DENALI NATIONAL PARK & PRESERVE

REVISED WORK PLAN

FOR

LONG-TERM ECOLOGICAL MONITORING

FY2002

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I. Overview and Objectives

This document describes the Denali Long-term Ecological Monitoring (LTEM) annual administrative report and work plan that summarizes accomplishments for the fiscal year 2001 and tentative scheduled activities and budget allocations for fiscal year 2002.

The Denali LTEM program supports the mission of the park by the development of broadly based, scientifically sound information on the current status and trends of the physical and biological resources of the park's ecosystem.

Goal for the monitoring program:

To help park management protect the resources of Denali by providing the ecological context for resource preservation decisions.

Two Objectives:

Ecological Focus Objective: To improve understanding of the Denali Ecosystem.

Management Focus Objective: To improve timely information to decision makers to determine if the ecological status and trends require a change in management.

II. Introduction

During the fall and winter of 2001, the Denali LTEM staff and regional advisors held a series of meetings to discuss the status of the Denali LTEM program and its future direction. It was generally recognized that a formal shift from a watershed approach (Rock Creek) to a landscape approach, including a probability-based sample design, would allow for an understanding of ecological changes on a scale that is more representative of the park and more useful for park management. The shift had already been happening with some of the monitoring components, including small mammals, weather, vegetation, and others; the decisions of the staff effectively approved the new approach. The landscape approach to ecological monitoring will allow for a monitoring effort, which will be more easily integrated among both physical and biological components. The shift to a landscape scale is epitomized by the plan set forth below by the vegetation program, using a parkwide grid sample design. An integrated biological reconnaissance pilot study is also planned.

Contemporaneously with the shift in Denali's approach to monitoring, the Central Alaska Network for monitoring (CAN) began holding technical committee meetings to develop its monitoring program, culminating in a successful scoping workshop in April, 2002. It became evident that the direction of the Denali LTEM program and the CAN monitoring program were heading in similar directions, and that maintaining the infrastructure for two distinct programs would have many redundancies. During discussions throughout the scoping workshop, a consensus emerged to more fully integrate the Denali LTEM program with the CAN monitoring program than was originally envisioned. Ensuing meetings with WASO and AKSO staff at Denali finalized this direction.

These two developments have made it necessary to revise the FY2002 Workplan from what was originally submitted in Fall 2002. Fieldwork for FY2002 will focus on efforts that are expected to be included in the CAN monitoring plan (due in 2003). Because the CAN workplan is still in development stages, the components and sample designs that will be implemented can't be definitively predicted. All of the protocols developed for the Denali LTEM program have been finalized or are near completion, all of which will be compiled in a 10-year summary report of the Denali LTEM program which will be submitted in FY2003.

III. FY2002 Field Work

A. Vegetation Monitoring

The vegetation component of the Long Term Ecological Monitoring Program in Denali has recently undergone a multi-year process of data and program review, objective setting, pilot studies and protocol development that has resulted in a shift in the design and scope of this project. Specifically, the vegetation monitoring program is considering adopting a parkwide sampling frame based on a two-stage systematic grid design. The foundation of this design is a mesh of points with 20 kilometer spacing that encompasses all Park and Preserve. There are 66 of the 20 km grid points parkwide, 50 of which are actually accessible for sampling on the ground (16 falling in high elevation areas of precipitous terrain or glaciers). A second random mesh of 25 points with 500 meter spacing is situated at each 20 kilometer grid point (see figure 3 for an example). These sets of 25 points ("mini-grids") represent the locations where vegetation sampling will take place; each of these 25 points is the center of a circular permanent plot that will be 16 meters in diameter (see figure 3). The mini-grids constitute independent 2.5 x 2.5 km square study areas within which vegetation and passerine bird monitoring will be conducted (at present) at the aforementioned points.

Objectives

The objectives of this aspect of the program are to detect landscape-level changes in the vegetation cover of the Park that occur over decadal time scales. More intensive monitoring (in time) is anticipated for a small subset of study areas for process-related variables such as growth and reproduction of tree species and vegetation phenology.

Study areas for 2002

We plan to perform the initial measurements in seven minigrid study areas during the summer of 2002. The locations of these areas are shown in figure 2. In addition to the five mini-grids on the Parkwide 20 kilometer sampling grid (E. Chitsia, East Toklat, Lower Stony, Gorge Cr, and Primrose), we will also plan to sample two grids (West Toklat and Cabin Cr) on an intensified 10 km grid in the vicinity of the Toklat Basin ecoregion as part of the Toklat Basin project (Northside studies NRPP project). The methods used will be the same at all sample locations.

