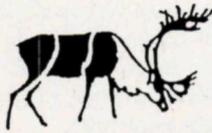


Denali National Park and Preserve 1996 State of Park Resources Report



RESOURCE CONDITIONS

MONITORING PROGRAM'S FIFTH ANNIVERSARY

This marked the fifth year of Denali's prototype program to evaluate a strategy for monitoring the status and trends of resources in large Alaskan parks. Thus far, field work has largely focused on intensive watershed studies in Rock Creek, a small stream in the eastern end of the park. Communities being studied have been selected based on prevalent vegetation, from lowest to highest elevation. Scientists, in cooperation with the U.S. Geological Survey - Biological Resources Division (BRD) and the National Park Service (NPS), monitored vegetation community structure, aquatic community structure, and water and soil characteristics at a series of permanent plots within the watershed. Co-location of plots with weather stations, small mammal productivity grids and bird survey stations allows interpretation of data from multiple disciplines. Methods completed and currently undergoing review include air quality, meteorology, stream hydrology, surface water chemistry, vegetation, aquatic insects, passerine birds, and small mammals. Field work to develop a soils monitoring method was also completed.

Some environmental parameters do not lend themselves well to being studied in a small watershed. In 1996, certain program elements, such as meteorology, glaciers and birds, continued to be monitored in areas beyond Rock Creek. Stream hydrology, surface water chemistry and aquatic insect sampling occurred extensively throughout the park. Park staff and cooperating investigators also continued to develop a variety of other monitoring programs that transcend watershed boundaries. These included studies of raptors, large mammals, wildland fires, and vegetation. These projects measure the status and trends of significant park resources and will eventually be linked to the Long Term Ecological Monitoring program.

In response to a program review conducted in 1995, two workshops were held in 1996. Forty scientists and agency staff worked together to strengthen the conceptual framework of the program and more closely link it to management needs. The conceptual design will build upon the ecological research and

development of monitoring protocols that have occurred during the first five years of the program.

THE GRIZZLY TRUTH

Denali supports one of the few naturally regulated grizzly bear populations in the world. Intensive population studies west of the Muldrow Glacier began in 1991. The objectives of the research are to determine what factors have the greatest effect on grizzly bear reproduction and survival rates and to develop cost effective, non-invasive ways to count bears. Both aspects of this study will be incorporated into the park's LTEM program. There are no published long-term studies of the dynamics of naturally regulated grizzly bear populations, so this study is expected to make important contributions to our understanding and management of grizzly and brown bears.

During the most recent population density survey in 1995, density was estimated at seven bears per 100 square miles. The female age structure is dominated by 18- to 28-year-olds and a cohort of five to nine-year-olds that are producing their first litters. There is only one female between the ages of nine and 18. During 1996, nine female grizzly bears emerged from dens in the study area with 19 cubs-of-the-year, for an average litter size of 2.11 cubs. Cub mortality was 63% with only seven cubs surviving to enter dens in the fall. Only one of seven yearlings (14%) died this year. However, the average mortality rate of cubs-of-the-year and yearlings, over a period of six years, was 62% and 38%, respectively.

This high cub mortality, although unusual compared to other bear populations, may be normal for a naturally regulated population. This population occurs at fairly high density for an interior Alaska grizzly bear population, but shows no indication of decline. The unusual age structure suggests attainment of breeding age may occur in pulses. The focus of our research is to determine the causes of the high variability in cub production and survival. With that information we will better understand the natural functioning of grizzly bear populations and be able to design a monitoring program that will allow us to sort out human caused disturbances from naturally occurring variations.

PROCREATIVE GOLDEN EAGLES

This was our ninth year for collecting data to monitor reproductive ecology of golden eagles in Denali. Our efforts to collect data this year were supported by a study that is examining habitat quality of eagles in Denali. The study is being funded by the BRD and is being conducted cooperatively with the Forest and Rangeland Ecosystem Science Center, BRD.

Field work in 1996 started in late March when we surveyed known nesting areas between Park Headquarters and Igloo Canyon via dogsled. In April, we observed 72 nesting territories in the study area to determine their occupancy. We found territorial pairs of eagles at 62 (86%) of the 72 nesting territories. Of these, egg-laying was documented at 26 occupied territories (laying rate = 43%). In late July, we re-surveyed the area to document nesting success and to count fledglings. We found 23 successful pairs (nesting success = 88%). A pair is considered successful if it produces at least 1 fledgling. In 1996, 30 fledglings were produced; mean brood size was 1.30 and mean productivity was 0.48.

While occupancy rates remained stable, laying rates, mean brood size and productivity remained below their respective 9-year averages. However, the highest nesting success over the 9-year study was recorded in 1996. We expect laying rates and productivity to increase over the next few years in response to increases in snowshoe hare and willow ptarmigan populations.

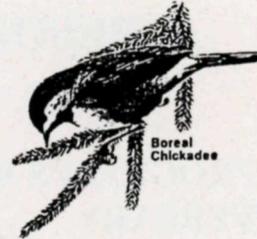
FAR-FLUNG GYRFALCONS

Results from our satellite telemetry studies of the previous year (1995) yielded some interesting results. In July 1995 we radio-tagged eight nearly-fledged gyrfalcons at three eyries in Denali with 29-gram satellite transmitters. The objectives of our study were to determine the movements of juvenile gyrfalcons in Denali and compare these movements with gyrfalcons from the Seward Peninsula. (We used satellite-radio telemetry to study movement of gyrfalcons from the Seward Peninsula in 1992 and 1994).

