



Denali National Park and Preserve

Resource Stewardship Strategy

Comprehensive Strategies and Projects

draft 11/2007

Denali's Resource Stewardship Strategy (RSS) provides strategic guidance for the research, resource management, and resource education programs of the National Park Service at Denali National Park and Preserve for the next 20 years. The RSS does not address all the resource stewardship projects that could enhance management of the park but instead focuses on those needs that are critical to maintaining the desired conditions of the park as well as its legal mandates. The RSS identifies 119 indicators to help assess if the desired conditions for park resources are achieved or maintained. Nineteen strategies (Strategy A – S) and 99 Projects (1-99) were developed to address one of three needs: (1) monitoring and managing park resources and visitor activities to assure that targets for each indicator are achieved, (2) filling data gaps necessary to define and evaluate indicators and targets for park resources, and (3) implementation of research or resource management activity required by legislation or the park's GMP. Strategies have been grouped into broad categories of base knowledge, monitoring, management and mitigation, parks and people, data management, education and communication. Program management is another broad category that encompasses general ways of doing business.

Base Knowledge of Park Resources

- Strategy A: Complete physical, biological, and cultural resource inventories for Denali.** Identifying species, features, and processes where data gaps now exist will allow the park to improve basic understanding of park resources. The development and implementation of inventories, surveys, and focused research will improve basic information, e.g., physical (projects 1, 2), biological (projects 3, 4, 5, 6), ecological (projects 7, 8, 9), and cultural (projects 10, 11, 12, 13), for making science-based management decisions. The outcome of these projects will be information that can be used to set or adjust indicators and targets for condition of park resources in relation to desired condition. The outcome inventories can be added to the baseline of park resource information used by the research community in site selection and interpretation of data. (Fill Knowledge Gaps)
1. **Special Geologic Features Inventory.** Identify and photograph the park's rare or unique geological features and periodically monitor their condition. Develop a database to document the location and condition of these geological features.
 2. **Paleontological Resources Inventory.** Complete a formal park-wide inventory of known paleontological resources and document their location, abundance, ease of access, risk factors and disturbance, baseline condition, fragility, and protection measures needed, if any.

3. **Nonvascular Plant Inventory.** Conduct a comprehensive park-wide inventory of nonvascular plants (mosses, lichens, and liverworts).
4. **Inventory of Rare and Endemic Flora.** Conduct research to determine the distribution and habitat associations of rare and endemic flora.
5. **Inventory of Bird Status and Distribution.** Conduct an inventory to determine the park-wide presence, distribution, and breeding status of birds.
6. **All Taxa Biodiversity Inventory.** Investigate the feasibility of conducting an All Taxa Biological Inventory (ATBI) in Denali. ATBIs incorporate citizen science, park scientists, and the research community to inventory biodiversity in park ecosystems.
7. **Wildland Fire History Prior to 1950.** Determine for Denali fire size, frequency, and duration, and fire return intervals by vegetation type and geographical area to enable fire managers and resource managers to make more informed decisions about fire management activities.
8. **Inventory of Smoke Conditions.** Determine the natural range of hazy conditions in the park caused by wildfire smoke.
9. **Burn Severity.** Using pre- and post-fire Landsat imagery, develop a robust mapping methodology and consistent data products to evaluate and compare burn severity within individual wildland fires and among fires across different ecosystems.
10. **Archeological Survey.** Survey high-probability areas to identify archeological resources for protection as per the inventory requirement of Section 110 of the National Historic Preservation Act (NHPA).
11. **Archeological Survey of Sites with Native Place Names.** Survey sites identified by Athabascan elders during the Native place names mapping project. Document traditional use patterns from late historic through contemporary.
12. **Native Place Names Map.** Convert into map form a report about Native place names in and around the park.
13. **Inventory of Cultural Landscapes.** Conduct a Cultural Landscape Inventory (CLI) at the 0 Level (Reconnaissance) to identify resources to be protected as per NPS-28 (Cultural Resource Management Guideline).

Strategy B: Develop an understanding of basic ecological relationships necessary for management decision-making.