Methods

Each of the 25 points in a mini-grid are Separated by half a kilometer (in map view; the points are actually separated by a much greater distance on the ground in sloping terrain). Each of these points will be the center of a permanent vegetation monitoring plot that will be

revisited once every ten years for remeasurement. The locations will be recorded using multiple GPS points in order to facilitate relocation of the plots during subsequent sample iterations. The location of each plot will be marked on the ground only by a low magnetic monument at the center of the plot. We plan to use low aluminum markers mounted on ¾" steel electrical conduit. The monuments will be round survey-type monuments that are pre-stamped with the name of the Park, the project, and the site identifier code – these monuments attach very snugly on the end of the conduit so that it will be unlikely to come off. The appearance of these "monuments" is very similar to benchmarks used by USGS and others for marking permanent locations on the landscape. Inside the head of each of the 2" to 3" diameter round stamped and identified monuments there will be a ceramic magnet that will assist in future relocation efforts. The monitoring program will purchase the (2) $700.00 magnetic locators for this purpose (please see the following website for detailed specs on the monument and locator products: **http:\\www.berntsen.com**). It is imperative that we mark plot centers for this work because we need to determine the exact locations of transects, quadrat corners and plot boundaries from a fixed point on the ground. We propose to follow these guidelines in the marking of plot centers:

1) plot markers will protrude a maximum of 5" above the surface in areas of low-statured vegetation such as tundra; in flat-surfaced, stable areas and wherever it is feasible, the plot markers will be emplanted as nearly flush with the surface as is practicable
2) in forested and scrub vegetation the plot markers will be placed below the level of the shrub layer such that they are not easily visible to the eye; the maximum height above the ground for makers in these densely vegetated sites will not exceed 14" and will be kept to a minimum height in all cases. Based on our extensive experience searching for old plot markers in the field, any markers located below the shrub canopy are all but invisible until the searcher is directly upon them.

Although this new protocol for plot marking using low-statured markers and magnetic locators is considerably more expensive and involved than the use of meter long or longer steel and PVC plot markers that have been used in the Park in the past, we believe that this protocol represents a workable and good solution that minimizes the publics exposure to visible signs of research activity but also allows for repeatable monitoring of permanent plots over the long term. The clearly marked and "official" appearance of the formal survey markers of stamped aluminum should reduce any concerns and questions on the part of the relatively few visitors that may encounter these markers in the Park.

The measurements that will be performed at each plot will be strictly observational in nature (i.e. non-destructive sampling) except for the following three items: **1)** voucher specimens for identification of plant species will be made where necessary (from outside of the plot boundary) **2)** 8 increment cores per site will be extracted from areas where spruce occur in the plot vicinity and **3)** during the first sample iteration for each plot, a small integrated surface soil sample will be taken for field characterization and subsequent laboratory analysis. Soils samples will be taken from the top 15 cm of soil and placed in a bag for analysis. The permanent plots are 16-meter diameter circular plots (see figure 4). Within this circumference we have four 4 m^2 quadrats, three transects, and all trees will be mapped and measured.

Logistics, Access and Schedule for 2002 fieldwork

We plan to access three of the 2002 mini-grid samples by hiking into the Primrose, Cabin Creek and Gorge Creek study areas. The East Chitsia, East & West Toklat and Lower Stony

sites will each be sampled in separate 10 day field bouts requiring two helicopter flights in, and then two helicopter flights out ten days later. The E. and W. Toklat grids, which contain extensive areas of large tussock tundra that makes walking difficult, may require some additional helicopter support to hop crews to the farthest plot locations from the camp spots. In all cases that the vegetation crew is camped remotely we will operate from backpacking-style camps that will be located close to the sample locations, and moved periodically to minimize damage to local areas. Crews generally consist of three to four members. We adhere strictly to leave no trace wilderness practices and store all food and garbage in bear-safe containers. There is little that distinguishes one of the vegetation crew camps from backpacking camp aside from tapes measures, quadrat frame and some specialized equipment such as GPS units and a small soil auger.

B. Fauna Monitoring

Golden Eagle and Gyrfalcons

Objectives

1. Determine occupancy of nesting areas of golden eagles and gyrfalcons;
2. Determine reproductive success including laying rate, success rates, mean brood size, and overall population productivity of golden eagles;
3. Determine nest success of gyrfalcons;
4. Estimate nesting phenology of golden eagles and gyrfalcons;
5. Estimate broad trends in abundance of snowshoe hare and willow ptarmigan;
6. Determine survival, sources of mortality, and identify wintering areas via banding;
7. Describe food habits of nesting golden eagles and gyrfalcons via collection of prey remains at nest; and,
8. Determine the utility of using shed feathers as a source of DNA for golden eagles in Denali.

