1) identify problems and develop management objectives;
- 2) assign priorities;
- 3) examine existing background data and relevant literature;
- 4) develop working hypotheses, conceptual models and an inventory plan; and,
- 5) complete inventory to establish existing conditions (must include adequate quality control and quality assurance).

Steps 6-10 lead to implementation of a monitoring program:

- 1) select monitoring approach based upon ecosystem character (determine spatial and temporal relationships and system variance);
- 7) select appropriate monitoring sites and establish sampling frequency;
- 8) determine logistical needs;
- 9) complete and implement the monitoring program (including providing for summary interpretation of results, data quality assurance and quality control, and data management and storage); and,
- 10) revisit periodically, review and evaluate the monitoring program and its relationship to established objectives.

Two requirements need additional emphasis: data management and data quality. Large quantities of data are being and will be produced by this program – uniform scaling and documentation is required. NPS has committed to a Geographic Information System. I & M data management is to be compatible and complementary. Detailed quality assurance and quality control plans, including accuracy and precision estimates, are needed for existing and future data sets that are to be incorporated into permanent data files. This will be a long, laborious process to integrate computing and analytic technologies into both the investigations and data collection aspects of the I & M process.

Development of site specific I & M plans is an important part of the coordinated collection of biotic and abiotic elements describing ecosystem processes of importance to park management. As previously stated, ecological processes occur at differing rates and in differing geographic patterns; some are thought to be geographically consistent at global or regional levels; while others are known to be locally site specific. To account for these differences, the NPS I & M program has incorporated a list of measurements or data sets relative to known agents of change. The resultant information base about park resources is proposed to be available to assist resources management in each park unit.