Denali National Park and Preserve

Center for Resources, Science, and Learning

(formerly Divisions of Research and Resource Preservation, and Subsistence and Cultural Resources)



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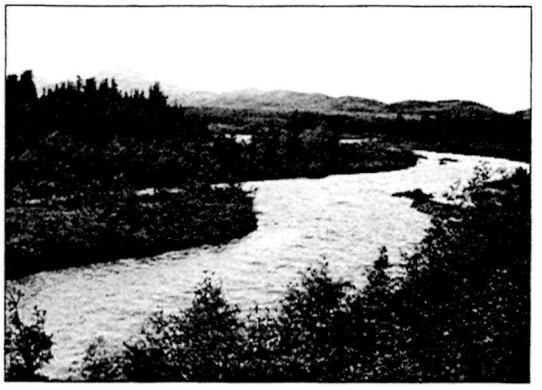


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National Park Service photo

Summary of Current Projects 2003

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< Natural Resources >

Integrated Programs

Long-Term Ecological Monitoring Program and the Central Alaska Network

In 1991, Denali National Park and Preserve was selected to serve as a prototype for the development of a Long-term Ecological Monitoring program. The LTEM program functions as an integral part of research and resource preservation in Denali with a single goal of helping park managers protect park resources by providing the ecological context for resource preservation decisions. The specific resources being monitored are divided into four spheres: fauna, flora, physical, and aquatic. The individual monitoring components within these spheres are discussed throughout this document.

From 1991 to 2000, the LTEM program largely focused on an intensive watershed sampling design in Rock Creek, a small second order stream in the eastern end of the park. For the past two years (2000-2002) the LTEM staff has explored a new landscape sampling design. One of the major efforts is based on a systematic grid that will meet objectives related to detecting vegetation change. Preliminary testing of this vegetation sampling design has been promising enough to integrate the bird monitoring component. In addition, this new landscape view is being implemented beyond the boundaries of Denali, through the monitoring efforts of the Central Alaska Network (CAKN) of parks (Denali, Wrangell-St. Elias National Park and Preserve, and Yukon-Charley Rivers National Preserve).

For 2003, Denali park staff is in the last stages of fully integrating the Denali LTEM program with the CAKN. In the fall, Denali staff will complete 3 documents: (1) an historical report from 1992-2003 on the Denali LTEM program, (2) a report on the mini-grid sampling design (see Figure 1), and (3) completion of data synthesis and analysis of each monitoring component for the past 10 years. These reports will fulfill Denali's role as a national Long-term Ecological Prototype Park and allow other parks to learn from the prototype experience.

In 2004, the Denali LTEM Program will officially join Wrangell-St. Elias National Park and Preserve, and Yukon-Charley Rivers National Preserve in the Central Alaska Network. CAKN one of 32 park networks established to gather baseline and long-term trend information about park natural resources. For more information, go to the website www.nature.nps.gov/im/monitoring/

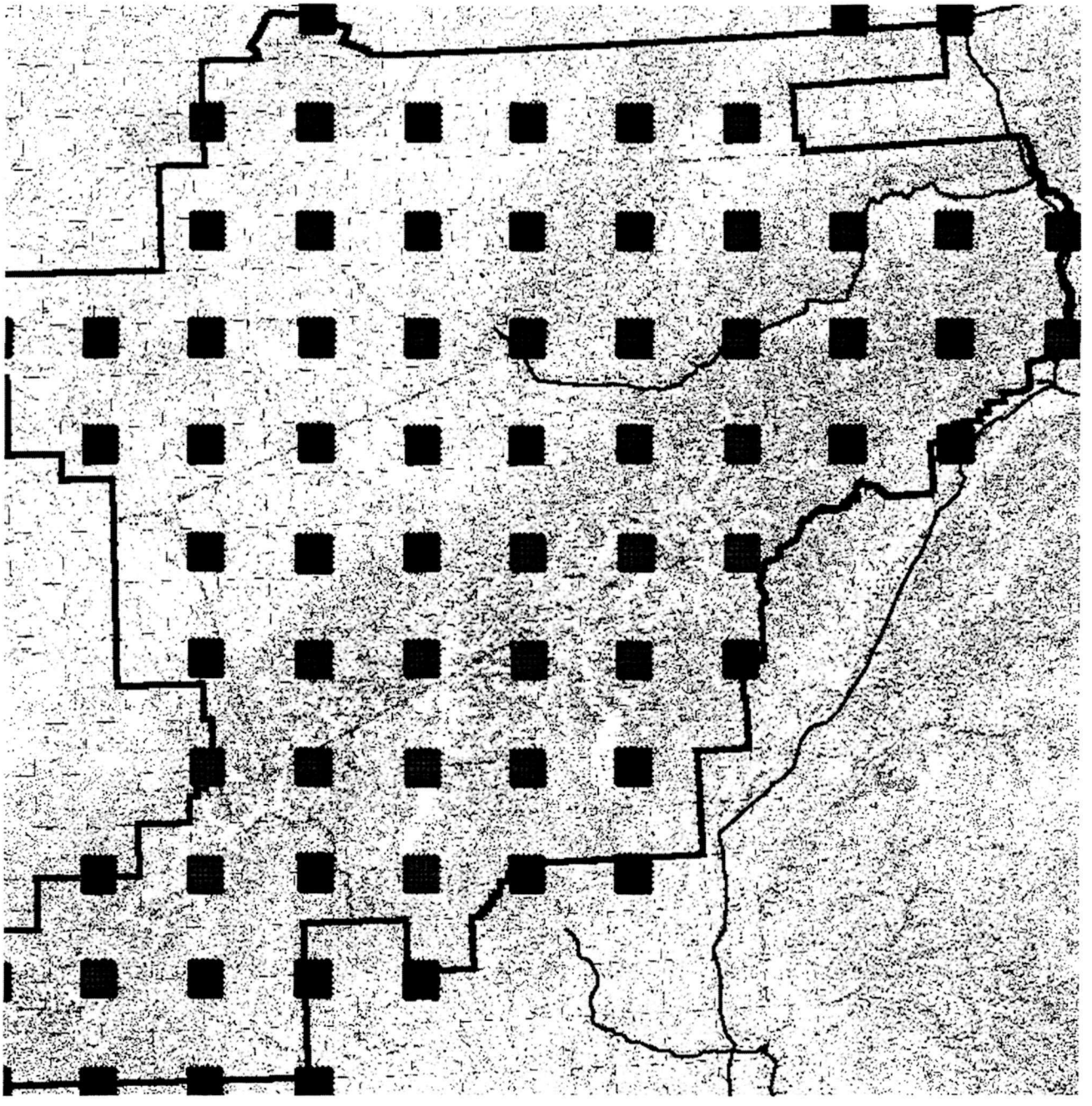


Figure 1. Schematic representation of 20-km "minigrids" or sampling blocks for Denali National Park and Preserve. Each minigrid is 6.25km^2, with the SE corner of each minigrid 20 km distant from the corners of adjacent minigrids. Minigrids are part of a pilot study to determine the best scale of sampling across Denali's huge landscapes, and to integrate the collection of data about plants, animals, and physical features (soils, ecoregions). Minigrids fall in three categories: (1) accessible by road, (2) high elevation (primarily bare ground and snow), and (3) low elevation, but not road accessible.

Proactive Approach to Protecting the Toklat Basin

The goal of this three-year project is to identify the natural and physical features that define the Toklat Basin ecosystem, and to develop an information base that integrates data about many resource attributes so it can be used effectively by National Park Service managers.

The Toklat Basin is located north of the park road (downstream of where the road crosses the Toklat River). It is the broad basin that includes the Toklat and East Fork of the Toklat Rivers north of the Wyoming Hills, and south of where the East Fork flows into the Toklat. It is further defined as the area bounded by the Sushana River (to the east) and the Clearwater Fork of the Toklat (to the west).

The study has five main components: reconnaissance of biological resources, development of computer models predicting where species of large vertebrates occur, inventories of selected species including anadromous fish and furbearers, mapping the surficial geology, and characterization of the soundscape.

Plants

Floristic Inventory

Denali's checklist of vascular plants (flowering plants, conifers, ferns, horsetails, and other fern-allies) now stands at 751 species. No survey work in search of species new to the park is scheduled for 2003. The inventory of the park's vascular flora is considered a full inventory, perhaps within 30 species of what is expected to be found in the park. While it is possible that a few species new to the park may be encountered while other work is being done, it is not likely.

Removal of Exotic (Non-native) Plants

In 2002, volunteers helped resource staff remove 610 pounds of non-native, exotic dandelions *(Taraxacum officinale)* from over twenty-five miles of the road corridor at the east and west ends of the park. The east end project focuses on the park road from Teklanika campground to the park entrance. The west end effort includes Wonder Lake Campground and the park road to the Kantishna Airstrip. By eradicating the pesky exotic dandelions near the entrance, it will reduce the number of seeds that could hitchhike further into the park on any vehicles.

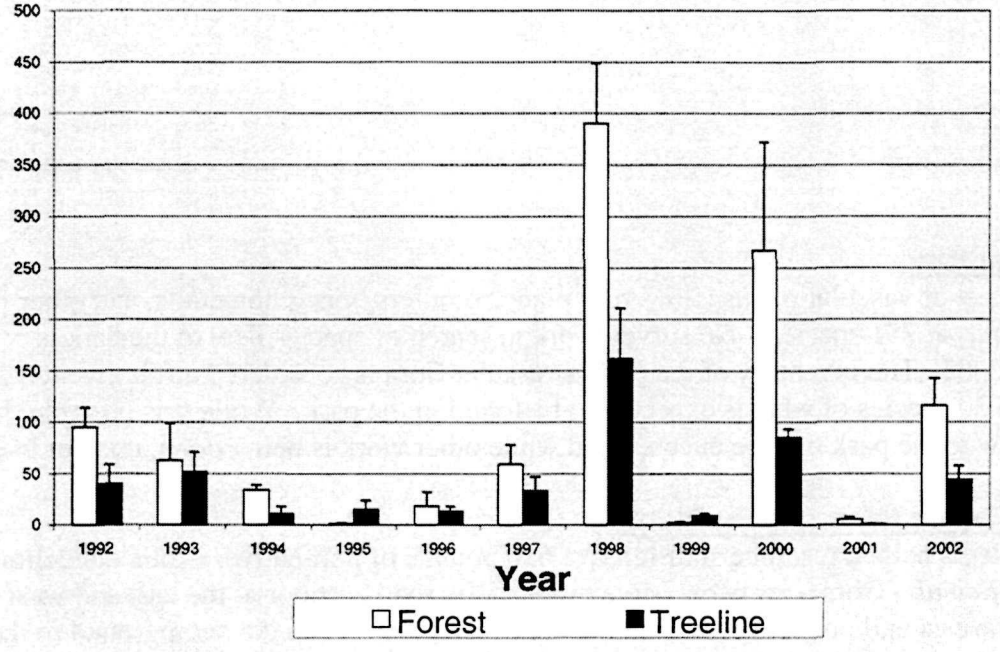
Again in 2003, for the fifth year, volunteers will be enlisted to pull dandelions. Additional non-native species will be targeted for removal near park Headquarters, including sweet clover, *Vicia cracca* (a pea-like vetch), and non-native Hawk's-Beard *Crepis tectorum.* Staff will likely pull these species because they bloom later in the season (August) after dandelion volunteers have long since departed.