Passerines – Accessing Spatial and Temporal Variation using Point Counts

We are proposing major changes in the study and monitoring of passerine and near passerine birds in Denali. We proposed these changes in response to comments made by peer-reviewers of the existing studies in 1996 and 1997 and to meet our goals of integrating monitoring components to detect change in ecological components and change in the relationships among components. Proposed changes also meet our goal of trying to identify explanatory mechanisms for changing patterns in terrestrial faunal, including passerine birds over space and time on a landscape scale.

This phase of monitoring passerines and near-passerines aims to obtain data to provide information on birds across Denali's landscape and has several long-term objectives including:

1. Describe the distribution (spatial patterns) and develop indices of relative abundance (including species richness) of avian species.
2. Describe and assess the variability, both spatial and temporal, of bird assemblages.
3. Investigate spatial and temporal variation in species richness and community composition to better understand the ecological patterns and underlying processes that produce them.

4. Determine the ecological processes that produce the observed variability (asks the question about bird-habitat relationships both at the local and landscape scale).
5. Determine the scale(s) that these processes manifest.
6. Describe how passerine populations and communities respond to changes in vegetation and climate.

Passerines - Monitoring Avian Productivity and Survivorship

Since 1992, MAPS stations have been operated in Denali NP&P as part of Denali's Long Term Ecological Monitoring Program. Results from the 10-years of MAPS data in Denali are thought to be essential for understanding population trends of passerines on a continental scale in North America (DeSante, pers. comm.). However, peer-review of the Denali MAPS program in 1996 and 1997 suggested that the current MAPS program needed to address several issues to best serve the needs of Denali. The peer-reviewers also suggested that a thorough review of the MAPS program in Denali would require an inspection of the data that have been collected to date. The U.S. Geological Survey (USGS), Biological Resources Division, Alaska Science Center is currently spearheading an analysis of MAPS data on a statewide scale. Results from these analyses will provide Denali NP&P with guidance on if and how to continue MAPS programs in Denali.

The revised partnership between the IBP and the NPS would provide for the continuation of data collection at four MAPS stations in the eastern portion of Denali until results from the USGS analyses are completed.

Terrestrial Vertebrate Monitoring - Pilot Study

Integrating monitoring components in space and time provides a basis for examining ecosystem patterns and processes, and changes in species distribution and abundance. This project will assess the ecological, statistical, and economic feasibility of conducting multi-species surveys to monitor population trends of small and medium-size terrestrial mammals in Denali National Park and Preserve (Denali). The project goals are to test and evaluate monitoring techniques that provide unbiased or nearly unbiased estimators of spatial distribution and presence and to develop sampling techniques to integrate these techniques into the sampling design used for vegetation monitoring in Denali. Results and techniques developed in this study will be applicable across other national parks, preserves, and refuges in Alaska.

We are hoping to answer the following questions leading to the development of a recommended protocol for monitoring populations of small and medium-sized terrestrial mammals in Denali:

Ecological Questions

1. What suites of terrestrial vertebrates are logical multi-species groups to monitor?
2. Can we integrate terrestrial mammal vertebrate sampling designs at the landscape scale with the sampling design used for vegetation monitoring?

Ecological and Statistical Questions

3. What techniques can we use to obtain unbiased estimates of population trends of smaller terrestrial mammals without intensive mark-recapture studies?
4. Can we conduct multi-species surveys to provide indices to track population trends of smaller terrestrial mammals?
5. What are the sample sizes and sampling intervals required to detect and monitor trends of smaller terrestrial mammals?

Economic Questions

6. What are the costs of conducting multi-species surveys and population monitoring on a park wide scale?
7. What are the most effective field and analytical methods for detecting and monitoring trends?
8. Can integrated teams of biological and vegetation technicians collect thesefield observations?

Wolf/Caribou Monitoring

Wolf-related issues will remain in the forefront for park managers at Denali National Park and Preserve, and throughout Alaska, because of the high public profile wolves hold, as well as their important ecological role as top-level predators. Wolf/prey research at Denali has provided a thorough and continuing assessment of the status and trends of the park's wolf population and their major ungulate prey. The results of this peer-reviewed research have regularly been used to evaluate or resolve park management issues. In addition, Denali's wolf/prey research program has provided new information for understanding the dynamics of wolf/ungulate systems throughout northern North America.

