

# **Long Term Ecological Monitoring Program**

## **Strategy**

### **Denali National Park and Preserve**

#### **I. INTRODUCTION**

The global significance of Denali National Park was recognized with its designation as a Biosphere Reserve in 1974. The park additions and preserve, added by ANILCA (Alaska National Interest Lands Conservation Act) in 1980, were included within the Biosphere Reserve in 1982. The park is one of the few mandatory Class I floor areas in Alaska under the Clean Air Act Amendments of 1977.

Denali is also one of three national parks in the subarctic that contain an area that is not subject to consumptive use. This older, pre-ANILCA core zone of protection, however, is now nested within a gradient of consumptive human use formed by the creation of surrounding layers of recent, less restrictive park and preserve additions. This mix of pristine and more heavily utilized lands presents important comparative research opportunities. It allows natural processes and their relationships with human activities to be analyzed more completely and efficiently. As a result, Denali presents the option to develop techniques at a single subarctic location which will be applicable for monitoring the major land use designations that occur throughout the Alaska Field Area and the distinct types of activities and potential biological changes that are associated with each of them.

Increases in resource development and the growth of the tourism industry have been dramatic over the last 10 years in Alaska. The pristine area of Denali now has an estimated 600,000 visits annually; a third of Alaska's out-of-state tourists visit the park. Requisite development is occurring outside the park and some development may occur on private lands, within the park, that were/are former gold mining claims. A coal fired power plant is being built near a coal mine just outside the park. The wave of change is just beginning in Alaska, has hit the hardest at Denali due to its accessibility, and argues for immediate monitoring activities to address these issues.

The monitoring program developed here will have wide application to other national park units in Alaska because the same basic array of issues are likely to affect those areas in the future. It provides a testing ground for many basic monitoring protocols that could eventually be modified to meet the specific needs of the other park areas.

Denali is by far the most accessible Alaskan park and while lacking significant facilities and a few key staff positions, it still has the best staffing and infrastructure to support research and resource preservation of any of the Alaskan parks.

While behind other parks in the prototype program, in terms of inventory information and pre-existing monitoring programs for a broad array of ecosystem components, Denali is still advanced relative to the other Alaskan parks and offers some special features for the initial development of an inventory and monitoring program.

A long history of protection, research, and controlled recreational use since its establishment in 1917 has made Denali a key location for natural resource and human use research activities in the subarctic. As a result, more basic inventory data exists relative to the newer park areas. Over 500 research projects have been conducted at the park and over 1500 references are included in its scientific bibliography. This tradition continues today with 92 research and resource management projects active in 1995.

Denali is also internationally recognized for its research and monitoring of large mammal and raptor populations. The prototype program has initially focused on monitoring protocol development for other system components, but integration of these existing long term mammalian and avian studies with the monitoring program was always intended to take place.

The program is based on the premise that a set of monitoring protocols can be designed initially in one watershed and then replicated in other watersheds throughout the park. The key assumption is that this network of intensive sites will provide representative data and address management issues at that parkwide level.

Work to date has largely focused on Rock Creek watershed, a small headwater stream in the extreme eastern end of the park. Four years of data collection has occurred.

The National Park Service initiated a Long Term Ecological Monitoring (LTEM) program in Denali National Park and Preserve (Denali) as one of a nationwide group of four prototype parks. Funding was initially added to Denali's base account. Protocol development work was initiated by park staff and services were contracted from independent researchers in manner similar to many other ongoing projects administered by Denali. With creation of National Biological Service (NBS), program funding was transferred to NBS. Contract management and the completion of many of those protocols became the responsibility of the NBS. Some funding was transferred back to Denali each year to assist the work by park staff in protocol development.

## II. PROGRAMMATIC GOALS AND OBJECTIVES

The overall goals of the Inventory and Monitoring Program for Denali are listed below. These provide the foundation for decision making and programmatic structuring.

- To provide a rational basis for taking management action on park resource preservation issues of a local and regional nature.
- To provide a quality subarctic data base that can be incorporated into studies of major scientific questions that relate to issues of a global nature.
- To assist in the development of resource inventory and long-term ecological monitoring programs throughout the Alaska Field Area.

These overall goals will be accomplished by the process of resource inventory followed by resource monitoring. Specific objectives for this process at Denali are:

- Obtain and then maintain a scientifically based inventory of the type and condition of natural resources values that park management is responsible for protecting.
- Monitor and document the variation of resource conditions through time.
- Determine if that variation is a result of natural causes or is human induced.
- Fully document and communicate the process and operational requirements of establishing an inventory and monitoring program to aid in the eventual expansion of similar programs throughout the Alaska Field Area.