Long-term Monitoring

Field work for the vegetation component of the long term ecological monitoring program continues this year. This program has two primary elements at this time:

Monitoring of white spruce growth and reproductive effort (production of cones and seeds). Resource staff continue to monitor what's happening in permanent plots installed in 1992 within the Rock Creek drainage near park Headquarters, including growth and seed production of selected white spruce trees. Spruce cone production was quite variable among years during this study, with high productivity observed in the years occurring in 1998, and 2000 (see Figure 2). On average, the trees in the forested sites produced more cones per tree than did trees in the treeline plots. This difference was due primarily to the larger size of trees in the forested site.

Figure 2. Mean number of cones produced per tree in Rock Creek Drainage permanent vegetation monitoring plots during 1992-2002.



Landscape-scale vegetation project. The goal of this project is to detect changes in fundamental properties of the vegetation cover of the park over long intervals of time. The design for this work is a systematic grid of sites laid out over the park landscape (see Figure 1). So far, sampling has been part of a pilot study to test what can be accomplished in a field season, and to install plots for baseline measurements about vegetation. Once grid size and other aspects of the sampling design have been decided, resource staff will finish the process of installing plots. To continue to monitor some basic properties of Denali's vegetation, the plots would be revisited at multi-year intervals. How big the grid is, and thus how many sample points it has, is still being discussed. (For a 20-km grid shown in Figure 1, there would be 66 sample plots and for a 10-km

grid there would be 255 sample plots). Parameters measured at these sites include species composition, abundance, tree density, tree size, tree vigor, and evidence of pathogens.

The vegetation crew will be establishing three new minigrid study areas for this landscape-scale vegetation monitoring project during the 2003 field season. This will bring to 12 the number of vegetation minigrids sampled so far.

Two of these new study areas will be located within the Toklat Basin, so that the long-term monitoring of landscape-scale vegetation project is fully integrated with the biological reconnaissance of the Toklat Basin [See above under Integrated Programs.] The goal is to document baseline conditions of Denali's vegetation resources in the Toklat Basin in advance of any potential development there.

Revegetation of Construction/Disturbed Sites

In anticipation of needing native seeds to revegetate areas of the frontcountry after development and construction are completed, resource staff are funded in 2003 to conduct a major native plant seed collection. Volunteers and Trails crew will be enlisted to help collect seeds of early successional species. These species are ones that will grow well on the newly-graded and bare soil sites being created by construction projects in the frontcountry (e.g., near the new Visitor Center and Train Depot). Seeds will be collected at the east and west ends. Seeds of many species will be collected, but are likely to include Oxytropis (*Oxytropis campestris*), Eskimo potato (*Hedysarum* spp.), Arnica (*Arnica* spp), and native grasses (*Elymus* spp).

Other revegetation projects in 2003 will be coordinated with frontcountry projects on a week-by-week basis.

Monitoring Dust Palliatives on Park Road

Beginning in 2003, resource staff will set up a study to monitor the effects on soil, water, and vegetation of applying calcium chloride (as a dust palliative) on the park road. The plans for 2003 are to summarize the history of where dust palliatives have been applied and in what years, to select sites to monitor (including control areas where dust palliatives have not be used), to select what attributes should be measured, and to plan the methods for sampling.

Wildland Fire

Monitoring Wildland Fires

Denali National Park and Preserve has 3,359,449 acres (out of a total of 6+ million) that are covered by burnable vegetation. Eighty-eight percent of the acres of burnable vegetation (2,966,707 acres) lie within what is known as limited fire suppression zones. Limited fire suppression allows fire to play its natural role in the ecosystem. Although some wildland fires are suppressed because they threaten natural or cultural values, the emphasis of the fire management program at Denali is on actively monitoring wildland fires while they burn and on protecting individual isolated structures

that lie in the fire's path. Monitoring includes observing a fire from aircraft, digitally photographing and mapping its progress, and keeping an updated narrative of the fire's status and behavior. Current and forecasted weather over the fire area is also monitored to ensure that the fire will continue to burn only where allowed. Protecting isolated structures that lie in the fire's path is generally accomplished by setting up a water pump and sprinkler system on or around the structure as most structures tend to be located adjacent to water sources.

Table 1. Fires in or near Denali National Park and Preserve in 2002.

Fire Name	Burn Period	Acres	Action Taken	Comments
Horseshoe Lake	May 19 - 26	7	Suppressed	Powerline caused
Trespass Fire	May 25 - 26	0.1	Suppressed	Unattended campfire
Moose Lake	July 20 – August 17	117,920 (56,552 acres in Denali)	Monitored – ruin protection	Lightning
John Hansen Lake	July 24 - September 30	25,750 (977 acres in Denali)	Monitored	Lightning
Yanert Fire	August 6 - 13	0.1	Suppressed	Lightning (in Full Management Zone)
Red Top/Glen Creek	September 10 - 12	0.1	Prescribed Fire	Burned old building debris

Creating Defensible Space Around Structures

History has shown the devastating effects when wildland fire combines with a buildup of vegetation around structures. Hazardous fuels around structures in the developed and backcountry areas of Denali National Park and Preserve will be reduced to create a defensible space around the structures. Creating this defensible space includes clearing all flammable vegetation within 30', and thinning the vegetation that lies within 30' – 100' of the structure. The defensible space reduces the risk of property damage in the event of a wildland fire and improves safety for visitors, residents, and firefighters. A maintenance program will be put in place to continue the benefits of this program. Defensible space will be created or enlarged in developed areas and also around cultural resource sites located throughout the park.

- ✧ Developed areas. Much of the built environment in Denali was constructed during the 1920s and 1930s. Structures were often built close to the forest edge or the forest has since grown back into the areas disturbed during construction. Defensible space in developed areas will incorporate approximately 40 acres. Hazard fuels reduction work in the frontcountry developed areas will commence in the late summer/fall of 2003. Areas to be treated include Toklat Work Center, Headquarters, C-Camp, and various structures in the old Hotel area. The Headquarters Historical District will be treated for hazard fuels within a historical cultural landscape context.

- ✧ Cultural resource sites. Of the sites to be cleared in 2003, those most visible from the park road are the sites near the Sanctuary Patrol Cabin, the Pearson Cabin, and the East Fork Research and Patrol Cabins.

Utilizing Satellite Imagery to Estimate Burn Severity

To more efficiently and safely monitor the severity and associated effects of wildland fire on the vegetation within Denali National Park and Preserve, an exciting new technology that utilizes satellite imagery is being developed. If it proves to be accurate, precise, and reliable, this technology will substantially increase firefighter safety by reducing the amount of time spent in aircraft flying over fires to collect data about fire severity.

Fire specialists have compared pre- and post-fire Landsat (satellite) imagery to develop this new index of burn severity called the Normalized Burn Ratio (NBR). This continuous index relies on the fact that vegetation reflects light in different ways if it is unburned or burned to various degrees. [For any satellite image "techies", NBR is calculated in a manner similar to the Normalized Difference Vegetation Index (NDVI), but uses Landsat bands 4 and 7 (not 3 and 4 as NDVI does).]

To be confident that the NBR system works for Denali, the satellite image NBR index has to agree consistently with ground observations. The NBR method was applied to Landsat imagery for Denali to produce a GIS map showing the mosaic of fire effects (NBR index).

During the summer of 2002, Denali and Alaska Region Fire Management staff installed a total of 84 plots in areas burned in 2000 and 2001. Areas of different burn severity (ranging from unburned to severe) were delineated on satellite images. The range of categories of burn severity described on the ground is referred to as the Composite Burn Index (CBI). Plots were located in all CBI categories. Because plot locations were recorded carefully with GPS, the locations could be compared with locations on the satellite image.

For each plot, CBI burn severity scores (from field work) were compared with ΔNBR burn severity data (from computer analysis of satellite images). Results were analyzed by fire year. For the 59 plots on the fires from the summer of 2000, nearly three-quarters of the variation in fire severity observed on the ground was explained by the satellite severity scores. The confidence in the system was even greater (84% of variation explained) based on the analysis of the 25 plots on the 2001 Herron River fire. Based upon these results, it appears that, at Denali, NBR technology (getting ΔNBR from pre- and post-fire Landsat imagery) provides an adequate predictor of on-the-ground burn severity.

Continuing analysis of the field data will seek to identify thresholds for the continuous ΔNBR burn severity datasets to find cutoff values that separate fires that are Low Severity, Moderate Severity and High Severity.

In 2003, Fire Management personnel will be ground-truthing specialized satellite images of two wildland fires that occurred in tundra landscapes near Bering Land Bridge National Preserve and Noatak National Preserve.

Wildlife

Keep Wildlife Wild

Denali National Park and Preserve resource staff will continue to educate people with the basic message: "Keep wildlife wild - do not approach or feed wildlife". Last year buttons, bookmarks, brochures, and signs were produced bearing a universal symbol "Do not feed the animals" with text explaining why this is important. In 2003, staff will distribute more of these materials around the park. Look for signs on trash cans, picnic tables, and on toilet stall doors.

The message will also become part of every interpretive program. This program will serve as a model for other parks. We ask that everyone working at the park take every opportunity to discourage the feeding and subsequent habituation of wildlife.

Bears

There are two park-funded bear studies at Denali National Park and Preserve, one focusing on the north side of the Alaska Range and the other on the south side.

- **Grizzly bear monitoring:** This long-term study on the north side of the Alaska Range focuses on a sample of grizzly bears between the Muldrow Glacier and the Herron River. Marked females are tracked to determine production and survival of cubs. An article that describes this study, "Grizzly Bear Population Ecology and Monitoring in Denali National Park and Preserve," was published in the Fall/Winter 2002 issue of *Arctic Research of the United States*.

  There are presently 22 grizzly bears, all female, with active radio collars within the original study area. Of these, 21 are of reproductive age (≥6 years old). Two are greater than 30 years old and five went to den with cubs-of-the-year (these bears are unlikely to reproduce). We obtained 257 radio locations of the 22 bears in 2002. Staff concentrated their efforts on radio-locating bears during the spring to measure cub production and in late summer/autumn to track how many bears survived to enter dens.

  In 2002, seven grizzly bears were captured May 21-22 to attach or change collars. Collars were replaced on six adult females and a collar was placed on the 3-year-old female cub of one of those females. Two females wearing collars that failed prematurely in 2000 have still not been located. One additional female has not been located since mid-May of 2002. It is likely that either her collared stopped working or she moved out of the study area beyond range of tracking.