Objectives

The overall goal of this research is to monitor population characteristics of wolves and their major prey species, caribou and moose, in sufficient detail to understand the population trends of each species in the context of the interrelationships that comprise the Denali wolf/prey system. This research strives to gain understanding of the roles that winter severity, differential landscape use, and relative vulnerability of prey species play in wolf/prey relationships in Denali and, ultimately, in determining the abundance and population trends of all 3 species. Through the conduct of this research and monitoring program, I will provide Denali National Park with annual assessments of the status and trends of wolves, caribou and moose populations in the park and a thorough understanding of the natural and human-caused factors that are influencing these populations. Funding for moose studies are provided by park base.

Wolves

1. Monitor population density, pack sizes and distribution, pup production, distribution and extent of harvest, and characteristics of natural mortality and dispersal.
2. Monitor the physical condition of wolves and the prevalence of disease in the Denali wolf population.
3. Relate changes in the wolf population to the abundance and vulnerability of their ungulate prey and patterns of harvest or other human-related disturbance.

Caribou

1. Annually determine the population size, composition and trends of the Denali Caribou Herd.
2. Evaluate the influences of maternal characteristics (age, reproductive history, physical condition) and environmental factors on calf production and survival.
3. Determine patterns of survival of caribou cows relative to winter severity and wolf abundance/distribution.
4. In cooperation with ADF&G, compare and contrast the population dynamics of the Denali Caribou Herd with the adjacent intensively managed Delta Caribou Herd.

C. Physical Environment Monitoring

Snow Monitoring

Snow cover in Denali National Park and Preserve is an important ecosystem driver, which affects surface albedo and regulates surface temperature. Snowcover affects airmass formation and insulates ground and vegetation from severe temps. Snowpack information provides additional understanding of a large number of natural resource processes within the park including wildlife research such as population density, birth survival rates, herd movements, vegetation succession, as well as hydrologic information regarding surface water supply.

Objectives

1) Continue to provide high quality snow data to the Natural Resource Conservation Service (NRCS) as part of a national network set up to efficiently obtain, manage, and disseminate high quality information on snow, water, climate and hydrologic conditions.
2) Continue to provide snow data to park scientists and management and to outside researchers for numerous projects including park maintenance issues.
3) Determine, through the addition of data points, the spatial and temporal variation of snow cover parkwide.
4) To better understand the key relationships between snow cover patterns and the physical and ecological ecosystems within the park.
5) To characterize the snowpack of areas within Denali National Park and Preserve frequently used by snowmobilers, and to determine whether a definition of adequate snow cover could be developed for Denali that would help park managers decide when an area should be opened/closed for snowmobiling.

Work for FY02

In FY02 snow monitoring will begin in November and continue through May. The ten snow course and aerial markers located in and around the park will be visited on a monthly basis. Information collected will be sent to NRCS and compiled for the year in an annual report. Sites will be visited once in the summer for annual maintenance including marker replacement and brushing.

In FY02 snow markers and courses will be increased by ~25% to more effectively cover variable terrain and integrate with other long term monitoring programs. Two additional snow courses will be installed in the summer of FY02 at Stampede Mine Airstrip and Dunkle Mine Airstrip. These sites will be co-located with new weather stations being installed at the same

time. Co-location makes data collection and maintenance of the two monitoring components more efficient and affordable. Additional aerial markers will be established at sites on the south side of the range near the Eldridge Glacier, Tokosha Mountains, Upper West Fork Yentna, the confluence of the Lacuna and Yentna Glaciers, and near the Pika Glacier. Data from these additional stations will be collected and reported in the same manner as stated above.

Objective(4) focuses on the physical aspects of the snowpack that may allow adequate support of snowmobile travel without causing adverse impacts to vegetation and soils. In FY02 the depth and density of the snowpack in the Broad Pass area south of Cantwell, and along the Stampede Corridor will be studied by visiting established sites on a bi-weekly schedule. The study will begin in the early season (late November-December), or when the first significant snowfall occurs, to determine if the areas used by snowmobilers and within the boundaries of the park have adequate snowcover for travel without disturbance to the resources. After a base is established that seems adequate (which varies depending on the location) sampling intervals will decrease until the spring melt event begins. Data will be compiled and made available to park managers who in turn will make the decision regarding snowmobile use within the park. Reports, photos, and data will be archived within the snowmobile files established at the park as part of the administrative record for the snowmobile issue.