## III. PROGRESS TO DATE

- Four years of field work has provided enough information to develop a basic protocol for most topics.
- Data is being collected using standard procedures and draft protocols for many of the components are now available for initial review.
- Good data management practices and GIS capabilities are being established at an early stage in the program.
- The program components that do not have draft protocols written at this time fall into two groups 1) those where the protocol could be written upon the completion of the 1995 field work and 2) those which will require another season of field work. Questions

certainly remain in these topic areas where draft protocols are not available, but by in large they are basic research in nature and do not need to be addressed at this point in the development of the overall program in order to complete an initial protocol for the topic so that implementation work could begin.

- The program has been integrated effectively into day to day park operations and has solid support from park management.

- Basic administrative and investigator annual reports have been produced that provide the foundation for more complete reporting in the future.

- The basic permanent staffing that is necessary to implement the program is now in place. Relatively few additions are needed in the immediate future.

- Funding designated for LTEM work has been dedicated to the program and has not been used for other park activities.

- The LTEM program is beginning to attract the interest of independent investigators. Program funding is being used to leverage other funding sources and develop cost effective partnerships with researchers and academic institutions.

- The LTEM program at Denali has reached a transition stage and is beginning to move from protocol development to routine and repeated implementation of standard procedures.

#### IV. ISSUES

- The program is based on the assumption that a system of replicated watersheds can adequately capture the variability for all system components at a landscape level. This is a concern because 1) initial indications are that some components do not lend themselves well to a sampling system based on watersheds and 2) that grouping all sampling together spatially can cause secondary impact problems from human use.

- Current focus of the program is geographically restricted and useful information cannot be produced at that limited scale to help address management issues identified in the Natural Resources Management Plan.

- Limited funding for the program will require setting priorities between additional or more detailed work in Rock Creek versus expansion into other areas of the park.

- Certain topics are receiving extensive funding for work at a very detailed level, while other key components are not being addressed at all. Significant program funding is being dedicated to secondary research questions that may not be directly related to the

development of an initial, basic protocol.

- No protocols have been completed by NBS contractors at this time.
- Even though the program is fairly new, some data backlog problems exist. Also, there is a large amount of historic data from other significant research efforts that must be integrated into the monitoring program data base.
- Infrastructure problems such as lack of work space or accommodations are limiting effectiveness of park staff and the potential of attracting additional cost effective partnerships with independent researchers.
- The reporting system in place at this time does not adequately communicate either technical or popular information to park staff, the public, or the research community.
- Current funding arrangements preclude efficient program implementation. Transferring money from agency to agency has been awkward, especially in the area of personnel management. The lack of NPS base funding to implement the program is preventing the resolution of staffing issues such as the conversion of important seasonal positions before key personnel are lost.

## V. FUTURE DIRECTIONS

Establishment of the field sampling at its current level has helped the development of the program, but some re-evaluation of the basic sampling design is needed at this transitional point in the program. The thrust of the program for the immediate future, if implemented by Denali staff would be to maintain a basic sampling protocol for current components of program and begin to address major system components and conceptual issues that have been omitted in the first few years of work.

Protocol development currently underway would be completed. Program areas that are not currently receiving any attention would be emphasized before new, more detailed research and funding on any of the existing program components is increased.

A strong emphasis would immediately be placed on refining program goals and objectives, priority setting criteria, and developing a detailed strategic plan prior to the start of new research or the expansion of existing projects. The following section provides some initial ideas for this process.

The assumed budget is 275,000 dollars of NPS base funds and would be assigned to Denali National Park and Preserve specifically for implementation of the LTEM program.



## VI. SPECIFIC FIVE YEAR GOALS AND PROPOSED ACTIONS

**Goal 1. Refine the conceptual foundation of the program and develop a more robust model that can better incorporate an extensive, landscape level sampling as well as the current site specific, intensive activities.**

There is a need to review the current program design to see if it can accommodate an expansion of sampling beyond the Rock Creek watershed. Four years of field work has raised questions about some of the assumptions that were made in the projects initial proposal. Conceptual planning will focus on the watershed level, but it will also include efforts to deal with natural system components and resource issues which may be beyond the capability of the current watershed approach to adequately inventory and monitor in the long term.

