Denali National Park and Preserve
Division of Research and Resource Preservation

Summary of Current Projects
2002

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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 has 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 (CAN) of parks. CAN is composed of Denali, Wrangell-St. Elias National Park and Preserve, and Yukon-Charley Rivers National Preserve. The network provides a framework for natural resource inventory and monitoring efforts.

In April, the Central Alaska Network had a monitoring scoping meeting in Fairbanks. The meeting objectives were to obtain review and input from scientists outside the National Park Service on the monitoring strategy at its present stage; to provide a forum for detailed discussion on the monitoring program and methodology; and discuss the eventual structure of an integrated monitoring program. During the discussions, a consensus emerged to more fully integrate the Denali LTEM program with CAN. CAN personnel have striven to provide integration among all three parks, however, there is now a more complete understanding of what that integration might entail. Fully integrating all three parks into a scientifically sound monitoring program is fundamental to accomplishing the National Park Service mission of conserving parks unimpaired.

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 ecosystem that exists in the Toklat Basin and develop an integrated information base that is critical to effective resource management by the National Park Service. 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 fishes and furbearers, mapping the surficial geology, and characterization of the soundscape.

Plants

Floristic Inventory

More than one-third of the 751 vascular plant species known to occur at Denali National Park and Preserve have been documented in the last four years during an intensive floristic inventory. Denali's plant ecologist is coordinating the inventory and enlisting the help of park staff, outside researchers, and park cooperators who are working to map the park's soils. During the first stage of this effort, information about the park's flora was assembled, yielding records for 489 species of vascular plants known from the park. These species had been documented during Denali's long history of plant collections, beginning with voucher specimens made in the 1920's soon after the park was established. In the next phase, a database was created to list the characteristics (e.g., elevation, habitat) of "expected" species (species likely to occur in the park but not documented in the preexisting data sets). Locations for collecting trips were selected based on which sites might yield the most expected (but undocumented) plant species. The third phase was carrying out plant inventories at the selected sites throughout the park. During these recent directed searches, voucher specimens were made for an additional 262 species of vascular plants. Denali's checklist of flowering plants, conifers, ferns, horsetails, and other fern-allies now stands at 751 species.

Exotic (Non-native) Dandelion Removal

Efforts to remove non-native, exotic dandelions *(Taraxacum officinale)* with the help of volunteers are in the fourth year. Work is done 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.

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 forecast 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.

Creating Defensible Space Around Structures

History has shown the devastating effects when wildland fire combines with a buildup of vegetation around structures. Hazardous fuels that surround 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 the following areas:

- ✧ Developed areas. Much of the built environment in Denali was constructed during the 1920s and 1930s, and structures were often either built close to the forest edge or the forest has since grown back into the areas disturbed during construction. Defensible space in the developed areas will incorporate approximately 40 acres.
- ✧ 60 cultural resource sites located throughout the park. The Sanctuary Patrol Cabin, Pearson Cabin, and East Fork Research and Patrol Cabins will be the most visible from the park road.

Utilizing Satellite Imagery to Estimate Burn Severity

To more accurately and efficiently monitor the severity and associated effects of wildland fire on the vegetation within Denali National Park and Preserve, a new system that utilizes satellite imagery is being developed. This new method is being tested in Denali and 10 other national park service units. Areas of different burn severity (ranging from unburned to severe) are delineated on satellite images. The range of categories is referred to as the Composite Burn Index (CBI). Fire management personnel will be groundtruthing the specialized satellite images obtained for the five wildland fires that occurred within Denali in 2000 and 2001. The initial results of the groundtruthing in other National Park Service units suggest that the CBI accuracy

may be over 80% in non-forested (tundra) areas. This exciting new technology, if proven accurate, precise, and reliable, will substantially increase firefighter safety by reducing the amount of time spent flying over fires in aircraft collecting this type of data.

Wildlife

Birds

Wildlife biologists are conducting several short-term and long-term studies focusing on different ecological aspects of bird life in Denali National Park and Preserve. Several of the 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.