The continuation of a cooperative study at Denali National Park and Preserve between the National Park Service (NPS) and the U.S. Geological Survey (USGS) will continue in FY02 to determine the occurrence and distribution of polyaromatic hydrocarbons (PAHs) in park aquatic environments. Semi-permeable membrane devices (SPMDs) designed by USGS scientists at the Columbia Environmental Research Center (CERC) to mimic the bioconcentration of hydrophobic organic contaminants such as PAHs. The SPMDs will be deployed in stream systems in the park by NPS personnel to collect PAHs over an extended period of time. During year one, a synoptic survey was conducted in two watersheds identified by the NPS as heavily traveled by snowmobiles. A reference watershed was also selected to measure any background PAH contamination (i.e., non-snowmobile related) in park surface water. The SPMD from the reference site was recovered in 2001 but the samplers from the other two stream systems were not recovered possibly due to spring flood events. This year two additional SPMDs will be deployed in creeks with a lower stream flow rate. The SPMD recovered from the reference site will remain frozen at the park. The other samplers will be recovered at the end of the summer season and all of the SPMDs will then be shipped to the USGS - CERC lab for analysis.
A report, summarizing analytical results and the potential biological implications of any detected PAH residues, will be submitted to Denali National Park and Preserve by February 1, 2003.

UV Monitoring

Objectives

1) To monitor changes in UV-B incidence at the earth's surface that may be affecting human health and ecosystem processes.
2) Identify UV radiation trends at Denali and compare with global network of instruments.
3) To provide UV data to researchers and park personnel.

UV monitoring will continue at Denali as part of the Park Research and Intensive Monitoring of Ecosystem Network. Calibration and maintenance will occur at regularly scheduled intervals throughout the year. An annual report for 2001 will be completed in February 2002. Data from the station will be downloaded daily by the data contractors at the University of Georgia (UGA), and an annual calibration by UGA and the National Institute of Standards (NIST) Calibration.

Weather Monitoring

Climate influences all aspects of natural resources and is the primary driving force of ecosystem dynamics. Climate variations impact both terrestrial and aquatic flora and fauna. Weather monitoring efforts will continue in Denali at established locations. New installations will occur in FY 02 that will help us gain a better understanding of park climatic conditions on an extensive scale. These additional stations would improve the understanding of the Denali ecosystem while providing timely information on snow and weather conditions to park managers as well as providing valuable data to the National Weather Service (NWS), Natural Resources Conservation Service (NRCS), park researchers and scientists, and the public.

Objectives

Monitor and record weather conditions at representative locations in order to identify long and short-term trends, provide reliable climate data to other researchers, and to participate in large scale climate monitoring and modeling efforts.

Work for FY02

In FY02, 3 additional weather stations will be installed complete with satellite telemetry. The sites will be at Toklat Road Camp, Stampede Mine Airstrip, and Dunkle Mine Airstrip. These sites were chosen because 1) they represent large climatic regions where there is a lack of basic weather data, 2) they are easy to access with fixed-wing aircraft, or snowmobiles, and 3) these are areas that will not be negatively impacted by the addition of meteorological equipment because they are in previously disturbed areas. The required compliance and permitting on all sites will be completed before work is started. The site visits will involve reconnaissance, installation, and a follow-up trip in the fall to ensure proper working condition before winter. The sites can than be accessed by skis, snowmobile, or skied aircraft if needed in the winter months.

The LTEM Weather Program will also coordinate with the Federal Highway Administration on a contract they have in place with the Maintenance division to record snow depths and temperatures along the park road corridor. The addition of air temperature and relative humidity sensors will provide valuable information for both the practical and scientific aspects of the road corridor conditions. Depending on the success of new radio technology used in this transect the future might involve an upgrade of satellite telemetry on weather stations to an extended line of site radio system which would provide two-way communication potential for managing the systems data and programming features.

Routine maintenance and sensor calibrations and sensor rotations on the existing stations within the park will be carried out in FY02 as in the past. Coordination will continue with the Radio Shop in the Anchorage Support Office which has been providing technical assistance

by performing annual maintenance checks and sensor replacements for the Remote Automated Weather Stations (RAWS).

The LTEM weather monitoring program will assist in the development of standardized measurement plans for weather stations for the integration with the Central Alaska Network (CAN) and will provide technical assistance for the purchase and installation of weather stations in Yukon-Charley National Preserve and Wrangell-St. Elias National Park and Preserve. LTEM and CAN will collect and maintain extensive, long-term databases. Data storage and dissemination needs to be discussed with the network data manager to make the data usable in a real-time capacity to scientists, researchers, and the public.