We anticipate that this planning process will include the following steps:

- Develop a master list of all possible issues and resource concerns which could conceivably be resolved or partially addressed through monitoring. This list should be grouped into those that are identifiable in a watershed context and those that are not tied to watersheds. The ability to perform this task hinges directly on the quality and accessibility of the existing inventory knowledge for the park. This task is also closely tied to the need to update the park's Resources Management Plan.
- Criteria for assigning priorities for issues/concerns will be developed.
- Each issue/concern will be given a priority assignment based on the aforementioned criteria. Separate priority lists will be developed for watershed issues and for non-watershed issues.
- Criteria will be set to determine how many issues can be addressed and at what level of detail at this stage in the program. Undoubtedly this will be driven by fiscal constraints but possibly will be influenced by political and managerial decisions.
- For each issue/concern a list of potential parameters to monitor will be prepared.
- As with the issues themselves, criteria will be established and used to set priorities for monitoring parameters.
- Once it has been established what is critical to monitor, then the most appropriate location and methods to use for monitoring will be determined, keeping in mind logistical concerns so that sampling can realistically be accomplished over the long term in the huge landscape areas of Alaska. Further critical analysis and

priority setting may be necessary to determine which methods should be used in some cases.

How to scale up from a local sampling level to a landscape level is a critical question for the Denali program and for the future application of any long term monitoring program in Alaska. Funding will be dedicated specifically to this question. We anticipate the need for consultation with experts through workshops and specialized field work to implement the program at a broader scale than the current level of Rock Creek.

**2. Complete field studies necessary to come to closure on protocol development for the current list of program components. Prepare peer reviewed protocol documents.**

The objective will be to complete all field work and draft protocols for currently funded projects by at least the end of Fiscal Year 1996. There will always be room for the refinement of protocols with future studies, but a written protocol at even the most basic level is a major step that must be completed as soon as possible. Funding requests for further research on these system components where some work is already done will be evaluated against the need to establish a basic level of protocol for other significant topics where no work has been conducted to date.

**3. Establish a sustainable level of monitoring from a financial, personnel, and resource impact perspective in Rock Creek.**

At the present time sampling is occurring at a level of detail and frequency that cannot be maintained financially or from a resource protection perspective in a long term implementation scenario.

- Determine the role of Rock Creek in the overall sampling model for Denali so that activities in the watershed are evaluated relative to the goals of the entire program.

- Establish limits of acceptable change for the Rock Creek watershed. Determine appropriate time intervals between sampling and limits on the number of studies so that change from our own monitoring activities does not alter what we are trying to study.

**4. Continue to expand the spatial scope of the program and the ongoing efforts to characterize resources at a landscape scale.**

Scaling up to landscape level will require a better understanding of resource variability than is currently available or is being obtained by work in Rock Creek. Some of landscape level information has been gathered for birds, stream chemistry, and stream invertebrates in the last year as the perspective of the Denali program has started to broaden. The work on these topics are good examples of what needs to be done for other program components before any kind of stratified approach can be developed

for future sampling.

- Characterize the significant system components that will be included in the monitoring program in enough detail to identify spatial variability.

- Develop protocols for rapid resource assessment work at the scale that is found in Alaska.

#### **5. Improve integration of LTEM program components with other monitoring and research activities.**

There are many other research projects at Denali besides the topics that are being addressed in the LTEM program. The LTEM projects have been conceptually and functionally separated from this other work during the first four years of the program. Initially this helped the program gather the momentum needed to get it started. Now this separation is hampering the program as it moves toward implementation and expansion geographically. More collaboration both conceptually and programmatically is needed to develop shared data gathering methods and then implement them efficiently in the field.

- Develop a model that shows the common data needs between the system components that were identified as requiring monitoring through the process described under Goal 1.

- Where common data needs exist between topics, establish spatially where the information must be collected and at what level of resolution for each topic.

- Factor these common data needs into the overall stratification process that is used to select representative sampling sites so that sampling efficiency can be increased by gathering data that is useful for multiple research projects at one site instead of at several.

- Current assumption is that a series of watersheds will include these common data point. This approach uses a predetermined sampling container instead of developing a container or sampling network that is driven by the data needs of the resource questions that are being monitored.

#### **6. Initiate protocol development in important areas such as invertebrates, other small mammals (hares, ground squirrels, etc.), small carnivores, lake and pond systems, human use, noise, etc. that have not been addressed in the first years of the program.**

There are several system components that are not being addressed in either the LTEM program or other existing monitoring efforts at Denali. The objective will be to balance out the monitoring effort and funding across the entire system by establishing at least a



basic level of monitoring in the areas that are determined to be significant by the selection process recommended in Goal 1.