Using the ARGOS data collection system, we monitored the movements of the radio-tagged birds from Denali for up to six months after deployment. All of the radio-tagged birds left their natal areas in early September 1995. However, siblings left their natal areas independently and moved in different directions. The radio-tagged males flew the greatest distances. The male from Jenny Creek spent part of the winter along the Colville River, on the north slope of Alaska. The male from Pirate Creek flew southwest and wintered along the Yukon-Kuskokwim Delta. The male from Stony Creek spent part of his winter near Demarcation Point along the Arctic Ocean, then moved inland into northern Yukon for the remainder of the winter. All the females stayed within 800 miles of Denali. Two females wintered in Canada near Kluane Park and another near Dawson City, Yukon. While our sample size is very limited, this study documents the large wintering area of Denali gyrfalcons.

THE BIRDS WERE SINGING...

Travelers to Denali find a wide variety of bird species not seen throughout most parts of North America. In turn, birds travel from all over the globe to breed in the Park. The Alaska Bird Observatory has been testing a variety of survey techniques for songbirds found in Denali since 1992.



Eighty-six bird species were detected in 1996 during systematic surveys, compared to 80 in 1995 and 86 in 1990. The relative abundance of most species was also similar between years. As in past years, the greatest

species richness was found on the west side of the Park where there are a wide variety of habitats, including extensive marshes and ponds. Gray-checked Thrush and Alder Flycatcher were common on the west side, while Swainson's Thrush, Ruby-crowned Kinglet and Yellow-rumped Warbler were more abundant on the east side of the Park.

The study also demonstrated that birds, using different migration strategies, arrive at the Park at different times. Migrants from the Neotropics, especially wood-warblers, generally did not arrive until the second half of May. Arctic warblers, migrating from tropical Eastern Asia, arrived the second week of June. Conversely, most sparrows, which migrate from the Southern North American areas, had arrived in the park when surveys were initiated in mid-May.

Annual songbird surveys will continue at Denali as part of the LTEM program to help ornithologists throughout the national and international communities discover the causes of widespread landbird population changes.

...AND BEING COUNTED

The North American Migration Count (NAMC) is conducted throughout North America by more than 70,000 bird watchers. At the core of the NAMC is the attempt to learn more about bird migration. As of 1993, very few NAMC's were being conducted in Alaska or other northern environments in North America. In 1994, Nan Eagleson (the coordinator for the Denali Park Christmas Bird Count), Pat Owen (who conducts the Breeding Bird Survey routes in Denali) and Carol McIntyre (NPS - wildlife biologist) started the Denali Count of the NAMC. Because of the diversity of bird habitats found in and near Denali we thought that this would be a worthwhile area for collecting data on the presence and absence of birds. We also thought that this would be a good way to participate in International Migratory Bird Day which is sponsored by Partners In Flight.

Pât Owen and Nan Eagleson were at the helm of organizing the NAMC in Denali in 1996. A total of 51 species of birds was recorded this year. New species for the 1996 count included trumpeter swan, pectoral sandpiper and northern hawk owl. Fewer species and few individual birds were recorded in 1996 (73 species were observed in both 1995 and 1994). The lower numbers of species and individuals in 1996 may have resulted from a decrease in survey effort; 10 observer hours in 1996 compared with 36 hours in 1995, and 22 observer hours in 1994. For those interested in the details, the report: *A three-year summary of the Denali Count of the North American Migration Count, Denali National Park and Preserve, Alaska, 1994 to 1996* can be requested from Carol McIntyre, National Park Service, P.O. Box 74680, Fairbanks, Alaska 99707.

DENALI MERLIN MONITORING

The park employed the assistance of a volunteer through the summer to coordinate the merlin monitoring work initiated in 1990. The monitoring effort focused on territorial occupancy and reproductive performance of merlins found along major river drainages in northeastern Denali and in the Wonder Lake tundra region within 13 traditional territories. Twelve of these territories were determined to be occupied. Merlin activity was observed late enough in the season, at five of these sites, to indicate that reproductive success was probable. In addition, seven previously unrecorded territories were located. At least three of these seven territories successfully fledged young. 1995 results indicate 18 of 30 traditional territories known to be occupied with at least ten successfully fledging young.

VOLES ARE DENALI'S LATEST RESEARCHERS

Dr. Eric Rexstad, University of Alaska, completed development of a protocol for monitoring populations of voles, lemmings and shrews. Small mammal populations in Rock Creek watershed have experienced substantial changes during the past five years. Population abundance in five study plots of an eight tenth's hectare each, has ranged from lows of 20 animals to highs of 120 animals per plot within the span of two years. Severe winters take their toll on the species of small, non-hibernating mammals live-trapped during the study.