Climate and natural processes (e.g., fire) play key roles in shaping Denali's landscapes. Many of the indicators selected in the Denali's RSS have targets described as needing to remain within the "range of natural variation." In response to climate changes, the "range of natural variation" may be changing. Analyses of how Denali's ecosystems are or may become impacted by climate change (projects 14, 15) will provide information about the existing or expected changes in "range of natural variation" so managers can make informed decisions about what can be managed and what is outside the control of management. New investigations and analyses of historical data about fire behavior, fire return intervals, and ecological impacts of fires (projects 16, 17, 18) will provide a better understanding of fire risk for safe fire management, and of

ecological relationships in boreal forest and tundra ecosystems.

14. **Biological Effects of Climate Change.** Develop an understanding of how climate change may affect the distribution of plant and animal communities and animal behavior. Develop methods to understand how climate change affects the spread of exotic species. Identify native species of plants and animals that may be particularly vulnerable to the effects of climate change, and develop protocols to monitor these effects. Develop methods to predict the effects of climate change on the park's fire regime. Initiate projects to develop habitat selection models for important species and to understand how species respond to changes in their habitat.
15. **Physical Effects of Climate Change.** Develop an understanding of how climate change may affect local and regional weather patterns, snowpack, glacial dynamics, permafrost, weathering, air quality, and other aspects of the park's physical environment.
16. **Weather, Indices, and Fire Behavior.** Gather historical weather data, verify its accuracy, and establish good weather predictors associated with fire development, fire behaviors, and the end (date) of the fire season. Examine historical weather data for commonness and rarity of significant weather events to determine the probability of such events. Evaluate the indices of the Canadian Forest Fire Danger Rating System (CFFDRS) versus actual fire behavior. Compare fire behavior parameters with CFFDRS indices, determine the utility of moisture probes to model CFFDRS indices, and evaluate whether alternative drought indices would be useful in Alaska.
17. **Ecological Impacts of Wildland Fires.** Investigate the effects of fires, including repeat fires and burn severity, and fire management practices on hydrological characteristics of boreal forests, wildlife habitat, moose utilization, and subsistence resources.
18. **Wildland Fire Return Intervals.** Determine the fuel characteristics (e.g., vegetation type, fuel load, moisture, and tree age) that allow previously burned areas to act as fuel breaks for new fires.

Strategy C: Develop the historic contexts necessary to evaluate resources and generate nominations for National Register significance.

To appropriately protect historic and archeological sites and the resulting cultural landscapes, these resources need to be evaluated for National Register significance (project 24). However, to complete these determinations of eligibility, the sites need to be evaluated in their historic context. The record of historic context is a gap in knowledge, although pieces of the context are available from various sources. Several historical context themes need to be researched and compiled as in-depth histories—e.g., mining, mountaineering, science in the park, park road history, and the history of trapping and subsistence activities.

19. **Mining History.** Develop a comprehensive history of mining from primary research and existing documents to help recognize the influences and impacts of mining on park resources.
20. **Mountaineering History.** Document the history of mountain climbing as well as the scientific studies conducted on the mountain.
21. **Scientific Legacy.** Synthesize information about the history of scientific studies conducted in the park, organize it in an historical context, and assess gaps in the documentary record.
22. **History of Park Road.** Develop a history of the park road—based on historic site and road construction records—to provide a good source for interpretation and management.

23. **Trapping History.** Document the trapping history of Denali before and after the establishment of the park in 1917, and before and after the additions of 1980, to provide valuable information for the historical and subsistence record.
24. **National Register Nominations.** Complete Determinations of Eligibility and write nominations for sites determined eligible for appropriate protection as required under Sec. 110 of the National Historic Preservation Act.

Monitoring Resources

Strategy D: Develop and/or implement vital signs monitoring protocols for physical and biological resources to monitor long-term ecological change.

Monitoring the condition of physical and biological resources will provide the baselines to maintain, preserve, and protect the ecological integrity of Denali. High-standards monitoring will help identify factors that influence the park's ability to maintain natural and healthy populations and natural processes. All the projects listed below except for Trumpeter Swans (33) develop/implement the peer-reviewed monitoring protocols for fauna and flora identified as vital signs by the Central Alaska Network (CAKN). Not all CAKN vital signs listed as high relevance to Denali are listed here.