Opportunities for outreach and educational programs regarding the weather program at Denali will be provided

Air Quality

The air quality monitoring program has been operating without interruption since 1980. It is primarily funded through the NPS Air Resources Division (ARD), and includes monitoring instruments from various nationwide air quality monitoring networks. Support from the Long Term Ecological Monitoring program supplements the national program, and allows park and regional goals to be met in addition to the nationwide objectives funded by the ARD.

Objectives

1. The specific objectives of each monitoring network differ somewhat, but the overall objective of each is the same: track the spatial and temporal trends of airborne contaminant concentrations through a nationwide array of monitoring stations.

2. In addition, the Denali program seeks to integrate biological and contaminant monitoring through support of the following protocol development efforts, which are evolving on parallel tracks: regional I&M lichen monitoring designed to measure contaminant concentrations and effects, and the NPS Western Airborne Contaminant Assessment Program (WACAP), which will measure persistent organic pollutants and other airborne toxic contaminants in various biotic and abiotic media.

Work for FY 2002:

Data continuity continues to be a high priority, and weekly station checks and sample changes will be performed throughout the year. Quality assurance and quality control procedures will be implemented as required by each monitoring network.

In 2002, lichen samples will be collected in Denali to support the development of protocols to assess airborne contaminant accumulation and effects in lichen communities. Denali LTEM funding will cover analytical costs for assessing variability within sample plots and among analytical laboratories. Results of this work will guide protocol development for both the WACAP program and the I&M program in all four Alaska networks. The Alaska Region has also submitted a multi-park proposal for NRPP funding (earmarked for air quality – ecological effects) to work on other aspects of protocol development.

As the budget allows, fish tissue samples may be collected and analyzed for persistent organic pollutants in support of the WACAP program.

Glaciers

Field data are currently being reduced and will be the 10th consecutive year of glacier mass balance data, one of the longer records in Alaskan glacier monitoring.

Objectives

1. Continue the mass balance measurements on the index glaciers (Traleika, Kahiltna) and benchmark glacier (East Fork Toklat), maintaining one of the longer glacier monitoring records in Alaska.
2. To upgrade the physical science's branch surveying techniques to include GPS technology, allowing for a significant increase in productivity.
3. To gain a thorough appreciation for existing protocols in order to refine them to form a sustainable, long-term set of procedures that can be scaled to other glaciated parks.

Index Glacier Monitoring. Two mass balance measurement sites were installed on two "index" glaciers in 1991, during the early stages of LTEM glacier monitoring in Denali National Park and Preserve. Those sites, on the Traleika glacier and Kahiltna glacier, were visited twice during 2001. Measurements of mass balance and movement were made in late May and early September, at the end of the accumulation and ablation seasons. The visited locations are near the ELA (equilibrium line) and provide a long-term record of glacier trends.

This portion of LTEM glacier monitoring is performed under the protocols described in the *Manual for Monitoring Glaciers at Denali National Park, Alaska, Using the Index Site Method.* This protocol was formally completed in March, 2001 in cooperation with L. Mayo of the U.S. Geological Survey – it is being formally reviewed during 2002. It will become a critical part of the overall glacier monitoring protocols currently being developed. The method is a relatively quick and inexpensive way to assess the overall status of regional glacier trends.

Benchmark Glacier Monitoring. More intensive than index glacier monitoring, benchmark glacier monitoring was performed on the East Fork Toklat glacier this year. Two site visits, in May and September, were made and eleven long-term measurement stakes were surveyed and assessed for mass balance trends. The methods are adapted from similar U.S. Geological Survey efforts at three other "benchmark" glaciers, each in a unique climatic zone. Detailed glacio-climatic data is obtained which aids in the interpretation of regional glacier trends that are observed through more extensive means (i.e. the index method and remote sensing).

Muldrow Glacier Monitoring. In cooperation with the second year of a three-year Fee Demo project, three field surveying campaigns will completed on the Muldrow glacier to characterize "normal" glacier movement (as opposed to "surging" movement). An identified trend in the historical movement patterns of the Muldrow glacier suggests that a dramatic surge could be imminent (within a few years).

D. Data Management

Due to the impending full integration with the Central Alaska Network, the data management program took made a significant change to its workplan for FY02. Rather than completing a data management plan specifically for the Denali LTEM program, the data manager will now work in coordination with the network data manager. Many of the tasks previously assigned to the park data manager have become part of a network-wide team-effort. For example, the data management plan (DMP) and integrated relational database management system have become network-wide initiatives, with Doug Wilder overseeing the writing and development of each. However, other tasks, such as data mining for the I&M databases Nature Bib, DataSet Catalog and NPSpecies have been delegated to data managers within the network parks (Yukon Charley, Wrangell St Elias and Denali). Denali's data manager, Olga Helmy, has been assigned the task of coordinating data-mining activities among the three network parks in order to facilitate writing the Vital Signs Monitoring (I&M Phase I) Report. Details of these activities are broken down below into parks' and individuals' roles. In addition, Olga will aid as needed in the research and writing of parts of the data management plan and the Phase I Report.