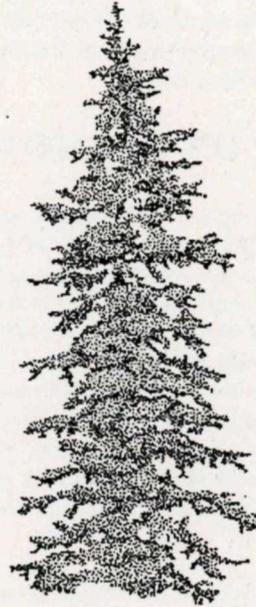


Of the three species of voles, one lemming and two species of shrews studied, the northern red-backed vole was by far the most numerous. Red-backed voles showed substantial within-year variation. Numbers climbed from the remnant population that survived the previous winter to a peak at the onset of the new winter. Between years, substantial variation in fall abundance was noted, with 1992 and 1994 being years of low abundance, 1993 and 1995 years of high abundance, and 1996 being somewhat intermediate. Comparing the years of high abundance in both riparian and open shrub habitats, survival and recruitment patterns were substantially different between years but not between habitats. This shows that very different processes (ie.

production and survival of young versus adult mortality) can give rise to similar abundance patterns. A dark color phase of the red-backed vole was noted in the study area. The incidence of the dark color morph has increased since 1992.

Voies are avid mushroom collectors, and have unknowingly helped develop the Park fungal inventory. Fungi grown from spores extracted from small mammal fecal samples demonstrate that voles eat species of fungi that had not otherwise been discovered in the Park by human collectors.

THE TREE REVIEW



Since 1992, the BRD and NPS have monitored the composition, structure and phenology of four major plant communities in Rock Creek watershed. This portion of the LTEM program is designed to detect vegetation shifts due to global warming. In 1996, vegetation was monitored at plots located in a riparian area, white spruce forest, at treeline and on the tundra.

Monitoring parameters include annual white spruce growth and reproduction. Although annual tree diameter growth has been

surprisingly similar in the forest and at treeline, growth has been less than in a comparable-aged low elevation stand located near Fairbanks (Bonanza Creek Long Term Ecological Research site). Cone crops have been small to moderate, with only a few viable seeds dispersed each year. More years of data will be needed to evaluate the relationship between climatic measurements and white spruce growth and reproduction.

SHEEP SURVEYS

During 1996, extensive Dall sheep surveys were conducted over essentially all suitable sheep habitat within the park and preserve. Ground-based Dall sheep counts have been conducted along the Denali Park road corridor since 1974. This effort was continued in July 1996 and a total of 177 sheep were classified. Ninety-eight ewes, 17 yearlings, 50 lambs, eight young rams, and four unclassified "ewe-like" animals were counted, resulting in 51 lambs:100 ewes and 17 yearlings:100 ewes. This year's lamb count was up slightly from 1995 results when 45 lambs:100 ewes were observed and the yearling count was down from the 1995 result of 29 yearlings:100 ewes.

Aerial counts were also conducted on lands south of the park, in the southwest preserve, and on park lands north of the Alaska Range and west of the Muldrow Glacier. During June and July, observers from the Park and the Alaska Department of Fish and Game surveyed Dall sheep in the Yentna, Tonzona, Kuskokwim, and Skwentna River drainages flowing from the eastern portion of the west-central Alaska Range. The survey area was bounded on the east by the Kahiltna and Muldrow glaciers, on the west by the Tatina, South Fork Kuskokwim, Styx and Chilligan Rivers, and on the south by Kenibuna and Chakachamna Lakes.

A total of 1,786 sheep were counted. Numbers were highest in those count areas encompassing the crest of the Alaska Range. Overall, the population was composed of 22% lambs, with 39 lambs:100 "ewe-like" animals and 37 rams:100 "ewe-like" animals. Of 373 rams observed, 114 were classified as full-curl or larger. Generally, those areas on the north side of the Alaska Range within the park had a lower percentage of full-curl rams and a higher lamb:"ewe-like" animal ratio.

DALL SHEEP ON THE MOVE

Observations of Dall sheep spring and fall migrations across the park road continued in 1996. In the study area east of the Teklanika River, migration occurred mid-May to the end of June.

A total of 132 sheep in nine groups from Mt. Wright and Primrose Ridge were observed migrating toward the crest of the Alaska Range. Group size ranged from one to 62 individuals. Three migration attempts were interrupted by traffic, and sheep returned to escape terrain. Additionally, two sheep from a group of nine retreated to escape terrain when near the road, while the remainder of the group completed the migration. At least two of these four groups successfully crossed the road within five days of their first attempts.

Observed fall migration occurred from late August to late September. A total of 109 sheep in 13 groups migrated to Mt. Wright and Primrose Ridge from the Alaska Range. Group size ranged from one to 26 individuals. There were no observed thwarted migration attempts during fall.

During spring and fall, migrations occurred at various times of the day between 0700 and 2030 hours. All sex and age classes of sheep were represented in migration attempts. Females with spring lambs did not begin migrating until mid-June. Sheep observed migrating from Primrose Ridge crossed the Sanctuary River south of the road to access Double Mountain in the Alaska Range. This migration route was reversed in the fall.

MOOSE SURVEYS

An aerial moose census was conducted in 1996 over the entire park and preserve area north of the Alaska Range. To date, this was the most extensive moose survey completed at Denali. The survey was conducted in October and covered over 5,200 square miles of moose habitat. The relatively long day length, good snow coverage, and favorable weather conditions allowed the survey to be completed in five days.

The resultant north-side moose population estimate was 2,168 animals (+/- 19.3%, 90% Confidence Interval). There were 29.6 calves:100 cows in the sample. This is significantly higher than the calf survival of 1986 and 1991 which were 23.2 and 23.0, respectively. There were approximately 23.5 yearlings:100 cows. This ratio indicates that the moose population may be increasing. The unusually mild winter of 1995-96 may have contributed to the high survival of the 1995 cohort.