  Eight adult females produced two cubs each, for an average litter size of 2.0. One adult female was accompanied by one 3-year-old cub in May. That cub was collared and became independent of her mother in June. There were no mortalities of independent bears. Mortality for cubs-of-the-year was 37.5% (6 of the 16 died). This mortality rate is well below the average annual mortality rate (71%) for 1991-2001 and indicates a possible

recruitment boost in this sample population. There were no yearlings or 2-year-olds in 2002 due to cub recruitment failure in 2000 and 2001.

During fieldwork in 2003, wildlife biologists will try to radio-collar more reproductive-age females, and learn more about cub production and mortality by tracking bears with collars.

✧ **Population estimates:** On the south side of the Alaska Range, the park is cooperating with the Alaska Department of Fish and Game to estimate population numbers for both black and grizzly bears. 2003 will be the third year of this three-year study.

A final report on this study will not be available until after the 2003 field season but preliminary results indicate that for the entire study area, the density for brown bears is approximately 27 bears/ 1000 km^2. This density is very similar to that documented on the north side, which is somewhat a surprise as the habitat on the south side was predicted to support more bears.

Density for black bears is about 80 bears/ 1000 km^2. In Game Management Unit 13E, which is part of the study area bordering Denali National Park and Preserve, the densities are likely to be a bit higher.

Bear Management

Bear problems at Denali escalated in the 1970's and 1980's. By 1982, Denali had the highest rate of backcountry bear incidents of any U.S. national park with a significant grizzly population and high backcountry use. Bears were getting food from backpackers and poorly-handled garbage, causing property damage, and injuring people. Between 1946 and 1983 forty-eight bears were relocated or destroyed in the park. Denali's Bear Management Plan (BMP) was developed to address bear problems and reduce bear-human conflicts.

By educating staff and visitors about bears and providing bear-resistant storage for food and trash, regular problems with bears as well as other wildlife, have been dramatically reduced. In 1984, Bear Resistant Food Containers became mandatory for backcountry users. By 1985, incidents with bears in the backcountry had dropped nearly 90%. The last problem with a food-conditioned bear in one of the Denali campgrounds was in 1994. Of the 21 human injuries caused by bears in the park, only four have occurred since 1983 and the last was in 1997. Since 1983 only four have been destroyed, one sent to a wildlife park, and two relocated by NPS management actions.

The success of the Bear Management Plan is largely dependent on the cooperation of all NPS employees. Within the BMP, it states that all employees are responsible for reporting or correcting possible bear problems as they develop. Supervisors and liaisons are responsible for ensuring that their staff or crews get bear safety training and are aware of Denali's policy regarding bears and other wildlife. To get further information or to schedule bear training, contact Pat Owen (Wildlife Biologist) at 683-9547. Information and some equipment can also be provided for bear-proofing camps and worksites.

Between May 19 and September 16, 2002, 240 bear-human interactions were documented. These were classified as 205 encounters (e.g., bear seen while hiking), 25 incidents (18 general incidents, 1 case of property damage, 4 cases of bears getting human food, 1 mortality from Defense of Life and Property, 1 hunter kill), 4 control actions (bears were hazed, aversively conditioned, or captured), and 6 observations (see Table 2). There were 177 interactions reported in the backcountry and 63 in the frontcountry. Eight of the incidents were in the backcountry and 17 in the frontcountry.

Table 2. Number of bear-human interactions in 2002, by management rating and location in Denali National Park and Preserve.

	Frontcountry	Backcountry	TOTAL
Encounters	35	170	205
Incidents (General)	14	4	18
Injuries	0	0	0
Observations	4	2	6
Gets Food	4	0	4
Property Damage	1	0	1
Control Actions	4	0	4
Hunter kill	0	1*	1
DLP kill	1**	0	1
TOTAL	63	177	240

* Grizzly at Moose Creek
** Problem black bear at Kantishna

According to numerous visitor and bus driver reports, bears were less visible along the road corridor in 2002 than in previous seasons. Cubs of the year were also reported on very few occasions. However, reports from backcountry users using Bear Incident Management System (BIMS) forms were consistent with previous years, and researchers observed that the radio-collared bears west of Wonder Lake produced 2 cubs each. No data are available to explain the differences in bear sightings and cub production.

Road Wildlife Study

This study relies on bus drivers who volunteer to help monitor wildlife along the park road. Drivers record the numbers of bears, moose, sheep, caribou, and wolves they see on their westbound trips. These numbers are summarized and compared to previous years to detect substantial changes. So far, differences in numbers from year-to-year are within the range expected due to natural variation.

Data from 2002 haven't been analyzed yet.

In 2001, three drivers made a total of 64 trips between June 14 and August 31. They recorded 2,786 individuals in 645 groups (46% of groups were caribou, 23% bears, 21% sheep, 4% moose, 4% foxes and 2% wolves). Species distribution and abundance varied by month.

Sightings varied by species and time of year. A comparison of 1999, 2000, and 2001 mean number of groups and individuals observed per trip by species is shown in Table 3.

A visitor taking one bus trip could expect (based only on averages) to see 15 caribou (in 3-4 groups), 3 or 4 grizzlies, 18-19 Dall sheep (in 1 or 2 groups). A visitor taking 10 trips into the park would be expected to see a moose on 8 out of 10 trips, and a wolf on 2 out of 10 trips. In other words, the odds of seeing the big mammals are: Caribou (very close to 100%), Grizzly bear (very close to 100%), Dall sheep (very close to 100%), moose (80%), and wolf (20%).

Table 3. Mean number of groups and individuals (by trip) by species observed along the park road corridor, Denali National Park and Preserve, June-August 1999-2001.

	Groups/Trip			Individuals/Trip		
	1999	2000	2001	1999	2000	2001
Caribou	3.8	3.3	4.6	12.6	16.9	15.3
Grizzly Bear	2.5	2.1	2.3	3.4	3.7	3.5
Dall Sheep	1.7	1.1	2.1	19.1	13.2	23.3
Moose	0.6	0.5	0.4	0.8	0.7	0.6
Wolves	0.1	0.1	0.2	0.2	0.3	0.3

Wolves

Denali National Park and Preserve's wolves have been studied since the park was established. Population estimates were not very accurate until 1986 when a large-scale wolf research project was initiated by David Mech and others. This project provided basic information necessary for effective wolf management. While the intensive research program was concluded in 1993, since that time, research and monitoring efforts have continued.

The current study consists of maintaining 2-3 radio-collared wolves in each known pack inhabiting the park north of the Alaska Range. Radio collared wolves are located every 2 weeks (with 5-6 additional locations during late September-early October to determine fall pack sizes and count pups) and 5-6 locations during mid-March (to determine late winter pack sizes).

Telemetry locations acquired over two biological years (biological year runs May 1 – April 30) are used to determine the area of each pack territory. Areas of each pack territory and respective pack counts are used to estimate abundance and density of wolves. In addition, monitoring data have been used to determine movements, mortality factors, behavior, and population dynamics.

In 2003, Layne Adams of the U.S. Geological Service, Alaska Biological Sciences Center continues one more year of associated prey work (caribou), but is no longer doing the wolf or moose parts of the study. John Burch of Yukon Charley Rivers National Preserve/Gates of the Arctic National Park conducted the spring 2003 wolf survey.

In October 2002, approximately 121 wolves in 20 packs inhabited Denali. In March 2003, Denali's wolf population numbered about 110 wolves (preliminary estimate) in 18 packs. In

March 2002, there were ~97 wolves in 20 packs. In March 2001, there were ~105 wolves. On average, pups account for about 36% of the fall population estimate.

Small Mammal Inventory

To document the small mammals of Denali, in 2002, a field crew from the Idaho State University, in cooperation with the University of Alaska Museum, set out pitfall and snap traps at 4 locations in the park (eastern Kantishna Hills, near the Stampede Mine, Chilchukabena Lake, and the upper Yentna River). Researchers discovered two mammals not previously documented at Denali, and collected study specimens for 16 other species of small mammals (voles, shrews, hares, mice, squirrels, pika).

By far, the three most common species collected were northern red-backed voles, tundra voles, and the cinereus shrews (236, 131, and 205 individuals collected, respectively, or more than 70% of the 821 specimens). In order to capture the rare species, researchers often need to capture many of the common species as well.

The discovery of a tiny shrew (*Sorex yukonicus*) at Chilchukabena Lake (a new species for Denali) is an important new record of this extremely rare and poorly-known species. This study also documented the occurrence of the meadow jumping (*Zapus hudsonius*).

Researchers gathered new site information on several other species, including taiga vole (*Microtus xanthognathus*), pygmy shrew (*Sorex hoyi*), northern bog lemming (*Synaptomys borealis*), and singing vole (*Microtus miurus*). According to Adolph Murie, this vole got its name because of the miniature warbling sounds that they make.

Mammalogists express the amount of trapping effort as person-days of sampling (the number of days times the number of people each day) or the number of nights that each trap is operational. The small mammal inventory invested 130 person-days and 2,840 trap-nights to the collecting effort.

The inventory is part of the Central Alaska Network's efforts to inventory and monitor park resources. Other primary institutions participating in the inventory included the University of Alaska Museum (UAM), USDA National Parasite Lab, University of New Mexico, and The Finnish Forest Research Institute (Vantaa Research Centre). Voucher specimens of mammals were deposited in (on loan to) the University of Alaska Museum (UAM).

At this time all 25 species of small mammals expected to occur in Denali have been documented (observed in the park and specimens collected) (Table 4). The goal of the Central Alaska Network inventory of parks is to document as high a percentage of expected species as possible (it is now 100% for Denali).

Table 4. Checklist of the small mammals of Denali National Park and Preserve, Alaska. All species listed have been substantiated with a vouchered specimen.