25. **Air Quality Monitoring.** Continue to implement air quality and visibility monitoring protocols in order to protect the park's air resources, which are designated Class I under the Clean Air Act. Continue to monitor lichen community structure (as a biological indicator of air quality) using the current vegetation monitoring protocols.
26. **Monitoring of Climate and Snowpack.** Continue to implement the climate and snowpack monitoring protocols in order to evaluate the influence of local and global climate trends on resources within the ecosystem.
27. **Glacier Monitoring.** Quantify broad-scale changes to glacial environments by implementing the existing glacier monitoring protocol. Update the protocol format to meet the standards of the Inventory and Monitoring program.
28. **Permafrost Monitoring.** Develop a permafrost monitoring protocol that incorporates diverse monitoring methods at multiple scales in order to evaluate permafrost status parkwide, identify permafrost trends and how they affect the ecosystem, and contribute to statewide and global permafrost monitoring efforts.
29. **Water Quality Monitoring.** Develop and implement monitoring protocols to measure success toward the park water quality goal—"Water quality of park rivers, streams, lakes, and ponds is improved and/or maintained to support a diverse aquatic community and ecosystem function, and to meet or exceed federal and state water quality standards." This effort includes Central Alaska Monitoring Network (CAKN) lake and stream studies.
30. **Stream Morphology Monitoring.** Develop and implement monitoring protocols to measure success toward the park goal—"Physical channel and floodplain integrity of park streams and rivers is maintained and/or improved to support natural geomorphic processes of fluvial systems and to support natural aquatic flora and fauna."

31. **Fish Monitoring.** Develop and implement a protocol to monitor the distribution and abundance of freshwater fish and of salmon spawning areas. Examine the effects of climate change, contaminants, water quality, and subsistence use on fish populations.
32. **Monitoring of Passerine Birds.** Continue to monitor passerine birds to determine how their abundance and distribution respond to changes in their habitats and to help document their population trends on park- and state-wide levels. Continue to conduct Breeding Bird Survey routes in Denali to assess broad-scale changes in the abundance and distribution of land birds along the two BBS routes and to provide information to state and continental bird monitoring programs.
33. **Trumpeter Swan Monitoring.** Continue to provide financial support to the U. S. Fish and Wildlife Service (USFWS) for monitoring trumpeter swan breeding populations in the park.
34. **Monitoring Golden Eagles and Peregrine Falcons.** Continue monitoring nesting area occupancy and breeding success of golden eagles to detect changes in occupancy and reproductive rates of the territorial populations. Continue to monitor peregrine falcon nest occupancy and breeding success.
35. **Monitoring Important Herbivore Species.** Develop monitoring protocols for important species of small- to medium-sized secondary producers. Species which have been identified as particularly important to Denali's ecosystem include Arctic Ground Squirrels, Red Squirrels, Snowshoe Hares, Willow Ptarmigan, and Beavers.
36. **Small Mammal Monitoring.** Continue to estimate annual population size and variation in small mammals in the Rock Creek drainage (using the Long-Term Ecological Monitoring protocol).
37. **Caribou Monitoring.** Continue to provide financial support for the monitoring of the Denali Caribou Herd by the United States Geological Survey, Biological Research Division, in order to document the size, distribution, movements, and demographic makeup of the herd. Develop and implement a monitoring protocol for the Denali Caribou Herd.
38. **Moose Monitoring.** Finalize and implement the protocol for moose monitoring. Continue to conduct periodic moose surveys in a standardized 10,000-square-kilometer area north of Alaska Range. Continue to conduct targeted moose surveys south of Alaska Range to monitor locally-harvested moose populations.
39. **Dall's Sheep Monitoring.** Develop and implement a protocol to monitor the distribution and abundance of Dall's sheep. Develop and implement a protocol to monitor migratory movements of Dall's sheep, and the impacts of human activity on migration.
40. **Wolf Monitoring.** Finalize and implement the protocol for wolf monitoring. Continue to monitor numbers and territories of wolf packs north of the Alaska Range.
41. **Brown (Grizzly) Bear Monitoring.** Develop and implement a protocol to monitor the distribution and abundance of brown bears. Continue to monitor cub production and survival of brown bears in the western park as a demographic component of the bear monitoring program.
42. **Monitoring Vegetation Structure and Composition.** Continue to implement the grid-based protocol to monitor vegetation communities across Denali.