The bull:cow ratio was 56:100. This ratio is significantly lower than 1986 and 1991 survey results of 75 and 81 bulls per 100 cows, respectively.

This year's effort fulfilled an element of a park wildlife monitoring strategy which recommends completing an extensive north-side survey every 3-4 years with less extensive trend area surveys conducted during the interim.

CARIBOU HERD DOWNSIZES

During 1996, we completed the thirteenth consecutive year of caribou research and population monitoring. The research program includes annual population assessments of herd size and composition as well as intensive studies of productivity and calf survival of radio-collared cows in the Denali Herd.

Calf survival was poor in 1996. The herd contained only 20 calves:100 cows by late May. Of 76 calves born to radio-collared cows, only 22 (29%) were still alive by 1 June. Of the 54 that died, 22 were killed by bears, and 3 were killed by wolverines. Calf mortality continued through the summer reaching a calf:cow ratio of 13:100 in late September. Bull:cow ratios also continued to decline reaching a low of 30:100 this September, declining from an average of 55:100 during 1984-90. The herd decline resulting from severe winters during 1989-93 has ended with herd size stagnant at about 2,000 caribou over the last 3 years.

DENALI WOLF POPULATION GROWS

Research on the dynamics of the Denali wolf population continued through 1996. Efforts continued to focus on determining wolf population parameters, including March and October den sites, size of surviving litters in October, and movements and survival/dispersal patterns of radio-collared individuals. During 1996, we also studied the movements of wolves on the caribou calving grounds using state-of-the-art data-logging radiocollars that utilized the Global Positioning System (GPS). Two wolves were instrumented with GPS collars that determined and stored their locations each hour for three weeks. With these data, we were able to gain new insights into movement patterns and den attendance schedules of wolves preying on newborn caribou calves.

We estimated approximately 100 wolves lived within Denali National Park and Preserve as of March 1996, a modest increase over the previous couple of years. Few wolves died or dispersed over the summer and packs we monitored produced nearly 4 pups per pack. The few population losses and moderate pup

production resulted in an increase to about 140 wolves by October 1996, the highest fall population estimate since 1993.

WHAT IS A STREAM?

Sampling on streams throughout Denali continued in 1996 as part of an ongoing cooperative study initiated in 1994 by Dr. Pam Edwards of the USDA Forest Service and Mike Tranel of Denali National Park. Water samples were collected during the 1996 season from 76 sites on both the north and south sides of the Alaska Range. Most sites were sampled more than once to maximize data on varying flow regimes. Pam Sousanes conducted field analyses and collected samples. Samples were sent to the Forest Service Timber and Watershed laboratory in Parsons, West Virginia for complete chemical analysis.

Six of the 76 sites were selected for more frequent and detailed field analysis using the Hydrolab H20 multi parameter data logger, which recorded temperature, pH, dissolved oxygen, turbidity, specific conductance, percent saturation, and total dissolved solids. The instrument was submersed in the stream and set up to record these parameters every 30 minutes for a 24-hour period. Results provided some insight into the diurnal characteristics of these streams.

The water characterization project was coordinated with a park-wide macro-invertebrate study being conducted by Sarah Roberts. This was the third and final year of data collection for this particular project. Results will be presented in a final report co-authored by Pam Edwards and Mike Tranel. Future monitoring on several streams selected from this study may continue as part of the LTEM program in Denali.

FRESH AIR

Once again, air quality monitoring in Denali has shown that clean air is not yet a scarce resource in the park. In fact, interior Alaska has some of the cleanest air measured in the United States, which helps make the world-class views in Denali even more spectacular. Of course, it is not uncommon for the view to



be obscured by haze when there are wildfires in or near the park, but human-caused pollution is well below the limits established by the Clean Air Act. For example, the highest ambient ozone value measured in 1996 was 63 parts per billion, half the national standard for ozone, a major component of smog.

WEATHER

Weather monitoring continued throughout the park in 1996. A new RAWS (Remote Automated Weather Station) system was installed on the south side of the Alaska range near the Tokositna River and the proposed site of the new south side visitor center. This is the first time that weather data, other than the winter snow surveys, has been collected anywhere in the southern half of the park. The data is being collected for the park's LTEM program, and will also be used for monitoring fire weather conditions and for south side planning.

Operation of RAWS systems continued in three locations in the northwest section of Denali at Wonder Lake, McKinley River, and Lake Minchumina. Automated weather stations were also operated at multiple locations in the Rock Creek LTEM site. Two of the stations at higher elevations in the Rock Creek Drainage were plagued by animal damage and repairs were made regularly. An additional station was operated near the park road at Teklanika Flats to support road corridor research projects.

SNOW? WHAT SNOW?

Snow surveys were carried out during the winter of 1995-1996 as a part of our continued cooperation with the USDA Natural Resource Conservation Service (NRCS). Monthly ground surveys, including measurements of snow depth, density, and water content, were carried out at five snow courses on the north side of the Alaska Range at Lake Minchumina, Purkeypile, Kantishna, Rock Creek Ridge, and the Headquarters air quality monitoring station. Hourly snow pillow (snow water content) data were logged automatically at the air quality monitoring station site. Monthly observations of snow depth were made at five aerial snow depth markers on the south side of the range at Tokositna River, Ramsdyke Creek, Dutch Hills, Nugget Bench, and Chelatna Lake.