INSECTIVORA - Shrews

Family **Soricidae**
- ☐ *Sorex cinereus*, cinereus shrew
- ☐ *S. hoyi*, pygmy shrew
- ☐ *S. monticolus*, montane shrew
- ☐ *S. palustris*, water shrew
- ☐ *S. tundrensis*, tundra shrew
- ☐ *S. yukonicus*, tiny shrew

CHIROPTERA - Bats

Family **Vespertilionidae**
- ☐ *Myotis lucifugus*, little brown bat

CARNIVORA - Carnivores

Family **Mustelidae**
- ☐ *Mustela erminea*, ermine
- ☐ *M. nivalis*, least weasel

RODENTIA - Rodents

Family **Sciuridae**
- ☐ *Glaucomys sabrinus*, northern flying squirrel
- ☐ *Marmota caligata*, hoary marmot
- ☐ *Spermophilus parryii*, arctic ground squirrel
- ☐ *Tamiasciurus hudsonicus*, red squirrel

Family **Dipodidae**
- ☐ *Zapus hudsonius*, meadow jumping mouse

Family **Muridae**
- ☐ *Clethrionomys rutilus*, northern red-backed vole
- ☐ *Lemmus trimucronatus*, brown lemming
- ☐ *Microtus miurus*, singing vole
- ☐ *M. oeconomus*, tundra vole
- ☐ *M. pennsylvanicus*, meadow vole
- ☐ *M. xanthognathus*, taiga vole
- ☐ *Ondatra zibethicus*, muskrat
- ☐ *Synaptomys borealis*, northern bog lemming

Family **Erethizontidae**
- ☐ *Erethizon dorsatum*, North American porcupine

LAGOMORPHA - Pikas & Hares

Family **Ochotonidae**
- ☐ *Ochotona collaris*, collared pika

Family **Leporidae**
- ☐ *Lepus americanus*, snowshoe hare

Small Mammal Monitoring

Scientists from the Institute of Arctic Biology, University of Alaska, Fairbanks, continue to study population dynamics of small mammals (mice, voles, and shrews) in the road corridor of Denali National Park and Preserve. In 2002, Dr. Eric Rextad and Ed Debevec of the Institute of Arctic Biology, University of Alaska, Fairbanks collected the eleventh year of data in the Rock Creek watershed, in order to study variation in numbers of small mammals within a year and from year to year during the snow-free period of "summer".

It was the seventh year that the scientists sampled small mammals at the west end of the park road along the McKinley Bar Trail, and the third year for sampling at two locations located along the park road (Teklanika River and Stony Creek). One location (Polychrome Pass) along the park road that was sampled in 2000 and 2001 was not sampled in 2002 because the sampling time was needed to try some experimental trapping in the Rock Creek minigrid where vegetation and bird surveys have been co-located.

A total of 36,000 trap checks were conducted, resulting in 2141 small mammal captures. Researchers use Sherman live traps to capture small mammals. To ensure that the small mammals are captured "live", researchers bait the traps with sunflower seeds and bedding, and check the traps 3 times per day. Captured individuals were released as soon as they are identified by sex and species, and have their weight and reproductive status recorded. Prior to release, any unmarked individuals (not previously caught) were implanted with passive integrated transponder (PIT) tags. A small proportion of the capture mammals die. These incidental mortalities are collected and archived at the Mammals Collection, University of Alaska Museum, University of Alaska, Fairbanks.

More small mammals were captured in 2002 compared to 2001 (35% increase), for less effort (7,000 more trap checks were made in 2001). Numbers of northern red-backed voles were the highest in seven years, while numbers of tundra voles were severely depressed. Researchers hypothesize that the low snowfall in 2001-2002 produced lots of aufeis, and thus delayed plant growth in favored riparian habitats of the tundra vole.

At McKinley Bar, the number of voles was reduced from 2000, but the relative numbers of red-backed voles and tundra voles was similar to the Rock Creek numbers. Singing voles continued to be practically absent from Rock Creek and McKinley Bar.

Researchers have found strong statistical relationships between elevation and what species of voles are likely to be present (both red-backed and singing voles). By knowing these relationships, it is possible to predict from elevation alone what the small mammal community composition would be for large (unsampled) areas of Denali.

Continued presence of yellow-cheeked voles at the McKinley Bar location may be an indication of colonization in that area. However, only a single individual was captured during the 2002 field season. Shrew (*Sorex* sp.) populations, which were vigorous in 2001, returned to their 2000 near-record lows.

Semivariograms [a statistical procedure used to explore data for spatial patterns] were produced from the 2002 field season data to attempt to find a spatial patterning in small mammal abundance. No patterns emerged. It seems clear that there is just as much variability among plots within a location as among locations.

Birds

Wildlife biologists are conducting short-term and long-term studies focusing on different ecological aspects of bird life in Denali National Park and Preserve. Several projects are aimed at protecting avian resources (birds, bird habitat, and prey sources) in and outside of Denali. Other projects provide information for national monitoring programs. For more information about Denali birds, check out an article on "Birds, Bird Studies, and Bird Conservation in Denali National Park and Preserve" in the Fall/Winter 2002 issue of *Arctic Research of the United States* published by the Interagency Arctic Research Policy Committee or visit the website http://www.nps.gov/dena/home/resources/wildlife/birdweb/index/homebirdpage.htm

✧ **Assessing the spatial and temporal variation in passerines (songbirds):** The objective of this project is to assess changes in songbird populations at Denali in both space and time and address these questions:

1) what birds are found together (species of birds, or groups of species)?
2) how many species are found in each habitat?
3) how important are local habitat versus landscape features to the abundance and distribution of birds?
4) how do the abundance and distribution of bird assemblages change over time in different parts of the park?

In additional, biologists also collect information on the presence of all species of birds observed during their point count surveys and associated field work.

At Denali, bird biologists are describing bird communities (what species of birds and species groups are located together in what habitats) by counting birds (by sight and sound) during 10-minute intervals at a series of sampling points within sites across the park and preserve. These sites are co-located with the vegetation monitoring studies so that park biologists can make inferences about the abundance and distribution of songbirds in relation to habitat and other environmental attributes. This project is conducted in partnership with the Alaska Bird Observatory.

Members of the Long-term Ecological Monitoring (LTEM) committees for fauna and flora are suggesting an integrated approach for monitoring many biological resources in Denali. To make inferences at a Denali-wide spatial scale from sample plots, each point on the landscape of Denali must have an equal probability of being sampled. Bird biologists are using the minigrid sampling design (designed for vegetation monitoring in Denali by Denali's plant ecologist, Carl Roland), and co-locating sampling points with the vegetation monitoring. Preliminary results are based on data collected at 10 minigrids in 2001 and 2002. Each minigrid consist of 25 points spaced 500-meters apart. In 2001 and 2002, we surveyed 200 points, on average 20 points per minigrid, at 10 minigrids in Rock Creek, upper Savage River, Primrose Ridge, Gorge Creek, Stony Creek, Wigand Creek, and Toklat River areas. We detected 1,937 individual birds of 45 species on the 8-minute counts and 14 additional species while traveling between points. On average, we detected about 17 species during each 8-minute count. At each minigrid, we detected a few more species than at any one point, for an average of 21 species per mini-grid.

Sixteen species were detected on at least 20 of the 200 minigrid plots and made up about 93% of all birds detected during the 8-minute counts: White-Crowned Sparrow, Savannah Sparrow, American Tree Sparrow, Fox Sparrow, Wilson's Warbler, Dark-Eyed Junco, Orange-Crowned Warbler, Yellow-rumped Warbler, Redpoll (either species), Swainson's Thrush, Lincoln's Sparrow, Varied Thrush, Gray-Cheeked Thrush, Hermit Thrush, American Robin, Gray Jay, Ruby-Crowned Kinglet, White-Winged Crossbill, and Arctic Warbler.

Three species, Wilson's Warbler, White-Crowned Sparrow and Redpolls (either species) were detected on all 10 minigrids. Seventeen species including Gray Jay, Horned Lark, Gray-Cheeked Thrush, Swainson's Thrush, Hermit Thrush, American Robin, Orange-Crowned Warbler, Yellow-rumped Warbler, Wilson's Warbler, American Tree Sparrow, Savannah Sparrow, Fox Sparrow, Lincoln's Sparrow, White-Crowned Sparrow, Golden-Crowned Sparrow, Dark-eyed Junco, and Redpoll spp. were detected on 50% of the minigrids.

✧ **Breeding Bird Survey (BBS):** The North American Breeding Bird Survey (BBS) is a large-scale survey of North American birds. Denali has two of the approximately 3,700 active BBS routes across the continental U.S. and Canada (about 2,900 are surveyed annually). The BBS has accumulated over 30 years of data on the abundance, distribution, and population trends of more than 400 species. These data can reveal whether major population changes of a species in certain states are related to a continental decline or merely represent population shifts within their breeding range.

The two BBS routes in Denali are run in mid-June along the park road at Savage River and Toklat. Each route consists of 50 stops spaced 0.8 km apart along a 39.4-km route. The observer records the total number of individual bird species heard or seen within 0.4 km of each stop during a 3-minute observation period, as well as the time and weather conditions.

We recorded 28 species of birds (630 individuals) on the Savage BBS route and 22 species of birds (322 individuals) on the Toklat BBS route. White-crowned Sparrow and American Tree Sparrow were the most common species on both routes in 2002.

Results from the Denali BBS routes are available at: http://www.mbr-pwrc.usgs.gov/bbs.

✧ **Denali Institute autumn passerine banding station:** The Denali Institute Migration Station (DIMS) is located near Moose Creek and is operated from early August to early September. Passerine birds are captured in a fine net strung between posts, banded within minutes of capture, measured, and released.

The DIMS staff, three trained banders supported by the Denali Institute and the Alaska Bird Observatory, banded 1107 birds of 34 species during 2133.25 net-hours during 2002. Seven birds banded at DIMS in 2001 and one bird banded at DMIS in 200 were caught again in 2002. Wilson's Warbler (375 captured) are the most common species captured at DIMS. Other species that are captured in high numbers are Yellow-rumped Warbler (n=114) and White-crowned Sparrow (n = 134). Most birds (93%) captured at DIMS are juveniles.

A juvenile Red-eyed Vireo was captured at DIMS in 2002. This individual is possibly the second record of the species in Interior Alaska. Red-eyed Vireos breed rarely in riparian areas of southeast Alaska as well as in the Mackenzie Mountains in Northwest Territories, Canada. The species is not likely to be captured regularly at DIMS.

More information is available on the Denali Institute's web page and summary reports of this project are available at: http://www.alaskabird.org/ABOResearchHome.html.

✧ **Developing indices of trends in willow ptarmigan (and snowshoe hare):** Indices of population size of snowshoe hare and willow ptarmigan on a broad scale are obtained by recording the number of each species observed during routine field activities. These data allow the tracking of changes in the abundance of both species over time.

The abundance of both Snowshoe Hare and Willow Ptarmigan were the lowest recorded in the study area in the 16 years that these numbers have been tracked. According to the indices developed for Denali and other regions of Interior Alaska, the Snowshoe Hare population appears to have crashed in 2001-2002 across Interior Alaska.

✧ **Reproductive success of golden eagles and gyrfalcons:** A comprehensive study of the ecology of golden eagles and gyrfalcons in Denali was started in 1988. Data on occupancy of nesting areas and reproductive success are collected annually at 56 to 80 golden eagle nesting areas and 12 to 26 gyrfalcon nesting areas using aerial and foot surveys. The first surveys are conducted soon after egg laying is completed (mid-April) to determine occupancy and breeding status. The second surveys are conducted late in the nesting season (late July) to determine nesting success and productivity. Results of this study have yielded new insights into the natural history of golden eagles in North America, the response of these predators to changes in their food supply and weather conditions, and the variation in reproductive success and productivity among nesting areas over a series of years.