- Establishing this broad balance in the next few years will be a higher priority rather than continuing to increase the level of detail on current program elements that already have enough work done to produce a basic protocol and implement it.

- Partnerships with scientists need to be developed to assist park staff with protocol development in meteorology and new areas listed above.

**7. Continue special focus on the establishment of good data management procedures in this phase of the program.**

Immediate prevention or correction of data management deficiencies at this early stage is paramount to the success of this program. As a result, an intensive effort will be made now to take all actions necessary to establish reliable, consistent data handling procedures.

Actions will continue to be taken to secure all current data and study sites. This will include updates to field marking of study sites, location of study sites using global position technology, preparation of narrative site descriptions, resolution of data distribution issues, duplication of paper and magnetic copies of field data records, and assessment of current curatorial activities.

Specific objectives for the next few years include:

- Continue to designate specific staff positions to guide the program development and oversee individual topic areas so there is accountability and increased consistency.

- Emphasize training for field staff so that the protocols are followed.

- Establish an oversight procedure to assure that the protocols are being followed by field staff.

- Standardize data base variables.

- Establish data entry protocols with error checking standards.

- Minimize manual entry methods needed to file data initially from the field and integrate it with other data sets later on.

- Establish procedures for the long-term protection of data from destruction.

- Establish minimum requirements of products prepared by

independent investigators.

- Analyze the data currently being produced for accuracy now in the early stages of the program so that adjustments can be made before a major commitment is made to a particular procedure.

- Establish contacts with professionals now who can assist in reviewing the integrity of data sets and prepare procedures for the review of data sets.

## **8. Increase GIS program**

A strong GIS capability is essential for scaling up monitoring beyond the local level of Rock Creek. An initial program is in place, but additional staff and equipment will be necessary to fully support expansion, implementation, and data management in the long term.

- Obtain up to date aerial photography for current and potential sampling sites.

- Produce in cooperation with national efforts a vegetation map for Denali.

- Digitize current and historic databases, particularly those that will be required for the selection of additional sampling sites.

- Provide output products for reports.

- Work is currently underway on a GIS plan for the park. This will be developed, in part, to dovetail with resource inventory and monitoring programs.

- Park staff will take every opportunity to encourage commitment of Service dollars toward resource inventory efforts at Denali in concert with the Servicewide Inventory Program.

## **9. Provide regular technical and popular reports on the program**

Information related to the planning, historic data base development, general inventory, and protocol development activities in the first few years of the program will be made available primarily in the following ways.

- An up-to-date park bibliography with abstracts of important works.

- Revised basic inventory information in accessible and cross referenced formats.

- Planning documents that communicate the long term goals and activities of the program.

- Protocol manuals.

The following yearly reports will be used to supplement and update this basic information.

- An administrative report that focuses primarily on the programmatic aspects such as budget, major accomplishments, or major problems.
- A technical report which includes detailed discussions of the various topics underway by the principle investigators and any yearly data summaries.
- An abstract of the technical report written in an informative style for use by the Park's interpretive staff and interested members of the public.

Within the next few years, emphasis will be placed on developing peer reviewed articles for publication in appropriate scientific journals. Also preparation for a major scientific conference to present the information from the program will begin.

**10. Resolve remaining personnel issues such as conversion of long term seasonal positions to permanent positions and the need for some additional temporary position.**

Through park committment to the program, several significant personnel changes have been made that support the monitoring program. The park has a core group of scientists (geologist, hydraulic engineer, air quality technician, botanist, and wildlife biologist) and administrators who can devote substantial quantities of time to this program. A limited number of personnel issues remain to be resolved.

- The seasonal position currently handling meteorological and snow programs needs to be converted to a permanent, year-round position.
- A carteographic technician position should be added to the park staff to handle geographic information development.
- An additional seasonal technicians may be necessary to handle fieldwork. Some of this is currently handled by contractors and graduate students. Existing park staff can not absorb this workload.
- A writer/editor would be very helpful in report preparation and in helping to bridge the gap between the research and resource preservation operation and the interpretive operation.

**11. Provide improvements to the infrastructure that is needed to**

**support program in the long term, particularly work space and a bunk house for researchers.**

Some program funding needs to be dedicated to the development of a moderate amount of additional lab/office space and transient housing for researchers, technicians, and volunteers. The combination of Denali's long history of research, its accessibility, and the presence of the LTEM program can attract partnerships, but current infrastructure cannot support additional investigators.