Observations included an unusually low amount of snowfall during the first half of the winter. These conditions led to the formation of a significant amount of overflow ice on streams and rivers in the park. Large accumulations of overflow ice along the Denali Park road created major obstacles for the snow removal crews while opening the road last spring. The total accumulation of snow in 1995-1996 was lower than average, and the corresponding decrease in spring runoff contributed to the dry conditions which resulted in major early season fires in southern and interior Alaska.

FIRE !! NOT.

There were three lightning-ignited fires in the park. All occurred in the open spruce forest located in the northern sections of the park. The fires were in limited suppression zones so they were allowed to burn under natural conditions. The Roosevelt fire started on June 18 and burned for over a month totaling 6000 acres. The McLeod fire started on July 4th and only grew to two acres before it was extinguished by rain. The Wigand Fire, also starting on July 4th, burned 600 acres. All fires were monitored by NPS personnel to assure they were not a threat. At one time a cultural resource was

threatened by one of the fires and with the help of some Alaskan Smoke Jumpers we were able to clear around the site to protect it from the main fire with minimal impact to the area.

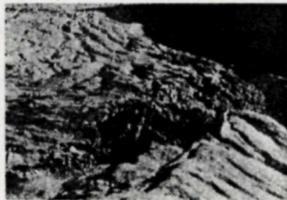
There were two human-caused fires in the park, neither growing larger than an acre before being suppressed.

CATCHING THE SURGE

A variety of glacier monitoring and research projects were begun and/or continued in 1996. Bi-annual surveys of glacier mass balance and flow were completed for index sites on Kahiltna and Traleika Glaciers. This project was begun in 1991, in cooperation with glaciologist Larry Mayo of Fairbanks, Alaska. The data which has been collected thus far is revealing interesting differences in glacier conditions between the north and south sides of Mt. McKinley, a significant climatic barrier.

A second year of survey work was completed on the Muldrow glacier, in cooperation with Dr. P. Jay Fleisher, glaciologist with the State University of New York at Oneonta, New York. The Muldrow Project's objective is a thorough documentation and characterization of the glacier in anticipation of its next surge. The glacier is known to surge approximately every 50 years and another event is expected to occur around the year 2000. A complete understanding of the glacier in its current state will be of tremendous value during and after the surge because it will allow interpretation of the changes which may take place.

A small glacier on the north side of Peters Dome surged during the late summer and fall of 1996. The event was first observed by pilots and park staff while conducting aerial wildlife surveys. Subsequent observation confirmed that the glacier was surging and a great deal of movement was documented by aerial photography after October. *(Picture compliments of Sandy Hamilton.)*



A program of high altitude aerial photography of all the park's glaciers was begun in August. This work was completed with Park pilots and with Hudson Air Service of Talkeetna, Alaska. Glaciers were photographed in the end of August from an altitude of 20,000' in order to document the positions of snow lines and the character of the glaciers in their most 'snow free' condition. This work will be repeated annually in order to build a historical record of glacier conditions in Denali. The photographs will be useful for documenting glacier change and for referencing observations made with other remotely sensed imagery.

GEOLOGIC MAPPING - MCKINLEY QUAD

Geologic mapping of the USGS 1:250,000 Mt. McKinley Quadrangle continued on a limited basis in the 1996 field season. A small (and new) group of 4 USGS personnel worked for a 14 day period out of Glen Creek Camp with dedicated helicopter

support. The project has been severely undercut by the USGS reduction in work force of all but one geologist. Efforts for 1996 were therefore limited to stratigraphic and structural work on Paleozoic marine sections on the Healy-McKinley Quadrangle boundaries. Refinement of the marine unit included 5 of 10 samples yielding microfossils (conodonts) which have given age ranges of Silurian-Devonian (386-439 million years old), which was not unexpected, but confirms and refines the subunits of the area. Also, volcanic ash layers were discovered interbedded with other marine sediments in the unit. These ash layers may also produce age dates when they are processed.

At this time, no work is planned for 1997. The USGS has put the project on hold until the reduction in work force lawsuits and related reorganizations are settled or completed.

MOMENTOUS MASS MOVEMENTS

The study of the "Drunken Forest," a landslide-slump of large proportions, has been ongoing in the park since 1987. In the summer of 1996, 35 stations were re-surveyed to monitor the rate of movement. The survey results indicate little to no significant movement (less than .1 meter) since the last survey in the early summer of 1995. Downslope movement rates have steadily decreased since a precipitation high in 1990, when displacement rates ranged from 8 to over 100 meters when surveyed in 1991.

A similar landslide-slump has been identified and monitored at milepost 45 on the park road since 1993. Re-survey of 36 stations indicate an average downslope movement of .86 meters for the measurement year, a moderate increased rate of movement since the survey of 1995.

FOSSIL FIXATIONS

Marine limestone reefs (like those of the Bahamas Islands) that were formed in the park 370 - 390 million years ago, represent a poorly known portion of the park's natural history. In a National Geographic funded effort, Dr. Robert Blodgett (formerly USGS and now with Oregon State University) and Park staff spent five days measuring a 100 foot thick section of these limestones, and sampling invertebrate fossils in the Shellabarger Pass vicinity. The work uncovered about 20 species of brachiopods, five species of trilobites, several species of plecyopods, gastropods and corals, and conodonts. The age range and species assembly suggest a close association with Siberia. This connection, and some of the possible implications, will be presented in a Geologic Society of America meeting in Hawaii, in late May of 1997.