In 2002, the occupancy of nesting territories of both golden eagles (92.5%) and gyrfalcons (80%) was similar to other years. The proportion of territorial pairs of golden eagles producing clutches (15%) and raising fledglings (36%) was the lowest recorded. Additionally, no gyrfalcons raised fledglings in 2002. This is the lowest productivity measured for gyrfalcons in this 15-year study. In all other years, gyrfalcons produced at least a few fledglings. Nesting phenology (timing of nesting-related events) for golden eagles in 2002 was similar to the 15-year mean for the study area. Snowshoe hare and willow ptarmigan abundance was low in 2002. The lack of food, particularly during the early nesting season, is the likely cause of the low reproductive success of golden eagles and gyrfalcons in 2002.

A cooperative study with the Alaska Department of Fish and Game to identify nesting territories and monitor reproductive success of golden eagles adjacent to Denali in the Wood River/Dry Creek area was initiated in 2001 and continued in 2002. Reproductive success of golden eagles in the Wood River area was also very low in 2002.

Proposed activities for 2003 include (1) continuation of golden eagle and gyrfalcon monitoring in the historic study area in Denali, (2) continuation of genetic studies of golden eagles in Denali, (3) continuation of the cooperative study with ADFG in the Wood River, (4) testing of a new analysis based on productivity recorded at individual nesting territories to assess the long-term trends of golden eagles and gyrfalcons in Denali, (5) completion of the

monitoring protocol for golden Eagles and gyrfalcons in Denali, and (6) continued public education and outreach efforts.

This study provides critical information for conservation of these species in North America. Both species are of conservation concern: Golden eagles because of habitat changes and persecution on their lower 48 wintering grounds, and gyrfalcons because Alaska is the only place they breed in the United States.

✧ **Examining fidelity of golden eagles to nesting areas**: Results from our genetic study on golden eagles conducted in conjunction with the USGS-Alaska Science Center Wildlife Genetics Laboratory show that we can identify individual eagles using DNA collected in their shed feathers. This is a non-invasive, cost-effective method for obtaining data to assess the population trends of breeding eagles in Denali. We will continue to collect shed feathers from nesting territories to determine if we can assess fidelity to nesting areas using this method. Feather collections for this research are conducted under the auspices of a U.S. Fish and Wildlife Service Eagle Scientific Collecting Permit and a State of Alaska Scientific Permit. After the DNA material is removed from the feather shafts, all feathers are transferred to the National Eagle Repository in Colorado.

✧ **Documenting annual movements of juvenile and subadult golden eagles:** Golden eagles have been tracked using satellite radio telemetry to test a series of hypotheses regarding annual movements of juvenile and subadult golden eagles from Denali. Data about the migration corridors and ranges in winter and summer for Denali's juvenile eagles are essential for protecting these areas in the rapidly changing western landscape.

- Most juvenile and subadult golden eagles from Denali migrate in late September, following the Rocky Mountains south as far as northern Mexico.
- Wintering ranges extend from central Alberta to northern Mexico, as far west as central Washington, and east to central Kansas.
- Juveniles and subadults return to Alaska from late April through late May and show little tendency to return to Denali. Their summer range extends from the Kenai Peninsula north to the Arctic Ocean, as far west as Cape Lisburn, Alaska, and as far east as the Mackenzie River Delta, NWT, Canada.
- Mortalities result from starvation, illegal shooting, illegal poisoning, and electrocution.

✧ **Examining environmental factors influencing reproductive success and survival of golden eagles:** Denali scientists are developing a landscape-scale model to determine how topography, habitat, and prey availability affect nesting golden eagles in Denali. Cooperators from the U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, and the Department of Fisheries and Wildlife, Oregon State University are also working on this project.

Our preliminary results indicate that high production nesting territories contain more alpine and upland areas than low production nesting areas. Additionally, forested and lowland regions are typically absent from high production nesting territories.

Amphibian Inventory

The wood frog is the only amphibian that occurs (or is expected to occur) in Denali National Park and Preserve. Information on the presence and habitat associations of the wood frog is being collected concurrently with many of the ongoing bird and vegetation projects. While these data are anecdotal, they provide a starting point for more detailed wood frog studies.

In 2003, these park findings will be greatly augmented by the work of Dr. Grant Hokit, Carroll College, Helena, Montana, who will search for wood frogs in the beaver and kettle ponds in the Wonder Lake area.

Freshwater Fish Inventory

In 2003, a search for fish species will occur at Denali as part of the Central Alaska Network's inventory of park resources. The goal is to document at least 90% of the freshwater fish species expected to occur in lakes and streams in each national park.

Eleven fish species are expected to occur within Denali's boundaries. Eight of these have already been documented somewhere in the park: round whitefish (*Prosopium cylindraceum*), inconnu (*Stenodus leucichthys*), chum salmon (*Oncorhynchus keta*), chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), Arctic grayling (*Thymallus arcticus*), Dolly varden (*Salvelinus malma*), and lake trout (*Salvelinus namaycush*). The inventory will target finding the three species that are expected to occur, but haven't been documented: northern pike (*Esox lucius*), Alaska whitefish (*Coregonus nelsonii*), and longnose suckers (*Catastomus catastomus*). The inventory will also make note of any new locations for the eight previously documented species.

Searches for fish will be targeted (based on a review of previous fish studies) in the drainages of the Kantishna River and Kuskokwin River. Sites include the Kantishna River, the Bearpaw River, Hot Slough and Star Lake, Wonder Lake, Sandless Lake, Chilchukabena Lake, and several unnamed lakes between the Muddy River and Lake Minchumina within the Kantishna River drainage. Other sites that will also be sampled for fish are Big Lake, Fish Lake, Spectacle Lake, Blackfish Lake, Sprucefish Lake and several unnamed lakes in the upper reaches of Highpower Creek within the Kuskokwim drainage.

Physical Sciences

Muldrow Glacier Monitoring

Denali Park and Preserve staff have monitored ice elevations and flow rates of the Muldrow Glacier since 1992. The Muldrow last surged in 1956-57 extending its terminus some 2.5 miles (four kilometers). Surges may occur at 50-year intervals; thus, another surge is anticipated within a few years of 2007. Monitoring efforts will continue in 2003 in order to describe the quiescent (period between surges) glacier so that the data can be compared to information collected during and after the next surge.

Ice surface flow rate markers will be surveyed on various points of the Muldrow Glacier, as well as the two largest tributary glaciers (Traleika and Brooks), to detect flow rate changes that might signal the start of a surge. The following items will be measured or sampled:

- Elevations of the main ice streams and moraine crests, using longitudinal and cross-section surveys
- Levels of the water table in moulins (stream caverns in glaciers) and other slow-flow subsurface ice pools
- Surface ablation (melting and evaporation) and the position of the terminus ice front
- Temperature and stage of water flowing at the terminus

Long-term Glacier Monitoring

Long term glacier monitoring sites were installed on the Traleika and Kahiltna Glaciers in 1991 to monitor long-term mass balance changes and flow of these two glaciers. These glaciers were selected to compare glaciers on the north (Traleika) and south (Kahlitna) sides of the Alaska Range (dryer and wetter climates, respectively). The measuring sites for both glaciers are located at approximately 6000' (1830 m). The Kahiltna Glacier flows ~660 feet (200 meters) per year, while the Traleika Glacier moves ~165 feet (50 m) per year . The Traleika glacier has lost approximately 13 feet (4 m) of water-equivalent (if the change in ice/snow were water) in 11 years of monitoring (a negative mass balance), while the Kahiltna has gained ~7 feet (2 m) of water-equivalent. Interestingly, the Traleika Glacier, though experiencing negative mass balance, has been thickening consistently, illustrating the complexity of glacier flow. The glacier surface at our measurement site has risen approximately 82 feet (25 m) in the past 11 years.

During 2003, radar soundings to estimate glacier thickness will be made on the Traleika, Muldrow and Kahiltna Glaciers. These 2003 measurements will indicate the dynamics of glaciers by document any changes in thickness of ice. Radar measurements in 2002 indicated that the East Fork of the Toklat Glacier is 660 feet (200 meters) thick; and the Muldrow Glacier is 1640 feet thick (500 meters) and 50 feet (15 meters) thicker near McGonnagall Pass. Basecamp (on the Southeast Fork of the Kahiltna Glacier) sits on ~985 feet (300 meters) of glacial ice.

Weather Station on Mt. McKinley

Denali Park staff worked with the International Arctic Research Center (IARC) to plan the transmission of data from a weather station on Mt. McKinley. The IARC, in cooperation with the Japanese Alpine Club, installed a new weather station at 19,200' on June 18, 2002. An expedition of eight climbers from the Japan Alpine Club, including one person from University of Alaska Fairbanks, climbed the mountain and installed the station 1,120 feet from the summit.

The club had originally installed a different weather instrument in the same location in 1990 and donated it to the International Arctic Research Center at the time of its opening ceremony in 1999. The 1990 weather station was set up in memory of four Japanese climbers, including the famous mountaineer and adventurer Naomi Uemura, who disappeared on separate climbing expeditions near the location of the station. It is believed that the climbers were all literally blown off the mountain by gusts of wind.

In January 2003, the new station stopped sending weather data. In the 2003 climbing season, a team will reinstall at the station some new equipment designed to withstand the extreme conditions found on Mt. McKinley, including winds in excess of 150 mph (241 km/hr). The instrument will take extreme-altitude measurements of temperature, wind direction, and speed, and transmit the information via satellite to the University of Alaska Fairbanks. The weather station will make real-time, near-summit weather information available to the hundreds of climbers who attempt the summit each year, as well as to park rangers, who must plan and perform search-and-rescue operations in the vicinity of the South Summit. Researchers find the data useful for their studies of the high elevation environment. The National Weather Service, which has in the past issued a specific climbing forecast for Mt. McKinley from its Fairbanks forecast office, utilizes the data to monitor and forecast weather at high altitude. To obtain Mt. McKinley weather data (when the station is operational), go to http://www.denali.gi.alaska.edu.

Weather Monitoring at Park Headquarters

For nearly 80 years, weather information has been collected at park Headquarters. Beginning in 1922, Alaska Railroad personnel collected weather information in their camp near Riley Creek. In 1924, the National Park Service took over operation of the weather station. In 1925, the station was moved from the old headquarters site near the confluence of Hines and Riley Creek to the current Headquarters area (near the Kennels). This station is one of over 12,000 in the National Weather Service's Cooperative Weather Observation Program. Long-term weather (climate) datasets provide valuable information for detecting and predicting changes or trends in both temperature and precipitation, both factors that play a critical role in the ecology of Denali.

Below is a summary of the 2002 climate data collected at park headquarters and compared with averages from the long-term database.