A. Denali National Park and Preserve
    1. Olga Helmy: Data Manager
       Tasks: See above.
    2. Lucretia Fairchild 6 May – 5 June 2002.
       Tasks: Compile reference list from NatureBib, TIC and Procite, eliminate duplicates and assign themes to all titles (3000 + records).
B. Wrangell / St. Elias
    1. Susan Sura: Library Technician
       Tasks: Susan's time is divided between this project and cataloging references for the library at Wrangell/St. Elias. She and Kari Rogers are working on locating and recording local files, largely "grey (unpublished) literature" residing within the park. All data are being entered into the DataSet Catalog and all references are being cataloged in Nature Bib.
    2. Kari Rogers: Seasonal Biological Technician
       Tasks: In addition to assisting in the tasks outlined above, Kari will also meet with and interview researchers in Wrangell/St Elias about their fields of expertise in order to gather information for the writing of the Vital Signs Monitoring Report.
C. Yukon / Charley
    1. Chris Crews
       Tasks: Data mining for network parks. Conduct "white literature" searches for all three parks using on-line databases of scientific abstracts. Filter results and eliminate duplicates. Enter acquired data into Nature Bib. Interview researchers from Yukon and Charley Rivers NP for Vital Signs Monitoring Report. Enter data collected in 2001 from Yukon / Charley into the DataSet Catalog.

Research Administration

A portion of the salary for a seasonal assistant to the Natural Resource Management Specialist (Research Administrator) will be supplied by LTEM to help with the administration of the research study files, the resources technical library, and the computer databases that summarize information about the park research files and library volumes.

E. USGS-Biological Resources Division Sponsored Projects

The integration of the Denali LTEM program with the Central Alaska Network, and the progress CAN has made in scoping and program development, has allowed the cooperative projects with the USGS-BRD to work with both programs as an integrated unit.

1. Central Alaska Network Monitoring Plan--Conceptual Models and Phase II Report

USGS will work closely with the Central Alaska Network as it develops its Monitoring Plan. USGS will assist in completion of the Phase I report, and take the lead on the conceptual models portion of that report. Model development will build on work already completed for the Denali LTEM program, incorporating relevant relationships for Wrangell-St. Elias and Yukon-Charley Rivers. A research assistant will be hired to assist in preparation of models, and graphics support will be obtained via contract. The Phase I report is due October 1, 2002, so intensive effort will be required in the remainder of FY 2002 on the conceptual models. Work on the Phase II report will occur simultaneously. We do not anticipate needing additional funds for that effort.

2. Statistical Properties and Performance of the Minigrid Design

Our existing Research Work Order (RWO) with Dr. Eric Rexstad (University of Alaska Fairbanks) expires at the end of FY2002. To continute our collaboration with Dr. Rexstad and Research Analyst Ed Debevec on analysis, integration and reporting of monitoring data, we will initiate a new RWO. The new RWO will provide for continued involvement in data analysis and web-based applications in serving and analyzing data. Initial contributions to the RWO will cover expected work in FY 2003, and be shared by the Central Alaska Network and USGS.

3. Data Analysis/Integration/Reporting

Our existing Research Work Order (RWO) with Dr. Eric Rexstad (University of Alaska Fairbanks) expires at the end of FY2002. To continute our collaboration with Dr. Rexstad and Research Analyst Ed Debevec on analysis, integration and reporting of monitoring data, we will initiate a new RWO. The new RWO will provide for continued involvement in data analysis and web-based applications in serving and analyzing data. Initial contributions to the RWO will cover expected work in FY 2003, and be shared by the Central Alaska Network and USGS.

4. Aquatic Monitoring Protocol--Description of Newly Discovered Chironomid Taxa

Dr. Sandy Milner is currently completing work on a recommended protocol for aquatic monitoring using benthic invertebrates. Because chironomids are a dominant taxa in all Denali collections, one of the aspects investigated was identification of the chironomid taxa in previous collections. Among the taxa found were 5-10 taxa that are previously undescribed. We had not anticipated requesting any further funding for aquatic work, but feel that we should provide some support to allow the taxa to be named. This requires additional field work to collect juveniles which are then reared to adulthood in the laboratory. With these specimens in hand, chironomid taxonomists can describe and name these taxa.