RESOURCE STEWARDSHIP ACTIVITIES

BEAR-HUMAN INTERACTIONS

As in 1994 and 1995, wildlife management staff began the season in March by patrolling park lands south of the Alaska Range. Previous illegal snowmachine activity and wildlife violations on park lands precipitated the need for increased NPS presence.

Denali National Park and Preserve saw a slight increase in the number of reported bear-human interactions during 1996, when 243 were documented compared to 216 in 1995. Of this total, 58 occurred in the frontcountry and 185 in the backcountry. Interactions consisted of 188 encounters (which include any situation of close enough proximity between bears and humans that the bear clearly knows of a human presence, excluding serious charges, property damage, and physical contact), 36 incidents (including 25 general incidents, six cases of property damage, and five cases of bears obtaining food from humans), and 19 control actions.

Bear-related management actions reached a relatively high level during the 1996 summer season. This high level of activity culminated in the death of two black bears as a direct result of park management action. One death occurred when a bear, which had been marked and was being aversively conditioned, was hit in the chest with a cracker round. The cracker round broke the bear's rib, entered the chest cavity, and exploded inside the bear. The second death occurred in a remote backcountry setting where a hunting patrol camp was established. A bear entered the camp, destroyed property following attempts to chase it off, and was shot.

A panel was convened to review the circumstances surrounding the death of these bears. The panel was charged with evaluating current bear management procedures and developing future bear management program direction for Denali. The participants met in the park in September and are in the process of providing written documentation of findings and recommendations.

ROAD/WILDLIFE STUDIES

During the 1996 field season, wildlife technicians resumed a second year of development and implementation of a long term road use/wildlife interaction monitoring program along the Denali Park road. The objectives were to establish a relationship between road-related stimuli and animal behavioral responses, to establish a standardized long term monitoring protocol that allows comparisons to previous road use/wildlife studies, to test the procedures in the field and recommend changes as necessary.

Behavioral and site-specific data were gathered on caribou, Dall sheep, grizzly bears, moose, and wolves within 500 meters of the Park road between Park Headquarters and Eielson Visitor Center.

All road-related stimuli and animal behavior were recorded over a 15 minute interval. Detailed site, weather, and animal age, sex, and group statistics were also documented. Between 22 April and 19 September, a total of 389 wildlife behavioral observations were made during 82 days of observation effort, compared to 295 observations during 62 days in 1995. Although the number of trips and observations differ between years, the mean number of observations per trip are very similar between years for all species.

This work is anticipated to continue as comparisons among years will only become more useful with subsequent years of data. Preliminary analysis of 1995 and 1996 data can be found in the appendix to the *Park Road Use/Wildlife Interactions: Behavioral Observations and Monitoring, 1996 report*.

DUST PALLIATIVE STUDY SUMMARY-1996

The NPS continued to conduct tests on dust control products during the summer of 1996 along the Denali Park road. These test results and a continuing study will help guide NPS in the selection of an effective method to reduce dust and maintenance along the park road while ensuring minimal environmental disturbance to park resources.

The tested dust control agents include a resin modified emulsion first tested in 1994, and calcium chloride, a simple mineral salt first tested in 1995. Additionally, though formal testing was not conducted on effectiveness, water was used as a dust control agent on various sections of the road between Savage River and Teklanika River. Since salt is harmful or lethal to some species of vegetation, sampling is being conducted to determine if the calcium chloride is leaching from the roadbed into the near-roadside soils and vegetation. Early measurements have found no indication of such leaching; late summer sampling has not been analyzed by the laboratory yet.

DIGGING DIRT

NPS staff began collecting soil samples along the perimeter of the 1996 park fires and at a Remote Automated Weather Station (RAWS), in an attempt to verify the drought codes produced by the Canadian Fire Danger Rating System. This system is currently used to predict the daily fire danger ratings here in Alaska. By weighing the samples before and after drying we can measure the duff and soil moistures and compare them to the numbers produced

by the Canadian System. Although preliminary results were inconclusive, we will refine our techniques and continue sampling next season.

We have begun to upgrade our digital technology in mapping fires. The fire perimeters were flown in a helicopter with a passenger holding a Global Positioning System to collect the coordinates along the fire line. The coordinates were then downloaded using Arc Info software to produce maps. This technique is much more accurate than hand drawn maps and was especially useful in areas of flat terrain without any obvious topographical features.

MINING ISSUES

The Mining in the Parks Act regulations were frequently referred to this past year. Denali received eight new or revised plan of operations proposals for mining in the Kantishna area. The park received five proposals for unpatented placer claims, located on Glacier, Yellow, Friday and Caribou Creeks, while three submissions proposed operations on unpatented Lode claims.

All proposals were analyzed by park staff and almost all have been determined to be, at some level, deficient according to the plan of operations criteria and the code of Federal Regulations. One proposal is currently undergoing an environmental analysis to determine possible impacts to park resources if the proposed operations are approved. Meanwhile, mining claim acquisition efforts, including validity sampling/report writing, appraisals and negotiations, are ongoing.