Temperature

- maximum temperature 28.9°C (August 4)
- minimum temperature –36°C (January 26)
- mean annual air temperature –0.1°C (warmer than historical average of –2.8°C)

Denali Headquarters Average Monthly Temperatures (°C)		
	2002	Historic Average
January	-10.1	-16.7
February	-10.5	-14.4
March	-10.3	-10.5
April	-5.8	-2.9
May	7.1	5.2
June	10.9	11.1
July	12.5	12.7
August	9.7	10.3
September	6.6	5.0
October	0.9	-4.3
November	-2.4	-12.3
December	-9.2	-16.3
Yearly Average	***-0.1***	***-2.8***

Comments on temperatures for 2002:

- January and February temperatures were warmer than average
- November and December temperatures were well above average
- Summer temperatures were about normal

Precipitation

- Yearly total: 51.3 cm (historic average 38.1 cm)

Denali Headquarters Monthly Precipitation (cm)		
	2002	Historic Average
January	0.97	1.85
February	0.00	1.50
March	0.43	1.09
April	6.99	1.14
May	2.03	2.06
June	9.60	5.61
July	11.66	7.44
August	13.64	6.81
September	2.06	4.04
October	2.82	2.49
November	0.43	1.83
December	0.66	1.98
Annual Total	***51.28***	***38.12***

Comments on Precipitation for 2002:

- January, February, and March were drier than normal with the total precipitation for the three months = 1.4 cm (well below average of 4.4 cm).
- November and December were also drier than normal with the total precipitation for the two months = 1.1 cm (below average of 3.8 cm).
- The summer months (June - August) were wetter than normal with the total precipitation = 34.9 cm (above average of 19.9 cm)

Parkwide Climate Monitoring

Climate monitoring continued at established locations around the park. These data are especially useful for weather forecasting related to fires, and detecting trends by long-term monitoring.

In 2002, staff installed new climate stations at the Stampede Mine Airstrip and the Dunkle Mine Airstrip, bringing the total number of climate stations to 14 distributed throughout the park. Most of these stations record air temperature, relative humidity, wind speed and direction, solar radiation, precipitation, and soil temperatures. From these stations, resource staff gain a park-wide perspective on the physical factors affecting Denali's ecosystems, while providing timely information on snow and weather conditions to park managers, the National Weather Service (NWS), the Natural Resources Conservation Service (NRCS), researchers, and the public.

In 2002, seven road corridor stations were installed to record temperature and relative humidity (Primrose Pullout, Igloo Forest (mile 32), Polychrome Rest Area, Toklat Ranger Station, Eielson Visitor Center, and Mile 71 (near Grassy Pass)). Denali's resources staff coordinated with the Federal Highway Administration and Denali's maintenance division to record snow depths and temperatures along the park road corridor. The objective of this new system is to bring together various groups with common data needs to provide for an integrated data collection network.

UV-B Monitoring

Thinning of the ozone layer, which acts as a protective shield, causes an increase in the amount of ultraviolet (UV) radiation that reaches the earth's surface. Seasonal fluctuations in the thickness of the ozone layer have been detected around the globe, but are most severe at higher latitudes. The effects of increased UV-B are not well known, but have been linked to negative impacts on humans, plants, aquatic ecosystems and amphibians. In 1997, as part of the Park Research and Intensive Monitoring of Ecosystems Network (PRIMENet), Denali National Park and Preserve was equipped with a spectrophotometer--an instrument designed to measure different wavelengths of light. These instruments track the sun as they monitor the variation in solar irradiance throughout the day. The instrument installed at Denali focuses on the ultraviolet spectra, specifically UV-B radiation in the 300-320 nanometer range of light. Because of the influence of sun angle, clouds, and air pollution, the seasonal variation in UV-B detected at the surface is large. Therefore, it will take many years of monitoring to detect trends in the incidence of UV-B. The preliminary data collected at Denali establish what these seasonal variations in UV incidence are, and provide the baseline information needed to monitor long-term changes in the levels of damaging UV-B that reach the earth's surface.

The highest daily UV value recorded for 2002 was 3398.5 Joules/m^2 on July 23, 2002. The incidences of UV, even on cloudless, sunny days at Denali, compare relatively low with parks at lower latitudes, and higher altitudes. In comparison, the highest values recorded at Rocky Mountain NP, Canyonlands NP, and Hawaii Volcanoes NP were in excess of 7000 Joules/m^2. Even though the values are lower at Denali, the extreme sensitivity of the subarctic climate and ecological systems implies that it could be profoundly affected by even slight human and/or natural climate changes. The monitoring site at Denali, as well as the other sites in the arctic, can help to quantify the doses of UV radiation received, and help to assess the role and recovery of ozone levels in the Arctic.

Air Quality Monitoring

Denali National Park and Preserve has been conducting air quality monitoring at a site near park Headquarters since 1980. In 2001, a second permanent station was installed at Trapper Creek to measure regional air quality under conditions that approximate park air quality on the south side of the Alaska Range. The following atmospheric parameters are measured at one or both locations: ground-level (tropospheric) ozone, sulfur and nitrogen oxides, fine particles and aerosols, wet deposition, and associated meteorological parameters.

Results have shown that, while Denali has some of the cleanest air measured in the United States, industrial and agricultural contaminants from other continents make their way to the park each year in a strongly seasonal pattern. On average, the peak concentrations of international contaminants occur in the late winter and spring, and naturally-occurring wildfire smoke is the primary contributor to air quality degradation in the summer. It is reasonable to expect that as the human population grows in source areas such as Europe and Asia, unless international control mechanisms are put in place, pollution will increase over time in Denali and other remote Alaska parks.

Persistent Organic Pollutants (POPs) and other toxic airborne contaminants are a growing concern throughout the arctic and subarctic. In March 2003, sampling for a 5-year, multi-park airborne contaminant assessment project began in Denali. Snow samples were collected at Wonder and McLeod Lakes, to be analyzed for an array of toxic airborne contaminants, including PCBs and DDT. Additional snow sampling will be conducted on the south side of the Alaska Range this spring, followed by two more years of sampling a variety of ecosystem indicators, including fish, lichens, willow bark, lake water, lake sediments, and subsistence foods.

More information about the National Park Service nationwide air quality monitoring program can be found at the following web site: http://www2.nature.nps.gov/ard/.

Snow Surveys

Snow surveys are done on a monthly basis from November–April at thirteen locations throughout Denali National Park and Preserve as part of a cooperative agreement with the Natural Resources Conservation Service (NRCS).

The six snow courses on the north side of the Alaska Range (Minchumina, Kantishna, Purkeypile Mine, Stampede Airstrip, and two at different elevations in the Rock Creek Watershed near Headquarters) are accessible by fixed-wing aircraft or by skis/snowshoes. At these snow courses, depth and density are averaged from five measurements on the ground.

On the south side of the Alaska Range there are seven aerial markers (Yentna, Chelatna Lake, Nugget Bench, Dutch Hills, Ramsdyke Creek, Tokositna Valley, and Eldridge Glacier). The information on depth is collected from the aerial markers by flying past the location and counting the exposed horizontal cross bars on the marker. Researchers learn about ecosystem relationships by correlating snowpack information with resource information such as wildlife population densities, birth survival rates, herd movements, vegetation succession, and surface water supply.

The snow depths on the north side were less than normal for the entire 2002-2003 season. There was no snow on the ground at most of the north sites for the first survey on December 1, and no snow at any of the sites for the May 1 survey. The average snow depth for the north side was 5.1 inches. On the south side of the Alaska Range, snow depths were 2-3 feet less than normal (average from 1971-2000) early in the season, but by April 1 the snow depths averaged only 9 inches below normal. The average snow depth for south side sites was 29.9 inches.

The average snow depth for the 2001-2002 season on the north side was 15.7 inches (compared to 30-year average of 18.8 inches). On the south side of the Alaska Range, the average snow depth was 49.8 inches (compared to 30-year average of 56.6 inches).

Snowmobile-related Research Projects

A number of projects were continued from previous winters that measure the effects of snowmobiles on various resources at Denali National Park and Preserve.

- **Snowpack characterization:** This study focuses on what physical aspects of the snowpack may allow adequate support of snowmobile travel without causing adverse impacts to vegetation and soils. This project provides depth and density information to park managers who are faced with the decision to open or close areas of the park and preserve to snowmobile use based on the current snow conditions.
  - Snow depth and density were monitored at several fixed survey sites throughout the winter season (December through May).
  - Survey sites were located in different vegetation types as well as in areas of special concern to park management.
  - Data were collected in an effort to define the development of an adequate snowpack for snowmobiles, and to monitor the change of that snowpack throughout the season.
  - The information will also indicate how changes in the measured variables affect the level of support provided by the snowpack.

- **Snowmobile activity patterns and route maps:** This study uses aerial and ground surveys, Global Positioning System (GPS) units and Geographical Information

Systems (GIS) to produce maps that show where winter visitors use snowmobiles the most on parklands. Little use along the Stampede Corridor occurred during the last two winters because of the poor snow conditions. Use on the south side of the Alaska Range also was lower than in previous years due to the lack of adequate snow depth.

- ✧ **Snowpack contaminants:** A hydrocarbon contaminants study was conducted to determine if snowmobile emissions are impacting and polluting the snow and aquatic ecosystems. Results indicated no snowmobile contaminants in the limited sampling area, but did detect pesticide residue, likely from airborne transmission.

Soundscape Inventory and Monitoring Program

A soundscape research program is underway at Denali National Park. Inventory and monitoring of natural and human-generated sounds have been conducted at numerous locations around the park including along the park road, near Cantwell south of Broad Pass, in the Ruth Amphitheater, at base camp on the Kahiltna Glacier, on the Pika Glacier, and at the toe of the Tokositna Glacier. The current focus is along the Stampede Corridor north of the Outer Range. More than 1.6 billion decibel levels and over 3500 hours of digital recordings have been documented in the park's three acoustical zones (alpine, sub-alpine, and scrub/forest). The amount and types of natural and human-made sounds as well as the decibel levels of these sounds are being documented in the park's three acoustical zones and several management areas. Sound metrics (minimum, maximum, average, etc.) are being calculated from the decibel data. Audibility data provide sound source identification and calculations such as percent time audible. Wind is the most widespread natural sound in all areas and aircraft overflights are the most common human-made sound. For those with interest in natural soundscapes in national parks (and the park service role in their protection), the National Park Service Natural Sounds Program Center website is http://www1.nrintra.nps.gov/naturalsounds/index.htm

Soils Mapping

A draft soils map for Denali National Park and Preserve has been produced after researchers from the Natural Resource Conservation Service spent six years (1997-2002) digging soil pits and collecting field data on soils and vegetation. In 2003, researchers will analyze data from the previous 6 years and prepare final reports and maps.

Toklat Basin Mapping of Permafrost and Glacial Extents

In 2003, surficial geology mapping in the Toklat Basin will focus on glacial extents and permafrost delineations. Resource personnel will use field investigations, along with interpretations of air photos and satellite images, to attempt to identify the extents of past glaciations (Early and Late Wisconsinan primarily). Using the Denali soils map (fieldwork completed in 2002), staff will also identify different types of permafrost and classify each type in detail. These investigations are part of the larger project that is a proactive approach to protecting the Toklat Basin by documenting its special features.