- **Assessing the spatial and temporal variation in passerines (songbirds):** The objective of this project is to assess changes in songbird populations across Denali by:
  1) Describing bird community structure and species group patterns
  2) Describing overall patterns of species composition of bird communities
  3) Describing species richness
  4) Assessing the relative contribution of local habitat and landscape context variables to abundance and distribution of birds
  5) Assessing change in the abundance and distribution of bird assemblages over space and time

  Data is collected using point count methodology in June at a series of sampling 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.

- **Monitoring Avian Productivity and Survivorship (MAPS):** songbirds are captured, banded, measured, and released at four banding stations along the Denali park road from early June to early August. Three banding stations are located along the very eastern end of the park road and one is in Igloo Canyon. Data collected on the number of birds captured are used to estimate the abundance, productivity, and survival for about 12 species of songbirds. Data from MAPS projects are used to assess population trends in songbirds across North America.

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

✧ **Denali Institute autumn passerine banding station:** The station is located near Moose Creek and is operated from early August to early September. Passerine birds are captured, banded, measured, and released. 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.

✧ **Bird habitat associations of cliff nesting raptors and waterfowl.** A three-year multi-component resources project on the south side of the Alaska Range was initiated in 2000. The goal of this project is to obtain information needed by managers to protect resources on the south side of Denali. The goal of the avian component of the project is to provide park managers with information necessary to minimize disturbance to cliff-nesting raptors and waterfowl, particularly trumpeter swans, on the south side of the Alaska Range.

✧ **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 variation in reproductive success and productivity among nesting areas over a series of years.

✧ **Examining fidelity of golden eagles to nesting areas:** By extracting DNA from shed feathers at golden eagle nesting areas over a series of years, wildlife biologists can identify individual eagles, and determine whether or not the same breeders are using the nesting area from one year to the next. This noninvasive molecular genetics monitoring technique is being developed in partnership with U.S. Geological Survey, Biological Resources Division, Alaska Science Center.

✧ **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.

Bears

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

- ✧ **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. 2002 is the third year of this three-year study.

- ✧ **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 female bears are tracked to determine production and survival of cubs.

Bear Management

The Denali Bear/Human Conflict Management Plan (known as the Bear Management Plan or BMP) was developed to address bear problems that had escalated during the 1970's and 1980's. By 1982, Denali had the highest rate of backcountry incidents of any U.S. national park with a significant grizzly population and high backcountry use. Bears were getting food from backpackers and from poorly handled garbage, causing property damage, and injuring people. 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 by 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. Between 1946 and 1983 forty-eight bears were relocated or destroyed in the park. 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 Park policy regarding bears and other wildlife. To get further information or to schedule bear training, contact Jason Ransom or Ed Vorisek (Wildlife Technicians) at 683-9574. They can also provide information and some equipment for bear-proofing camps and worksites.

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.

Woives

Denali National Park and Preserve's wolves have been studied since the park was established. However, population estimates were not accurate until 1986 when a large-scale wolf research project was initiated by David Mech and others. The results of this project have provided basic information necessary for effective wolf management. This intensive research program was concluded in 1993, but research and monitoring efforts have continued in the park by Layne Adams of the U.S. Geological Service, Alaska Biological Sciences Center. This effort consists of maintaining 2-3 radio-collared wolves in each known pack inhabiting the park north of the Alaska Range. Radioed 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 (1 May - 30 April) are used to determine the area of each pack territory. Areas of each pack territory and respective pack counts are used for abundance and density estimates. In addition to estimates of abundance and density, monitoring data have been used to determine movements, mortality factors, behavior, and population dynamics.

Small Mammal Inventory

An inventory of small mammals is being conducted in three study sites in Denali National Park and Preserve (eastern Kantishna Hills, Chilchukabena Lake, and West Fork Yentna River) in 2002. This inventory is part of the "Mammal Inventory of Alaska's National Parks and Preserves," which is being conducted as a partnership between the National Park Service and the University of Alaska Museum. The inventory will provide Denali's managers with information on the mammalian diversity of the study areas and on the relative importance of Denali as home to assemblages of northern small mammals.