COMPLIANCE

1996 was an interesting year for Compliance issues. Development Concept Plans for the frontcountry of the park and for the south side/Denali State Park area were finalized and released to the public. The teams producing both documents worked effectively and efficiently, including unprecedented cooperative efforts with State, local government and private planning partners, to produce quality documents and public processes on a tight schedule. A Northern Access Feasibility study was also produced for Congress, with continuous and open public participation, in a short time frame.

A 1995 Programmatic Agreement to carry out National Historic Preservation Act Section 106 responsibilities was implemented in 1996. The parks, rather than the System Support Offices, were made responsible for cultural resource compliance. This required Compliance Office re-tooling and a wider net for park coordination of 106 compliance on park projects.

A draft revision of NPS-12, Bureau guidelines on implementing the National Environmental Policy Act, is being reviewed by compliance personnel. Some changes to the documentation of use of categorical exclusions may result, and provide a heavy workload, from this revision.

Environmental Assessments were written during 1996 to evaluate the construction of a loop trail segment at the Savage River Cabin,

and to evaluate the construction of a replacement subsistence cabin in the Birch Creek drainage.

EXOTIC PLANTS

Exotic plants within Denali Park are concentrated in the park entrance area near Highway 3, and are spreading west along the park road. The most obvious exotic plant to visitors is the European dandelion with its showy yellow flowers that bloom in June. But there are about 15 other, less obvious, exotic plants in the entrance area.

Most of these exotic plants are not considered an immediate threat to park resources since they are unlikely to spread aggressively. But others, such as dandelions, can rapidly expand their numbers and move quickly into disturbed areas. During the summer of 1996, we located and removed all dandelions and most other exotic plants that we noticed along the Park road west of the Savage River bridge. Dandelion infestations west of the park entrance but east of the Savage River bridge were recorded and mapped. This information will be used to plan future control and removal activities for dandelions and other exotic plants.

THE TRAILS MEANDER

Many park visitors enjoy taking day hikes and overnight camping trips while at Denali. In some areas, social trails have developed along routes that are easy to hike. These trails may develop signs of adverse impacts. Information on resource conditions was collected for 15 trails during the summer of 1996.

The information included such attributes as soil compaction and erosion, trail width, vegetative changes, frequency of collateral trails and litter (human garbage). Results show which trails are more heavily impacted than others, and identify which parts of impacted trails are the most affected. These results will be used to assess visitor movement patterns and to make future trail management decisions.

RESTORATION ACTIVITIES

Past mining activities in the Kantishna Hills area of Denali have resulted in a variety of disturbances to the ecosystem, from bladed scrapes through the tundra to the disruption of the entire system of physical, hydrologic, and biological relationships in a watershed. Restoration activities to correct these impacts have been ongoing; the program focused on three watersheds in 1996.

Habitat degradation and impaired water quality combine to place Slate Creek at the top of park priorities for restoration activities. In preparation for restoration work funded for 1997-98, park personnel conducted initial field work on Slate Creek, including engineering surveys, and soil and water sampling.

In addition, a restoration project was initiated at the Red Top mine site; mine drainage and slope erosion problems were targeted for remediation. Access issues across private property, as well as cultural resource restrictions, halted the project several days after earthwork activities began. Finally, channel and

vegetation surveys were conducted again as part of a long-term monitoring program to assess the success of the 1991-92 restoration project in the Glen Creek watershed.

BIBLIOGRAPHIC DATABASE

For the past several years, park staff members have been working with contractors in the development of a bibliographic database of reports and journal articles on Denali resource topics. This has been part of a Servicewide initiative to prepare these databases. The final database was received during 1996 and contains 1063 citations, probably the largest amongst the units of the National Park System in Alaska.

While this project has been underway, park staff have been collecting additional materials that need to be added to the database. The current backlog stands at roughly 200 citations. These will be added to the database during 1997.

DATA MANAGEMENT/GIS

1996 was the first full year the park had in-house Geographic Information System (GIS) capability. A number of advances forward were made during the year. The GIS was used in support of the three major planning efforts taking place during the year; The Northern Access Feasibility Study, and the South Side and Frontcountry/Road Corridor Development Concept plans. Digital coverages were obtained and refined, and maps were prepared for display and reports. Assistance continues as the projects move forward.

Digital coverages of a wide variety of themes were obtained during 1996 through contract efforts, purchase, and in-house digitizing. The park, as well as the System Support Office, have mirror copies of all available data which is stored on CD-ROM format.

The Division received an upgrade to the PC-based Arcview GIS software during the year. The program is now stored on the park's local air network where it is available for all users. A customized browser developed by the regional GIS branch was also received which greatly facilitates access to the GIS dataset located on the UNIX workstation.

A Draft Data Management Protocol was submitted to the BRD for peer review as part of the LTEM effort in September. The protocol addresses a variety of data management issues relating to data collection, editing, storage, archiving, and security. The protocol will be applied to each of the disciplines conducting LTEM activities and their handling of data management.

SUBSISTENCE MANAGEMENT

Denali's Subsistence Resource Commission held meetings in April and August of 1996. Two new members were appointed to the Commission. The Commission passed numerous motions to define and clarify their positions regarding subsistence issues, and sent letters with their recommendations and proposals to the

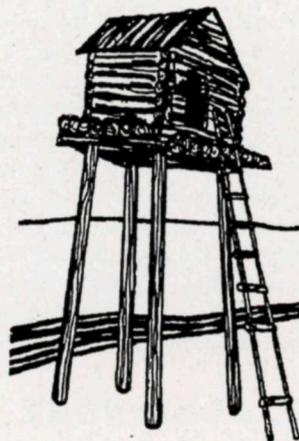
Park Superintendent, Federal Subsistence Regional Advisory Councils, and the Federal Subsistence Board.