Monitoring Landslide at Mile Post 45

At mile post 45 on the park road, survey stations were established in 1993 to monitor the rate of movement of the surface area of a mass movement (landslide). This movement is a classic rotational slump with a headwall scarp, subsiding basins, pressure ridges and fractures, and flow features. The apex of the headwall scarp is within 35 horizontal feet of the park road, and park management and Federal Highways personnel are concerned about the threat that this movement poses to the road.

Both horizontal and vertical movement has been monitored since 1993. Approximately 50 stations have been established over the entire period. Some have been lost to surface fracturing, squeeze-out, or animal damage, and some are added each year. Results of the horizontal component are shown in the table below.

Surveyed Horizontal Movement of Landslide at Mile Post 45, Denali National Park

Survey Year	93-94	94-95	95-96	96-97	97-98	98-99	99-02
Approximate Elapsed Time	1 yr	1 yr	1 yr	1 yr	1 yr	1 yr	3 yrs
Zone 1 – Above Scarp (Above Road)							
Number of Stations Surveyed	0	0	0	0	0	0	4
Average Movement of Stations (ft)*							**0.3**
Zone 2 - Above Scarp (Below Road)							
Number of Stations Surveyed	6	6	3	5	5	7	4
Average Movement of Stations (ft)*	**0.3**	**0.3**	**0.4**	**0.3**	**0.3**	**0.2**	**0.5**
Zone 3 - Below Scarp (Upper Basin)							
Number of Stations Surveyed	9	8	9	9	9	12	9
Average Movement of Stations (ft)*	**6.8**	**2.3**	**2.7**	**1.2**	**3.4**	**0.9**	**1.9**
Zone 4 -Below Scarp (Lower Basin)							
Number of Stations Surveyed	11	11	15	13	11	13	12
Average Movement of Stations (ft)*	**8.4**	**2.8**	**3.4**	**1.6**	**4.7**	**1.2**	**2.1**

*Survey values represent average horizontal movement (in feet) for one year (in the columns for years 1993 to 1999) or three years (in the last column)

Stations above the scarp, which are both above and below the road (Zones 1 and 2), show little to no movement (±0.3 ft) since the origin of the survey network, suggesting the ground immediately above and below the road remains relatively stable at this time. Zones 3 and 4 represent the actively subsiding basin, which demonstrated large displacements in the 93-94 survey. Generally, the degree of displacement has diminished in recent years of survey. However, increased rates of precipitation or concentrated periods of precipitation could re-activate the landslide.

Annual monitoring of the landslide will continue, so staff can watch for sustained or increased rates of movement, with particular attention paid to Zones 1 and 2, because these most immediately threaten the park road.

Seismic Monitoring

In 2002, Denali staff completed writing the Environmental Assessment (EA) evaluating the environmental effects of an upgrade and a new installation of seismic monitoring equipment in the park. Researchers at the Geophysical Institute at the University of Alaska Fairbanks have maintained seismic monitoring stations within Denali at Wickersham Dome, Thorofare Mountain, and Mt. Healy for over thirty years. Their proposal to upgrade these sites to allow for digital, multi-signal transmission, and to install a new site on Double Mountain, was given the go-ahead, as long as they follow some mitigating measures. The installations will occur in 2003.

Mining Issues (Minerals Management)

Mining issues within Denali National Park and Preserve are very complicated and specific situations can change from day to day, especially due to ongoing acquisitions and litigation.

- **Patented/unpatented:** There are "patented" mining claims" (privately owned surface and mineral estates) and "unpatented" mining claims (federally held and managed surface and privately held mineral estates). Most of the mining properties in "downtown" Kantishna are patented, while the outlying stream claims are mostly unpatented. Patented lands are private lands and require the owner's permission to cross. Unpatented lands are in federal ownership.

- **Lode/placer:** There are two types of mining found in the park—**lode mining** (mining for mineral veins found in bedrock) and **placer mining** (mining for gold out of creek gravel). Most of the lode claims are located on Quigley Ridge and many have been purchased by the National Park Service or abandoned. In "downtown" Kantishna (Moose Creek floodplain from the Kantishna Roadhouse to the airstrip), there are five patented placer claims that had been variously subdivided into multiple private ownership, most of which were recently acquired by the American Land Conservancy, and returned to federal ownership.

- **1985 Injunction and Mining Claim Acquisition:** A lawsuit was brought against the National Park Service (NPS) in 1985 for failure to manage the mining properties under the applicable environmental laws and regulations. As a result, the NPS completed an Environmental Impact Statement in 1992 that promoted the purchase or acquisition of all mining properties. Although mining of the claims was allowed to continue (under applicable laws) only a few mining plans of operation have reached the approval stage since 1985.

- **Legal takings issues:** A large share of unpatented claims in Denali has been under "takings" litigation. These are complex legal situations where the claimants' rights to mine the properties may have been compromised (considered a "taking"), and the claimant and government go to court to resolve the date of taking and the value of the property. Following one major court settlement of an unpatented block of claims, several other unpatented properties in Kantishna have been acquired through out-of-court settlements through these takings issues. Only two major unpatented blocks remain unsettled, and several smaller patented parcels still remain in negotiations.. One of the large unpatented blocks (US vs. 191.7 acres (Martenek) is before the court (4/03) for a takings decision.

- **Claim evaluation and court ordered sampling:** There are frequent differences of opinion between the U.S. and the claimants on the mineral values of the properties. In recent years, this difference in value opinion has resulted in the court ordering that systematic sampling take place to establish values on certain properties. In 1999, the court ordered sampling to take place on the Howard properties (Lower Caribou Creek) resulting in one month of hand operations. In 2000, the court ordered sampling on three creeks (Friday, Yellow, and Glacier) resulting in a full summer season of heavy equipment operations in those streams. There are ongoing discussions between the NPS, Bureau of Land Management (BLM) and Department of Justice, as to the need for such sampling on the NorthWest Exploration properties on Moose, Rainy and Spruce Creeks.

Reclamation of Disturbed Areas

The mandate of the National Park Service (NPS) and the Mining in the Parks Act of 1976 requires reclamation by a mining operator to "restore natural conditions and processes" and to "return the area to a condition equivalent to its pristine beauty." Historically, mining and access activities in Denali National Park and Preserve have resulted in major surface disturbance and environmental damage, with minimal or no reclamation being done to restore disturbed area to their natural state. The result is approximately 1500 acres of barren gravel tailings in riparian zones from placer and lode mines, 75 miles of trails and roads, and miles of disrupted stream channels and floodplains.

- **Glen Creek project**: Restoration work on the lower portion of Glen Creek, initiated in 1988, has been the flagship for NPS floodplain restoration techniques for 10 years. The upper portion of Glen Creek (formerly 15 placer claims) has recently reverted to NPS ownership, and contains considerable amounts of abandoned equipment, scrap metal, and other debris. An effort will be made this summer to inventory the abandoned materials and evaluate the property for future restoration efforts.

- **Red Top Mine:** A lode claim at the Red Top Mine site was reclaimed during the 1999 season, with an emphasis on tailing pile stabilization and treatment of adit drainage (flow from the mine tunnel opening). In the 2002 field season, a plywood cabin was successfully removed and final re-grading of the roadbed was accomplished. The need for seeding or revegetation will be assessed and performed this field season if time and funding allow.

- **Caribou Creek:** In the 2001 and 2002 field seasons, creek channel and floodplain re-construction occurred on five claims in the upper Caribou Creek drainage. Bank and floodplain stabilization structures (biodegradable coconut logs and erosion control blankets) were installed. A revegetation effort is intended for the 2003 field season to create habitat and floodplain stability. Other portions of the stream adjacent to the area that was reconstructed last year will be assessed for additional restoration work. The last few miles of the access road to Caribou Creek will be scarified and revegetated when this additional work occurs, or once no further stream restoration work is intended.

- **Glacier Creek:** Funding has been made available for the restoration of Glacier Creek. In the 2003 field season, resource staff will conduct topographic surveys, measure stream position and flow condition, and inventory plants at Glacier Creek in order to develop a plan to accomplish the restoration work. Depending on the results of the field work, restoration work will either take one or two field seasons following 2003.

Social Sciences

Visitor-related Projects

Two ongoing projects monitor visitation to Denali National Park and Preserve. One of these projects also focuses on park use by park staff.

- **Monthly public use report:** This project documents visits to the park including Talkeetna Ranger Station, mountaineering, aircraft landings, Park Highway, Park Road traffic, bus passengers, and backcountry users, for both recreational and non-recreational purposes. According to this report, recreational visitors to the park were 311,335 for 2002, compared to 360,190 in 2001 and 363,983 in 2000. However, there have been some glitches in the program that summarizes the totals from input of visitors on tour buses, shuttle buses, arriving by train, driving the road with lottery permit, etc., and the totals still needs to be reexamined for accuracy.

- **Road traffic monitoring:** Because the road corridor is a man-made feature within a pristine natural area, monitoring the direct and indirect effects of park road use on the natural resources is critical. Vehicle use of the park road by both visitors and park staff is being documented. Six automated traffic counters are located along the park road from the entrance to the park boundary in Kantishna. Vehicles will also be counted at the Savage Check Station. Two thousand vehicles entered the park on July 4, 2002 (compared to 17 on December 25, 2001).

Cultural and Subsistence

Updates of Subsistence Community Use Profiles

This project is an ongoing process to obtain subsistence harvest information from Denali's resident zone communities of Cantwell, Lake Minchumina, Telida, and Nikolai. Interviews and mapping were completed for Cantwell in 2000 and Telida in 2001.

In 2002, a final draft report was completed for the Cantwell portion of the study. Staff conducted scoping meetings and fieldwork in the communities of Nikolai and Lake Minchumina. In cooperation with the Alaska Department of Fish and Game (ADF&G), Subsistence Division, park staff spent several weeks in the communities of Nikolai and Lake Minchumina conducting subsistence harvest surveys, mapping, and interviews. Local people were hired to assist with logistics and interviews within the community. An effort was made to sample as close to 100% of the households.

In 2003, staff will compile data from the surveys and interviews and prepare the Subsistence Community Harvest and Use Reports for Nikolai and Lake Minchumina.

Kantishna River Fall Chum Salmon Stock Assessment

This will be the third year of a cooperative study between the NPS and ADF&G to assess the Tanana and Kantishna Rivers fall chum and coho salmon runs. Live capture fish wheels will be operated on lower Tanana, Toklat and Kantishna Rivers to determine to fall chum and coho salmon run abundance and timing.