Small Mammal Monitoring

Scientists from the Institute of Arctic Biology, University of Alaska, Fairbanks, are continuing studies on the population dynamics of small mammals (mice, voles, and shrews) in Denali National Park and Preserve. This 10-year project has provided new insights into the spatial and temporal variation of these animals at northern latitudes.

Amphibian Inventory

The wood frog is the only species of 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 will provide a starting point for more detailed wood frog studies.

Don't Feed the Wildlife Program

Beginning this year, Denali National Park and Preserve resource staff will implement a four-tiered program to educate people with the basic message: "keep wildlife wild - do not approach or feed wild animals". The first program component is the distribution of buttons and bookmarks with the program logo and message at visitor centers and interpretive programs. The second and third components are that park staff will design signs to attach to picnic tables and trash cans, and create an informative color brochure. The fourth program element is the development of interpretive displays and/or wayside exhibits.

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.

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 four kilometers. Surges may occur at 50-year intervals; thus, another surge is anticipated within a few years of 2007. Monitoring efforts will be expanded in 2002 to be sure to describe the pre-surge glacier so that the data can be compared to information collected 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 sediment load of water flowing at the terminus

Soils Mapping

A soils map for the Denali National Park and Preserve has been produced as a result of five years of field study (1997-2001). During 2002, the final year of the investigation, the Natural Resource Conservation Service staff will study soils in areas identified in previous years as needing extra work to finalize the map.

Weather Monitoring

For 75 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. 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.

In the past decade, numerous weather stations equipped with meteorologic sensors have been installed around the park. Data from these sensors are used in fire management, aircraft advisories, research projects, and long-term monitoring. Denali is upgrading the technology at most of these stations, including adding satellite transmitters at some locations. Having these transmitters will mean that in the future, weather data will be available in real-time, rather than having to wait until the data stored at the location is retrieved.

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.

Air Quality Monitoring

Denali National Park and Preserve has had year-round air quality monitoring instruments in place near park headquarters since 1980. Denali was selected as a monitoring site partly because it has Class 1 status under the Clean Air Act. In the fall of 2001, a second permanent station was installed in Trapper Creek to measure regional air quality under conditions that approximate park air quality on the south side of the Alaska Range. Ideally, south-side monitoring would occur within park boundaries, but current monitoring techniques require line power and weekly ground access, neither of which is available on the south side of the park. The overall air quality monitoring program measures the following atmospheric parameters: ground-level (tropospheric) ozone, sulfur and nitrogen oxides, fine particles and aerosols, wet deposition, and associated meteorological parameters. More information about the National Park Service

nationwide air quality monitoring program may 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 ten locations throughout Denali National Park and Preserve as part of a cooperative agreement with the Natural Resources Conservation Service (NRCS). The five snow courses on the north side of the Alaska Range (Minchumina, Kantishna, Purkeypile Mine, 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 is averaged from five measurements on the ground. On the south side of the Alaska Range there are five aerial markers (Chelatna Lake, Nugget Bench, Dutch Hills, Ramsdyke Creek, and Tokositna Valley). 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 the hydrology of surface water supply.

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.

- **Animal track counts:** Through animal tracks, park biologists are determining whether animals are avoiding, favoring, or are indifferent to snowmobile trails. Initial results indicate that at least five species of park mammals modify their behavior upon encountering a snowmobile trail. These species include wolves, foxes, coyote, wolverines and moose.

- **Snowmobile activity patterns and route maps:** This study uses Global Positioning System (GPS) units and Geographical Information Systems (GIS) to produce maps that show where winter visitors use snowmobiles the most on parklands. Maps of snowmobile use in the winters 1999/2000 and 2000/2001 are available.

- **Snowpack contaminants:** A hydrocarbon contaminants study was initiated to determine if snowmobile emissions are impacting and polluting the snow and aquatic ecosystems. Results are pending.

- **Impacts of snowmobile compaction on vegetation and soil:** This project will document what effects snowmobile use and the subsequent snow trail compaction have on vegetation and soil temperature. Data has been collected, but are still being analyzed.

- **Snowmobile noise experiments:** As part of the soundscape monitoring program outlined below, a snowmobile audibility study is determining the proportion of time that recreational snowmobiles are heard during the day. An experiment also compared noise levels of four types of snowmobiles used for by park staff. The new technology four-stroke engines were much quieter than the traditional two stroke engines.