43. **Landcover Monitoring.** Develop and implement protocols to monitor landcover and long-term landcover trends; a protocol to detect short-term (0-17 years) differences in vegetation types particularly in burned areas; and a model for vegetation succession in burned areas.
44. **Sound/Soundscapes Monitoring.** Develop and implement soundscape monitoring protocols in order to detect changes in soundscapes at a landscape scale, and to meet the monitoring requirements that are included in the Denali Backcountry Management Plan and any that are developed for frontcountry areas.
45. **Monitoring of Plant Phenology and Landscape Phenology.** Develop and implement a protocol to monitor the timing of seasonal snow cover, vegetation green-up, maximum greenness, and senescence on the landscape.

Strategy E: Monitor natural resources that may need management response.

Monitoring geohazards (e.g., the slump at Mile 45 of the Denali Park Road) and wildland fires ensures that park managers have information to make decisions about the management of developed areas in the park to afford the highest degree of staff and public safety possible.

46. **Monitoring and Assessment of Geohazards.** Monitor and assess geohazards (e.g., earthquakes, landslides, avalanches, thermokarst) in the vicinity of developed areas in the park.
47. **Documentation and Assessment of Wildland Fires.** Continue to document wildland fires with GIS coverage of fire perimeters, on-site fire observations, and photography. Compare observed fire behavior with results from existing fire behavior models.

Management and Mitigation

Strategy F: Develop and implement plans to monitor and manage vulnerable park resources.

Certain park resources are particularly vulnerable to human activities or certain management actions (e.g., dinosaur fossil sites, cultural sites, darkness of night sky, and water quality. To identify, avoid, minimize, and mitigate those factors and management actions that have a deleterious impact on the physical environment, these projects develop and implement indicators and standards and effective management plans for specific human-related resource issues to provide science-based information for making management decisions. Factors that occur outside Denali's boundaries that affect Denali's resources would be considered as well to achieve/maintain Denali's desired conditions for park resources.

48. **Paleontological Resources Management Plan.** Develop and implement a management plan for paleontological resources to guide research and resource protection, to prioritize searches for new sites, and to develop site monitoring protocols. (See also A2 above).
49. **Cultural Sites Monitoring Plan.** Develop and implement a cultural sites monitoring plan to standardize a rotating schedule for monitoring and assessing the condition of all cultural sites in the park to ensure appropriate protection.
50. **Natural Lightscapes Monitoring Plan.** Develop a monitoring plan to preserve natural lightscapes in the absence of human-caused light, and to minimize the impacts to lightscapes in developed areas by incorporating lightscape-sensitive lighting designs into site plans.

51. **Waterway Navigability.** Acquire all necessary data to assess navigability issues, support continued Federal ownership where appropriate, and protect affected water resources within the park and preserve regardless of determination of title ownership.

Strategy G: Restore and monitor disturbed lands.

Most of Denali's physical and biological resources are in near-pristine natural condition and therefore the indicators seek to maintain rather than to achieve the desired condition. There are a few areas where the integrity of landscapes has been compromised by placer mining (past) or OHV activities (past and present). Remedial actions are needed to restore disturbed lands (projects 52, 54), and to monitor their recovery and future condition (55). It is important with management activities that disturb rivers (e.g., scraping the Toklat River for gravel) that the physical channel, floodplain integrity, and natural geomorphic processes of fluvial systems are maintained so these systems support natural aquatic flora and fauna.

52. **Restoration of Mined Sites in Kantishna.** Revise and implement recovery plans for impaired watersheds, i.e., Slate Creek and Caribou Creek. Develop and implement restoration plans for disturbed mined lands in the Kantishna Mining District. Monitor disturbed and restored lands parkwide to ensure that restoration is effective and natural systems recover.
53. **Monitor and Mitigate Impacts of Park Gravel Acquisition Operations.** In areas of direct management impact from gravel acquisition, monitor and mitigate impacts to fluvial morphology and water quality.
54. **OHV Trail Rehabilitation.** Rehabilitate areas degraded by use of Off-Highway Vehicles (OHVs) in the Cantwell Subsistence Traditional Use Area.
55. **OHV Impacts Monitoring.** Monitor the effects of OHVs on vegetation, wetlands, and other biological resources in areas where these vehicles are allowed for recreational and subsistence use on park and preserve lands.

Strategy H: Determine and monitor visitor carrying capacity by management area.