IV. Status of Protocols

Protocol Status Table - June 1, 2002

Protocol	*Date*	*Author*	*Date of Review*	*Review Comments on File*	*Review Responses on File*	*Status of Protocol*
Air Quality Monitoring Handbook	Oct-97	Andrea Blakesley - NPS	Feb-97	Yes	Yes	Final
Monitoring Protocol for Assessing Long Term River Ecosystem Change In Denali National Park & Preserve	Dec-97	Dr. Alexander M. Milner Institute of Alaska University of Alaska	May-97	Yes	No	Draft
Stream Channel Reference Sites: Channel Morphometry & Water Chemistry	May-97	Ken Karle - NPS	Apr-97	Yes	Yes	Final
Data Management Protocol	Aug-97	None given	18-Mar-97	Yes	No	Final
Glacier Monitoring Protocol, Denali National Park & Preserve	Oct-97	James Roush - NPS Phil Brease - NPS	27-Mar-97	Yes	Yes	Final
Monitoring Protocol for Assessing Reproductive Success of Golden Eagles		Carol McIntyre - NPS				Draft
Landbird Monitoring Handbook	Feb 11,99	Peter W.C. Paton Dept. of Natural Resources Science University of Rhode Island	1-May-97	Yes	Yes	Final
Monitoring Avian Productivity & Survivorship	Dec-97	David DeSante The Institute for Bird Populations	18-Aug-97	Yes	No	Final
Small Mammals Sampling Protocol for Long-term Ecological Monitoring	Dec-96	Dr. Eric Rexstad Institute of Arctic Biology University of Alaska	18-Apr-97	Yes	No	Draft
Inventory & Monitoring Project Vegetation Protocol	Apr-98	Roseann Densmore, Karin Alstead, Leah Sansone, Mary Beth Cook, Phyllis Adams	21-May-97	Yes	No	Final
Weather Monitoring	June	Unknown	June 11, 1997	Yes	Yes	Final

Handbook, Denali National Park & Preserve	25,97		
Monitoring Protocol for Assessing Population Trends Of Wolves and Caribou in Denali National Park and Preserve		Dr. Layne Adams USGS - ABRD	Draft

V. Budget

Denali National Park & Preserve
Division of Research & Resource Preservation
FY 2002 LTEM Proposed Budget
06-June-2002

Funding Source	NPS	Park Base	Partners & Other Sources
Servicewied I&M Program - LTEM	485,000	426,000	
USGS-ABRD Partnerships			105,100
PRIMENet			6,500
Air Quality Networks			10,000
Total Income	485,000	426,000	121,600
FY02 Expected Expenditures			
Personnel (salary and benefits):			
Division Chief		20,000	
LTEM Program Manager		90,000	
GIS Coordinator	3,000	60,000	
Research Administrator	3,727	20,000	
Office Assistant		10,000	
Budget Analyst*	45,146		
Database Manager*	28,054	20,000	
Physical Scientist*	48,538		
Environmental Specialist*	40,218		10,000
Cooperative Agreements:			
USGS-ABRD			
Central Alaska Network Monitoring Plan – Conceptual Models and Phase II Report			35,100
Statistical Properties and Performance of the Minigrid Design			25,000
Data Analysis/Integration/Reporting			35,000
Aquatic Monitoring Protocol – Description of Newly Discovered Chironomid Taxa			10,000
Monitoring Components:			
Air Quality	10,000	27,000	10,000
Weather	20,500		6,500
Snow	8,500		
Glaciers	36,864	10,000	
Passerines/Community Monitoring/Program Development	62,203	25,000	
Golden Eagles/Gyrfalcons	18,000	10,000	
Small Mammals	25,000	3,000	
Wolves/Caribou	37,000	64,500	30,000
Vegetation – Grid Based Monitoring	94,950	60,000	
Operations and Equipment			
Computers & Software		4,000	
Office Supplies	5,300	500	
Vehicle lease - GSA	6,000		
Transient Housing	10,000		
Travel			
Travel and training	7,000	2,000	
Total Expenditures	**485,000**	**426,000**	**121,500**

* The actual cost of supporting the four permanent positions in FY02 is less than the $260,000 that is expected for FY03. This is due to a vacancy in the Database Manager position, a mid-year upgrade to the Environmental Protection Specialist position, and an effective lapse of the Physical Scientist position while that person was acting as the Program Coordinator.