Soundscape Inventory and Monitoring Program

Natural quiet is becoming more difficult to find even in national parks. Because the soundscape of Denali National Park and Preserve has not been inventoried and is becoming increasingly impacted by human-generated noise, a soundscape program is underway at the park. Inventory and monitoring of natural and human-generated sounds is being 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 and at the toe of the Tokositna Glacier. More than 560 billion decibel levels during 7000 hours and over 330 hours of digital recordings have been documented to date.

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

NPS 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 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:** Most of the unpatented properties in Kantishna are now under "takings" litigation. These are complex legal situations where the claimants' rights to mine the properties may have been compromised, and the claimant and government go to court to resolve the date of taking and the value of the property. Six separate lawsuits regarding "legislative takings" are in various stages in court. A decision on KMC v. Babbitt was rendered by the U.S. District Court in December, 2000, and complete settlement was reached in July 2001. Howard v. United States, regarding unpatented claims on lower Caribou Creek, reached complete settlement in June of 2001. Likewise, complete settlement was reached on Clark and Copley (Lower Glacier Creek) in December of 2001. A December 2002 trial date has been set for U. S. v. Martinek (Friday, Glacier and Yellow Creeks). More complaints have been filed in U.S. District court, and additional suits may still be filed.

- **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. Recently the BLM and the Department of Justice have requested that we re-evaluate placer claims on upper Glen Creek (Gold King claims), and currently there is a plan to contract the mineral examination.

Reclamation of Disturbed Areas

The mandate of the National Park Service and the Mining in the Parks Act of 1976 require 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**: The project, initiated in 1988, has been reclaiming a stream segment that was significantly disturbed by placer mining. Research conducted for 10 years at the Glen Creek site focused on stream and floodplain reconstruction, riparian zone restoration, and revegetation techniques for barren gravel tailings. Results from this study have been used for recent restoration projects on Slate Creek and Eureka Creek, which were also placer-mined for many years.

- **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). Plans for the 2002 field season include the removal of a plywood cabin and final re-grading and seeding of the roadbed.

- **Caribou Creek:** In the 2001 field season, creek channel and floodplain re-construction occurred on five claims in the upper Caribou Creek drainage. For the 2002 field season, bank and floodplain stabilization structures (biodegradable coconut logs and erosion control blankets) will be installed, and a revegetation effort will be made to help create habitat and stability. Additionally, the last few miles of the access road to Caribou Creek will be scarified and revegetated.

- **Other projects:** Other projects slated for the 2002 season include final smoothing and restoration of the Eureka Creek outlet, and clean-up of hazardous mining materials and debris throughout the Kantishna area.

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.

- **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. Eleven automated traffic counters are located along the park road from the entrance to the park boundary in Kantishna. Ten of the automated counters were installed in summer 2000. Vehicles will also be counted at the Savage Check Station.

≺ 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. The system is managed on a central workstation and used by park staff on their desktop computers.

Denali National Park and Preserve Museum

Denali National Park and Preserve's museum collection is an assemblage of objects, works of art, historic documents, and natural history specimens documenting the human and natural history of Denali. It presently includes over 44,000 objects and 50 linear feet of archives. It includes archeological objects systematically recovered from within the park's boundaries as well as the field records for them; biological voucher specimens that document natural resource management research conducted within the park and associated field records; early climbing gear; mining tools and equipment related to the Kantishna mining district among others. Due to a lack of suitable display space, much of the collection is maintained in a storage facility in the Headquarters area and is not on public display. This spring the collection and curation functions moved into a newly remodeled facility in the basement of the carpenters' shop. There is space to accommodate researchers when using the collection. Access to the collection for research is by appointment only. Appointments can be made by calling 683-9536.

Research Administration

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 park's inception in the early 1900's. More than 650 scientific and scholarly studies have taken place in the park over the years. In 2002, 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), as well as by investigators from other agencies and institutions. Appropriate research gathers information while making minimal impacts to park resources.

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 can 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.

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