Protection of park resources and positive visitor experiences are achieved and maintained when the influence of park visitation is known and incorporated into park planning. By developing and implementing monitoring protocols (and indicators and standards) for various management areas of the park (park road, backcountry, developed areas (trails and campsites, entrance area, south Denali), which will work for different segments of the visitor population, Denali can comply with the Backcountry Management Plan (for backcountry) and maintain quality visitor experiences while protecting park resources.

56. **Integrated Study of Park Road Capacity.** Complete the Park Road Capacity Study and develop indicators and standards for the park road experience beyond mile 15. Develop monitoring protocols and studies for park road indicators and implement them at regular intervals. If indicated by the initial research, experimentally raise vehicle traffic and implement a Before-After-Control-Impact (BACI) study to determine whether standards are still achieved.
57. **Backcountry Monitoring.** Develop monitoring protocols using indicators of backcountry visitor experiences to address both day and overnight visits and to address year-round use. Collect information on new indicators for visitors, such as scenic air tour passengers, whose experience is

not adequately measured by existing backcountry indicators. Implement these protocols at regular intervals.

58. **Trail and Campsite Impacts Monitoring.** Quantify specific standards to evaluate the impacts of social trails and backcountry campsites. Develop and implement a protocol to detect changes in the spatial extent and distribution of these impacts, as required by the *Backcountry Management Plan*.
59. **Entrance Area Indicators and Standards.** Develop and implement monitoring protocols to ensure that standards for frontcountry visitor experiences are maintained.
60. **South Denali Indicators and Standards.** Develop and implement monitoring protocols to ensure that standards for South Denali visitor experiences are maintained. Conduct studies before and after major facilities are constructed. Incorporate the mandates of partner land management agencies, including the state park system's emphasis on Alaska residents.

Strategy I: Minimize habituation of park wildlife.

To keep wildlife wild (prevent habituation to humans and human food) and humans safe, Denali has developed management plans for addressing bear-human and wolf-human interactions. These projects achieve the natural behavior of animals in Denali, part of the desired condition for the "Wildlife populations, habitat, ecosystems" fundamental resource and value.

61. **Brown Bear Management.** Revise and continue to implement the management plan for brown bears. Continue to implement strategies to safeguard food and garbage from bears and protect visitor safety. Develop methods to assess the effects of road traffic on bear movements and demography.
62. **Wolf Management.** Complete and implement a wolf management plan. Continue to protect vulnerable den and rendezvous sites from disturbance. Continue to implement strategies to prevent wolf habituation.
63. **Wildlife Habituation Management – Other Species.** Use aversive-conditioning techniques as appropriate, to prevent wildlife behavior that might jeopardize the survival of wildlife or visitors. Manage human activities in such a way that wildlife does not become food-conditioned or otherwise habituated to human presence in harmful ways.

Strategy J: Detect, monitor, and mitigate environmental influences external to the local natural ecosystem

Denali's borders do not stop certain external influences (contaminants, exotics, diseases) from reaching Denali and impacting Denali's ecosystems. The goal is to identify, avoid, minimize, and mitigate those factors and management actions that increase contaminants, exotic species, disease, and other pests inside Denali to help keep wildlife and plant populations natural and healthy.

64. **Monitoring of Anthropogenic Contaminants.** Monitor the levels of contaminants in aquatic and terrestrial habitats and biota. Implement appropriate recommendations of the Western Airborne Contaminants Assessment Program (WACAP).
65. **Exotic Plant Species Monitoring.** Continue to monitor the distribution and spread of exotic plant species. Investigate the factors that allow exotic plants to enter and spread in the park, and manage exotic plant species where possible.

- 66. **Exotic Animal Species Monitoring.** Develop and implement a protocol to detect and monitor exotic animal species.
- 67. **Wildlife Diseases Monitoring.** Maintain awareness of the statewide distribution of significant wildlife diseases. Monitor the occurrence of diseases that pose a threat to park wildlife, with particular attention to human-introduced diseases.
- 68. **Integrated Pest Management.** Continue to implement an integrated pest management (IPM) program to reduce risks to the public, park resources, and the environment from pests and pest-related management strategies.

Strategy K: Mitigate the risk of wildland fire to park infrastructure and cultural resource sites.