One individual living south of Cantwell was issued a 36 CFR 13.44 subsistence eligibility permit. Park staff managed the Federal subsistence registration permit hunts in wildlife management units 13(E) and 16(B), issuing a total of 35 moose hunting permits and 88 caribou hunting permits for unit 13(E) and one moose hunting permit in unit 16(B). A temporary closure prohibiting the discharge of firearms was implemented for the developed area of Kantishna during a portion of the fall hunting season when the lodges were operating. After consulting with the Subsistence Resource Commission, Regional Advisory Councils and the Federal Subsistence Board, park staff prepared and submitted a proposed special NPS regulation to establish an annual closure of the high visitor use area in Kantishna regarding the discharge of firearms during the period when the Kantishna lodges are operational.

An Environmental Assessment was prepared to evaluate a request for the construction of a subsistence trapline cabin on Birch Creek within Denali National Park.

Denali prepared four ANILCA Section 810 subsistence and land use analyses for actions that could potentially impact subsistence users or subsistence resources. Park staff prepared and presented several analyses on proposed Federal hunting regulations to the Southcentral and Eastern Interior Regional Advisory Councils, and the Federal Subsistence Board.

LIST OF CLASSIFIED STRUCTURES EXPANDS



During the 1996 field season, approximately 30 structures were evaluated in the park and preserve. This documentation process includes accurate mapping using global positioning system technology, producing measured drawings, photographs, physical description, condition assessment, and

determining existing and potential impacts. Previous to the 1996 season, Denali National Park and Preserve had 124 structures listed on the List of Classified Structures (LCS). Upon final review from the park, 19 of the 30 structures evaluated in 1996 will be added to the LCS, bringing the total number of classified structures to 143.

ADMINISTRATIVE PROGRESS

PERSONNEL CHANGES

During 1996, two important personnel changes occurred. Early in the summer, the park hired Penny Knuckles as an Ecologist and placed her in charge of the park's Long Term Ecological Monitoring Program. This was in response to a recommendation made during the 1995 review of the park's monitoring program. Penny was working most recently at Yukon-Charley Rivers National Preserve as a Natural Resources Management Specialist. Her presence on the staff should greatly enhance management of the park's monitoring program. In the fall, Kevin Fox accepted a position at Yukon-Charley Rivers National Preserve as a Unit Manager. His departure from the park's Wildlife Biologist position will create a significant void.

RESOURCE APPRENTICE IN DENALI

1996 was the first summer Denali sponsored a student through the multi-agency Resource Apprenticeship Program for Students (RAPS). The program was designed to give hands-on experience to high school Juniors and Seniors, especially Native Alaskans, who are interested in natural resource careers.

Gilbert Dementi, Jr., a resident of Cantwell, Alaska, joined our staff for seven weeks. He worked on a variety of projects that taught him new skills and gave him a chance to see the type of work we do in the field and the office. He assisted with wildlife, vegetation and trail surveys, and an aerial survey for salmon. Andrea Blakesley, his primary mentor in the program, shifted the focus of his office work to include many computer projects once she discovered it was an area in which he was both interested and talented. Gilbert completed a number of scanning and digitizing projects, becoming familiar with equipment and software that were unavailable to him at his school. We gained as much from having him here as he did from participating in the program, and are looking forward to sponsoring another student in the future.

FINANCIAL SUPPORT

Funding to support research and resource preservation activities at Denali came from a variety of sources during 1996:

Park Funds:	\$1,329,050.00
Other NPS Funds:	460,794.00
BRD and USGS Funds:	599,816.00
Total:	\$2,389,660.00

These figures do not reflect additional funds that independent investigators expended on projects in the park other than BRD and USGS.

FINANCIAL TRENDS

Since fiscal year 1992 there has been a gradual increase in the amount of funding committed to resource preservation at Denali. Comparing FY92 to FY96, nearly \$700,000.00 more funding has been put into resource programs. This increase has been the result of several factors. First, the implementation of LTEM program development efforts resulted in significant increases. Second, the Servicewide professionalization initiative and the conversion of a number of seasonal employees to permanent positions improved the financial picture. Third, emergence of pressing resource issues, primarily related to the park road and Alaska Range south slope development, focused the need for additional financial resources to study resource conditions. Finally, a larger staff has permitted better approaches to obtaining funding from special fund sources. Broader diversity in the use of fund sources is apparent in 1996 over 1992.

Some financial setbacks were experienced during this period of time. \$275,000.00 was removed from park funds and sent to the BRD in FY94 for management of the LTEM program. While BRD continued to apply most of that funding to Denali, some was lost to administrative costs. Similarly, BRD scientists who were working on caribou, bear, and revegetation projects at Denali lost some of their funding to overhead. FY93 was the last year of special funding for the wolf study. No base increases were given to carry the monitoring element of the wolf program forward. This had to be absorbed within existing park funds. Fortunately these losses have been offset by other increases although some implications remain for those programs.

For Further Information write to:

Division of Research and Resource Preservation
Denali National Park and Preserve
P.O. Box 9
Denali Park, Alaska 99755

Dena_Resource_Management@NPS.gov