In 2002, mark-recapture studies on fall chum salmon *Oncorhynchus keta*, were conducted for the eighth consecutive year on the Tanana River and for the fourth year on the Kantishna River. In the Tanana River, chum salmon were captured and tagged using a fish wheel located on the right bank of the river, immediately upstream of the Kantishna River mouth, and recaptured in a fish wheel located approximately 76 km upriver on the right bank. In the Kantishna River, chum salmon were captured in a fish wheel on the left bank of the river, approximately 9-km upstream of its terminus on the Tanana River, and recaptured in three fish wheels; two fish wheels were located approximately 113 km upstream in the Toklat River (one on each bank) and the other fish wheel was located 139 km upstream on the Kantishna River. These studies were conducted during August and September 2002.

There are about 110,000 chum salmon reaching the upper Tanana River (using the Bailey model abundance estimate), and about 56,700 chum salmon reaching the Kantishna River. Spawning ground surveys in the Toklat River revealed an escapement of approximately 28,500 fall chum salmon. The Toklat fall chum salmon fishery has been below the established biological optimum escapement objective of 33,000 since 1995 and has been identified by the State Board of Fisheries as a Stock of Concern.

This cooperative salmon fishery study will continue in 2003 for both the Tanana and Kantishna Rivers. Denali's participation will focus on the operation of the upper Kantishna recapture fish wheel under a contract with a local resident.

Aerial Fisheries Stream Surveys

Flights will be made over Denali streams in 2003 (pending adequate funding) to survey the presence and abundance of King salmon (mid-summer flights) and Chum and Coho salmon (late fall flights). The flights will also check what areas are being used for spawning. Similar surveys will be conducted at Gates of the Arctic and Yukon Charlie National Preserve. No aerial fishery stream surveys were flown in 2002 due to lack of funds.

Historical Fisheries and Traditional Ecological Knowledge

This project gathers contemporary and historical fishery information for both anadromous and resident fish populations in the Denali area. The information is collected in conjunction with the Community Use Profiles. Local traditional knowledge regarding fisheries and their use will be documented. Elders will be interviewed to gather information on historic use-harvest areas, important spawning areas, over-wintering areas, abundance of past runs, and timing of runs, and changes they have observed over time.

In 2002, two trips were made to the community of Nikolai to start recording traditional ecological knowledge (TEK). During the first trip (9 days) researchers established rapport with the community, designed a survey instrument, and conducted TEK interviews. During the second trip (two weeks), researchers conducted a harvest assessment survey, TEK interviews, and limited mapping of resource use areas. A similar harvest assessment survey was conducted during a 5-day trip to Lake Minchumina.

Researchers felt they had barely scratched the surface of what elders had to tell and were willing to relate and community members asked the researchers to return to Nikolai for a third trip. With the financial assistance of the Alaska Humanities Forum, Liz Williams and Davin Holen (two researchers from the Division of Subsistence) returned to Nikolai for Russian Christmas in January of 2003. The researchers observed preparations for Russian Christmas, participated in the three-day event, and documented the traditional subsistence foods served in the community.

In 2003, data from the surveys and interviews are being compiled. Reports are being prepared in conjunction with the Subsistence Community Harvests and Use Reports.

Athabaskan Legacy Display Panel

The interpretive exhibit "The Athabaskan Legacy" was completed in 2002. It received many favorable comments while it was on display in the Denali Visitor Access Center lobby along with numerous native handcrafts. "The Athabaskan Legacy" is the fourth large display panel prepared for interpretative purposes (the others are "Kantishna – The Golden Years", "McKinley Park Station – The Early Years" and "Science in Denali"). In 2003, these interpretative display panels, representing some of Denali's cultural themes, will be made available throughout the year to local lodges and visitor centers.

Mountaineering History Jukebox

The Denali Mountaineering History Jukebox, utilizing an interactive computer program with oral interviews, photographs, video clips, and maps, was completed in 2002. The Mountaineering History Jukebox focuses on the history of mountaineering, early exploration, mapping of the Alaska Range, access and transportation associated with Mount McKinley and Mount Foraker, and the history of park service mountaineering management. A computer dedicated for operating the program for visitors was provided to the Talkeetna Ranger Station. The program has been installed on the park network at Denali National Park (Headquarters and Talkeetna) and Gates of the Arctic National Park and Preserve /Yukon-Charley Rivers National Preserve.

For 2003, park staff are working to make this information accessible to the public via Denali's web page.

Historical Road Trip Video

A 17-minute video presentation, "Across Time and Tundra", was completed in October 2002. This film uses historic photographs and film footage to show today's park visitor what the visitor experience was like in Mt. McKinley National Park in the 1920s and 30s. This video is available from the Center for Resources, Science, and Learning for presentation to visitors, employees and other interpretive needs.

Denali's Historic Resources and National Register

Research began this past winter to determine whether historic sites in the park are eligible for listing on the National Register of Historic Places. To date, only two historic resources are listed on the National Register: the Headquarters Historic District and the Patrol Cabins of Mt. McKinley. Historical sources of information (correspondence, archival material, oral history, photography, and architectural information) are collected and evaluated to develop Determinations of Eligibility to the National Register. Draft nominations include the Kantishna Mining District, Caribou Creek (part of Kantishna District), McKinley Park Station, CCC Camp, and the Stampede Mine Historic District. These draft nominations will be finished first , then research and evaluation will begin on all other sites.

Historical Reseach and Oral History

Cultural resource staff participated in planning for interpretive exhibits at the new visitor center and for interpretive trails in the frontcountry. In addition, work was completed on the wayside exhibits for the exterior of the Quigley house in Kantishna. These waysides interpret the history of mining in the area.

A historical CD titled "Celia's Alaska: Pioneer Stories of Denali" was produced by Amy Mayer through sponsorship by Denali National Park, the Alaska Conservation Foundation, Camp Denali, and public radio station KUAC. Celia is Celia Hunter, the renowned conservationist, whose stories about pioneering in the Denali area were compiled for this CD. Celia Hunter died December 1, 2001.

Oral history interviews were conducted with Dick and Florence Collins about their life and activities at Lake Minchumina. Bill Nancarrow was also interviewed; he was asked for his recollections of revegetation in McKinley National Park, aufeis management along the park road,

the park kennels in 1951, the railroad trestle, and Cantwell resident John Rumohr (a park ranger in McKinley Park from 1930s to 1952).

In 2002, Denali acquired three new historic photograph collections, including photos from a 1929 McKinley Park Ranger, a CCC worker, and photos of the 1944 expedition to the C47 aircraft crash near Mount McKinley.

Cultural staff have initiated the Comparative Photography Project to illustrate landscape change over time. Ten historic photographs of Denali landscapes have been selected for re-photographing (same location, later in time).

In partnership with the Anchorage School District and GCI, Denali staff provided cultural and subsistence research materials to develop and support "Parkwise", the regional educational curriculum that brings information about parks into the classroom. The curriculum is found at the following website: http://parkwise.schoolaccess.net/Students/StudentResources.htm

In 2003, the cultural staff will continue oral history interviews with park staff, former employees, local residents, and others who have knowledge of park history. Historian Frank Norris (Alaska Regional Support Office) continues to conduct research toward writing an Administrative History for Denali National Park and Preserve. Cultural staff will continue to seek out historic park-related photographs to enhance Denali's historic photograph collection.

< Research Support >

Geographic Information System

A Geographic Information System (GIS) is a computer-based system for storing, analyzing, and displaying spatial information. Anything that can be depicted on a map can be incorporated into a GIS. The Denali National Park and Preserve GIS is used by all functions in the park for preparing maps for planning purposes, public displays, and analysis of park resources. Engineering drawings for construction, mining site rehabilitation, and design work are also produced by the GIS. Denali's GIS includes several hundred layers or themes of information (hydrology, elevations, buildings, roads, etc.) that can be overlain by the computer to form composite maps. In addition to producing maps and other visual products, the associated databases can be queried in a variety of ways to analyze the features appearing in the maps. The system is managed on a central workstation and used by park staff on their desktop computers.

A major improvement in 2002 was an increase in storage space which allows us to maintain the entire NPS GIS dataset for the state of Alaska locally. Many additional layers of information have been added. The dataset is kept current through updates that conducted nightly over the internet.

GPS (Geographical Positioning System) has become a valuable tool for park managers in all disciplines. As receivers have become smaller, cheaper, and more precise, the number of units in use in the park has grown dramatically. The park glaciologist uses Survey-Grade GPS to measure movements of glaciers within 0.5 meters. Biologists use GPS to document sample site and observation locations within 2 to 5 meters. The backcountry staff uses small, recreation-grade GPSs to document patrol routes, locations and for search and rescue. In the future this tool will increasingly be useful for precisely locating park infrastructure and documenting management activities.

Denali National Park and Preserve Museum

Denali National Park and Preserve's museum collection is an assemblage of objects, works of art, historic documents, photographs, and natural history specimens documenting the human and natural history of Denali. During 2002, over 400 research requests for information and access were handled. An additional 10 linear feet of archival material was cataloged. It presently includes over 44,000 objects and 50 linear feet of archives. The majority of the collection is maintained in a storage facility in the Headquarters area. Access to the collection for research is by appointment only. Appointments can be made by calling 683-9536.

Research Administration

As of May 1, 2003, 693 study numbers have been assigned to scientific and scholarly studies that are in progress, in review for 2003, or have taken place in the park over the years. Each year there are approximately 100 studies that are recently completed or ongoing. These projects are either conducted by Denali staff (described in this document) and park cooperators (e.g., U.S. Geological Survey, Biological Resources Division, and the Alaska State Department of Fish and Game), or by other investigators (e.g., from other agencies and institutions). Appropriate research gathers information while making minimal impacts to park resources. Scientific research on arctic and subarctic ecosystems has been integral to the understanding, management, and protection of resources at Denali National Park and Preserve since the early 1900's.

Any scientist wanting to conduct research must submit a study proposal and fill out an application. To expedite this process, the National Park Service developed a Research Permit and Reporting System (RPRS). Beginning in 2001, scientists file an application using the RPRS website (http://science.nature.nps.gov/research). Denali Park staff review the application and study plan for any administrative, scientific, or compliance concerns, assess how the proposed project fits in with the overall science goals of the park, and set the conditions of the research permit, if approved and issued. Collecting permits may be granted for limited collecting of objects, whole organisms, or parts of organisms (e.g., leaves). Some samples may be destroyed while being analyzed. Some animals may be collected and released after they have been measured or tagged.

Each researcher reports his/her results in an Investigator Annual Report (IAR). Anyone can access and read the Investigator Annual Reports for projects conducted in Denali and all national parks by going to the website http://science.nature.nps.gov/research. Beginning in 2002, each

researcher at Denali will be expected to include an educational component to their project, in addition to filing an IAR.

Study files about each research project are kept in fireproof file cabinets in the resources building. Reports, dissertations, and publications resulting from scientific studies become part of Denali's resources technical library. Arrangements can be made to use these materials by contacting the research administrator at 683-6352. Computer databases are maintained about the research studies and the library volumes. Archived documents and collections are housed in the Denali National Park Museum or are loaned temporarily to other institutions.

Compiled 5/03 LT