Knowing more about the response of vegetation after fuel treatments to reduce vegetation around structures in the Frontcountry will help determine the most efficient ways to initially treat and maintain structures in full suppression zones. The goal is to protect cultural resources (and other infrastructure) from wildland fire.

- 69. **Fuel Treatments and Wildland Fire Risk.** Document the pre-and post-treatment condition of the vegetation of the 2004 Denali Frontcountry hazard fuels treatment; monitor the effects of the treatment on vegetation; and evaluate the original prescription. Model fire risk associated with different types of fuel treatments, including the Frontcountry hazard fuels treatment and untreated areas. Determine maximum efficiency in hazard fuels reduction techniques for application at Denali and elsewhere in Interior Alaska. Address fire hazard in areas within full suppression zones that are untreated in order to prioritize fuel treatments.

Strategy L: Preserve the museum collection and rehabilitate and preserve park historic structures.

Protecting the resources and values associated with historic, archaeological, and ethnographic resources requires bringing the museum collections to standards (projects 70, 72) and rehabilitating historic structures (e.g., project 74). In addition, Denali will be able protect the museum collection, yet for provide for access, by making electronic records (photographing objects and digitizing archives, project 71) and by making finding aids (documents that list what is available, project 73).

- 70. **Improving Collection Standards.** Write the Scope of Collections Statement (SOCS), an Integrated Pest Management Plan, an Emergency Operations Plan, and a Structural Fire Plan for the Denali museum collection. Purchase equipment and storage materials, including museum cabinets, shelving, archival supplies, and digital storage space. Re-house archival material and store natural history specimens properly. Meet 79 of 82 Collection Standards by completion of this project.
- 71. **Digitizing the Museum Collection.** Photograph objects in the museum collection and digitize the archival collections in order to enhance object descriptions, document the condition of museum objects, provide visual cues to identify objects, and ensure the preservation and availability of the entire collection. Transfer motion picture film and oral history audiotapes to the medium that is preferred for long-term preservation.
- 72. **Addressing Catalog Backlog.** Catalog research and management documents to preserve the information and make them accessible for historical and scientific research, beginning with documents related to the ongoing predator-prey study and documents related to mining.

73. **Creation of Finding Aids for Archival Collections.** Create finding aids to protect documents by decreasing the frequency with which they need to be handled.

74. **Historic Structures Rehabilitation.** Rehabilitate six historic structures in the park (the Hotel Powerhouse, Doty House (HQ residence), Busia Cabin, Pearson Cache, and Quarters 111 and 22). Improve condition of these structures from poor or fair to good.

Strategy M: Monitor and manage consumptive uses of park resources, including subsistence use. Consumptive uses of fish and wildlife (subsistence use or sport) or timber products should not be allowed to disrupt or drive the natural processes of Denali's ecosystems. Management decisions, which protect park resources and thereby continue to provide for subsistence ways of life as well as sport opportunities, will be better informed by developing and implementing monitoring protocols for documenting forest resources (project 75), trapline activities (project 76), and past and contemporary wildlife harvests, harvest areas, and means of transportation (projects 77, 78, 79). Outcomes would include a comprehensive parkwide firewood/log management plan for qualified subsistence users and a furbearer harvest program.

75. **Forest/Timber Resources Management.** Establish a monitoring protocol to assess timber resources using plots and aerial photography. Formulate a plan for the subsistence use of forest/timber resources (firewood and cabin logs) in the park.

76. **Furbearer Trapping Management.** Establish a furbearer harvest program, working with local trappers and ADF&G. Obtain furbearer harvest data from trapper surveys and ADF&G records. Assess the effects of various trapline management regimes on the population dynamics of marten and other furbearers.

77. **Wildlife Harvest Management.** Acquire data about wildlife populations and about subsistence and sport harvests. Evaluate existing data for consistency and identify gaps in knowledge of harvest numbers. Conduct wildlife population surveys as needed. Track ADF&G harvest data for game management units that include Denali National Park and Preserve lands.

78. **Wildlife and State Game Regulations.** Work with ADF&G and the Alaska Board of Game to identify regulations and management practices that would assist the National Park Service in achieving desired conditions for park wildlife.

79. **Documentation of Subsistence Customs and Traditions.** Document the history of contemporary and traditional subsistence practices, the adoption and use of new technologies for subsistence activities, and the impacts of federal management regulations and policies on the subsistence way of life.

Strategy N: Enhance and increase the effectiveness of wildlife protection by deterring illegal activities. Curtailing illegal motorized access to park lands and poaching of wildlife helps keep wildlife populations natural and healthy.

80. **Harry Karstens Wildlife Protection Initiative.** Deter illegal OHV activity and illegal hunting through an integrated program that 1) provides consistent ground and aerial patrol presence; 2) increases the effectiveness of patrols by regular upgrading training and equipment, and by organizing data and information-gathering tools to improve targeting of patrol activity; 3) enlists the

cooperation of other agency enforcement personnel, volunteer boundary watchers, and local community members; and 4) educates the public about park regulations and the park mission.

81. **Boundary Marking.** Mark critical sections of the park boundary and develop a GIS inventory of boundary sign locations so that signs can be effectively monitored and maintained over time.

Parks and People

Strategy O: Improve estimation of park visitation.

Estimates of the number of park visitors, by different visitor segments will help park managers to gauge visitor impacts on park resources, provide for quality park experiences to various segments, and to custom-fit park protection messages to each segment. Tools and models are needed to estimate total number of visitors and track numbers in distinct visitor segments, including dispersed entry visitors, and frontcountry and backcountry hikers. Visitor carrying capacity has not been defined in two management zones. Some significant types of park visitation are not accounted for, and the park's model for estimating visitation is inadequate.

82. **Dispersed Entry Visitation.** Develop a tool to estimate the numbers and describe the basic visit characteristics for dispersed entry visitors (those who enter the park from locations other than the park road, including those who fly over but may not land).
83. **Day-Hiker Inventory.** Develop a system for estimating day-hiker use both in the frontcountry and backcountry, to answer questions about how many visitors are day-hiking, how far they go, where they go, and what are the demographic characteristics of Denali day-hikers.
84. **Visitation Model.** Develop a comprehensive model for estimating visitation to Denali within different visitor segments (e.g., independent travelers, packaged tour visitors with one overnight) during all seasons. Replace the formula presently used in the Monthly Public Use Report with the model that incorporates not only visitor counts but also indirect data from state and other sources.

Strategy P: Monitor trends in adjacent community populations, land use, and local economy.

The relationship of surrounding human communities and land uses to park visitors and resources is not understood. Measuring community understanding and support of Denali in gateway communities from Anchorage to Fairbanks and nearby Bush communities (Minchumina, Nikolai, Skwentna) will help managers learn if efforts are needed to inform the public about the national park's role in the community's economy. This strategy (project 85) also coordinates with the CAKN human use vital sign monitoring.

85. **Human Populations Monitoring.** Develop and implement a CAKN-prescribed monitoring protocol to use state and federal census data to monitor trends in the number of people residing in communities in and near the park.
86. **Community Survey.** Develop a survey to be employed periodically in a random sample of citizens from communities between Anchorage and Fairbanks to measure such things as the public perception of the national park as a beneficial/detrimental influence in the region; public understanding of the purposes of the park; the reasons for local public use or avoidance of the park; and the response of local community members to current and potential management strategies (including fire management).

87. **Economic Impact Model.** Develop an economic model—potentially in cooperation with other parks or the entire Alaska Region—that demonstrates the impact of Denali on local and regional jobs and income.

Data Management

Strategy Q: Develop and implement effective data management strategies for use by managers, specialists, and the public.

For information about park resources and research to be most useful in support of park management and decision-making, it needs to be stored, organized, and available for distribution or further analysis. Data management must comply with formats that are standardized.

88. **GIS Database.** Assure that the GIS database accurately manages park resource information for efficient use by park and associated researchers and managers, including natural resource data layers, cultural resource base map, access routes (OHV, boat, trail, etc), hunting camps, and available base maps in coordination with AKRO data service standards. Develop new layers as required for park management through other projects identified in this strategy. Develop tools and training to effectively use geospatial data throughout the park. Where appropriate, make GIS data available to the public through NPS internet sites.
89. **Cultural Resources Data Management.** Standardize and update all records in the Automated National Catalog System (ANCS+) for museum records, the Archeological Site Management Information System (ASMIS) for archaeological records, and the List of Classified Structures (LCS) for historic building records.
90. **Natural Resources Data Management.** Develop standardized data management, archiving, and distribution for natural resource data sets, technical reports, and research-related records. Coordinate with the CAKN data management structure and efforts.
91. **Data Dissemination and Availability.** Develop an appropriate internet data distribution system for commonly requested natural resource data sets, such as climate, wildlife, air quality, and museum collections, and a technical library. Coordinate with CAKN data dissemination efforts.

Education and Communication

Strategy R: Facilitate the education of all audiences (external and internal) about resource issues in and around Denali to gain support for the park's management decisions.

The ability to share widely important park protection messages increases when there are education staff (project 97), good communication connections among education and resource staff (project 93), and outreach partnerships and programs (92, 94, 95, 96).

92. **Science-rich Media.** Create science-rich information and interpretation materials in a variety of media including publications, newsletters, curricula, fact sheets, talking points, websites, and technology-enhanced learning (e.g., digital video).
93. **Trans-disciplinary Communications and Training.** Encourage communications and training across disciplines of science and interpretation (e.g., encourage seasonal interpretive rangers to

participate in park research, offer interpretation training seminars for Denali scientists and science training for interpreters). Strengthen regular communications among staff Murie Science and Learning Center (MSLC) and Center for Resources, Science, and Learning.

94. **Researchers-in-Residence.** Offer park-based sabbaticals for researchers, in order to have researchers collaborate with educators, and communicate the relevance of their projects to variance audiences.
95. **Science-based Education Seminars.** Host seminars for specific audiences such as “Fire in Alaska Workshop” or the current MSLC Field Seminars.
96. **Research and Community Connections.** Engage resource staff and researchers in local communities through their involvement in science-based curricula, citizen science programs, teacher trainings, youth camps, and high school or college level internships.
97. **Education Staff.** Support Denali’s educational staffing by converting temporary education subject to furlough (STF) positions—education coordinator and two educational specialists—to permanent STF.

Strategy S: Develop staffing and infrastructure to enhance bridges between research and interpretation and to facilitate higher levels of understanding and preservation of park resources.

Staff and facilities development will bring the Murie Science and Learning Center to the intended level of “fully operational” in support of its goals for Denali and the other MSLC parks.

98. **MSLC Staffing.** Hire an MSLC Director, MSLC web master, and MSLC Science Coordinator/Liaison, who would work in partnership between the Center for Resources, Science, and Learning and the MSLC.
99. **MSLC Facilities Development.** Fund and build the MSLC Residential Facility to support staff and visiting researchers. Funds would like be obtained through a donation capital campaign project.

Program Management

The National Park Service will pursue several strategies that have budgetary implications and that underlie the success of all the other strategies and projects described. These are not discreet projects but general ways of doing business that should be continuously addressed. The budget table below shows resource support for strategies and projects comes in the form of support from several divisions, informally referred to as Resources, Rangers, and Maintenance. They include the following:

Strategic Program Review. Periodically review the park's staffing situation, in order to identify potential or impending deficiencies or strengths. Identify projects, make appropriate budget plans and form strategic partnerships to solve staffing needs. Fill identified staffing needs in research, enforcement, and interpretation to accomplish the strategies and projects that have been identified.

Staff Training, Development, and Learning. Provide adequate training, development, and learning opportunities to maintain a high level of expertise and professionalism among resources, enforcement, and

interpretive/educational staff. Provide multiple opportunities for staff to learn and develop new skills, acquire new knowledge, familiarize themselves with new equipment or techniques, and distribute the results of research.

Collaborative Efforts. Collaborate with other land management agencies, federal, state or private biologists and researchers, and universities to maintain high standards of inventory, management, and research activities. Collaborate with other enforcement agencies to cultivate an interest in wildlife protection at Denali.

Engaging External Research Partners. Develop and circulate information on important gaps in knowledge about park resources to the research community. Facilitate research and provide basic logistics to attract quality research projects that will discover and explain park resources to inform park management and protection activities. Examples of ongoing partnerships include those with the University of Alaska Geophysical Institute, the University of Alaska Geology Field Camp, partnerships with several regional Cooperative Ecosystem Study Units (CESUs), and partnerships with USGS researchers.

Accountability for Mitigation Prescribed through Environmental Analysis. Monitor compliance with and effectiveness of mitigation measures prescribed through NEPA environmental analysis (Environmental Impact Statements, Environmental Assessments) of new development projects, including no net loss of wetlands.