



CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

This chapter analyzes the probable impacts, by resource topic, for each alternative described in chapter 2. Impacts resulting from actions common to all alternatives are also discussed. Table 2-11 summarizes the impacts of each alternative; the table appears at the end of chapter 2.

The impact assessment evaluates the magnitude of impacts and how these impacts compare to current conditions and to the no-action alternative. The cumulative impact assessment outlines overall impacts resulting from past, current, proposed, and reasonably foreseeable management actions. The impact assessment is intended to guide the decision-maker in choosing a management action that protects the environment based on an objective understanding of environmental consequences.

METHODOLOGY

Varieties of methods were used for the impact analyses in this chapter. The principal method involved a review of published and unpublished literature regarding the effects of human activities on the resources discussed in the individual sections in this chapter. Literature sources presenting data collected from Alaska and other northern environments were given priority, and unpublished data collected in the park were reviewed and assessed for applicability. It is assumed that the results of impact studies in similar tundra and taiga environments in Alaska and Canada can be extrapolated reasonably to the Denali backcountry when specific data are lacking for Denali National Park and Preserve. In addition to literature review, the impact analyses were based on observations by park employees; discussions with residents, interest groups, and businesses at scoping meetings and in telephone conversations; site reconnaissance; and best professional judgment based on previous experience with similar projects and activities. Mitigation measures were assumed to be in place when analyzing the impacts of visitor activities and plan elements under the action alternatives.

The general methods used in the cumulative effects analysis are based on impact assessment principles outlined in the handbook produced by the Council on Environmental Quality (CEQ 1997: vii):

- address additive, countervailing, and synergistic effects;
- look beyond the life of the action;
- address the sustainability of resources, ecosystems, and human communities.

These impacts are assessed in relation to the baseline conditions existing before any actions are taken under the backcountry plan; in this case, pre-existing conditions are those described in the no-action alternative. Comparisons were made with the evaluations and predictions of previous NEPA documents and planning processes (referenced below) to ensure consistency with those approaches and to build on their analyses. Impacts are described in as specific a manner as possible, bearing in mind the programmatic, general nature of the management alternatives.

NPS Management Policies affirm and clarify that the National Park Service may allow certain impacts in national park system units as long as “park resources and values” are left unimpaired. The Management Policies define park resources and values as:

- The park’s scenery, natural and historic objects, and wildlife, and the processes and conditions that sustain them, including, to the extent present in the park: the ecological, biological, and physical processes that created the park and continue to act upon it; scenic features; natural visibility, both in daytime and at night; natural landscapes; natural soundscapes and smells; water and air resources; soils; geological resources; paleontological resources; archeological resources; cultural landscapes; ethnographic resources; historic and prehistoric sites, structures, and objects; museum collections; and native plants and animals;
- Opportunities to experience enjoyment of the above resources, to the extent that can be done without impairing any of them;
- The park’s role in contributing to the national dignity, the high public value and integrity, and the superlative environmental quality of the national park system, and the benefit and inspiration provided to the American people by the national park system; and
- Any additional attributes encompassed by the specific values and purposes for which it was established (NPS Management Policies 2001 1.4.6).

At Denali, the National Park Service is particularly concerned with the set of these resources and values that are specifically identified in Sections 101 and 102 of ANILCA, the preservation of which is the reason for the designation of new conservation system units. In other sections, ANILCA refers to these as “resource values” and “natural and other values.” For the purposes of evaluating impacts and determining impairment for Denali, this plan equates these two ANILCA terms with the NPS Management Policy term “resources and values.”

The geographic scope of this assessment is the entire 6-million-acre area of Denali National Park and Preserve, plus adjacent lands used for subsistence, recreation, and tourism, including the associated communities along the Parks Highway, as well as those off the road system. The temporal scope extends at least 20 years into the future, the duration of the plan.

For each resource, the analysis includes a conclusion about the level of impact and about impairment under each alternative. For natural and cultural resources, the conclusions are based on the following criteria. The impacts are discussed in terms of intensity, duration, and context.

Intensity

Low: A change in a resource condition is perceptible, but it does not noticeably alter the resource’s function in the park’s ecosystem, cultural context, or visitor experience.

Medium: A change in a resource condition is measurable/observable and an alteration to the resource's function in the park's ecosystem, cultural context, or visitor experience is detectable.

High: A change in a resource condition is measurable/observable and an alteration to the resource's function in the park's ecosystem, cultural context, or visitor experience is clearly and consistently observable.

Duration

Temporary: Impacts would last only a single visitor season or for the duration of discreet activity, such as construction of a trail (generally less than two years).

Long term: Impacts would extend from several years up to the life of the plan.

Permanent: Impacts are a permanent change in the resource that would last beyond the life of the plan even if the actions that caused the impacts were to cease.

Context

Common: The affected resource is not identified in enabling legislation and is not rare either within or outside the park. The portion of the resource affected does not fill a unique role within the park or its region of the park.

Important: The affected resource is identified by enabling legislation or is rare either within or outside the park. The portion of the resource affected does not fill a unique role within the park or its region of the park.

Unique: The affected resource is identified by enabling legislation and the portion of the resource affected uniquely fills a role within the park or its region of the park.

Overall Conclusion

Conclusions about the overall impacts on the resource synthesize information about intensity, duration, and context, which are weighed against each other to produce a final assessment. While each conclusion reflects a judgment call about the relative importance of the various factors involved, the following descriptors provide a general guide for how those conclusions are reached.

Negligible: Impacts are generally low intensity, temporary, and do not affect unique resources.

Minor: Impacts tend to be low intensity or of short duration, although common resources may have more intense, longer-term impacts.

Moderate: Impacts can be of any intensity or duration, although common resources are affected by higher intensity, longer impacts while unique resources are affected by medium or low intensity, shorter-duration impacts.

Major: Impacts are generally medium or high intensity, long term, or permanent, and affect important or unique resources.

Impairment: A resource would no longer fulfill the specific purposes identified in the park's establishing legislation or its role in maintaining the natural integrity of the park.

For some topics, such as Socioeconomics, separate criteria are included in the Methodology section of the topic.

ASSUMPTIONS

Assessing the consequences of actions proposed in the various alternatives requires making some assumptions about changes in human use patterns over time. Listed below are some of the assumptions that are referenced in the impact analysis for individual resources. Additional assumptions useful for the particular impact topic may appear in the Methodology section of the impact topic. For the impact analysis, the following time period references refer to specific "visitor seasons:"

Summer Beginning of May to the end of September

Early Winter.. October and November

Mid Winter December through mid-February

Late Winter ... Mid-February to the end of April

- 1) Summer visitation at Denali will resume its growth, although not at the 5% annual growth rate of the 1990s. The rate may be closer to the 2% growth seen in visitor arrivals to Alaska over the past several years (ADCED 2001). Much if not all of the growth will be among package tour travelers associated with cruise ships or other tour companies. Cruise ship arrivals in Alaska climbed 27% from 1999-2003 although this period showed a lull in visitation growth at Denali. The tourism industry clearly expects growth to return to Denali, since the number of rooms available for overnight accommodation in the Denali Borough grew 19% from 1999-2004, demonstrating continued industry interest in investment (statistic courtesy of Denali Borough).
- 2) Those package tour visitors interested in experiencing the Denali backcountry will generally rely on a guided service for access. This means that the demand for a variety of guided activities and commercial services will continue to grow, including the demand for activities and services that have not been offered at Denali in the past.
- 3) New visitor facilities will be constructed in South Denali consistent with the 1997 *South Side Denali Development Concept Plan*. As a result, some of the growth in visitation to the park backcountry will originate from the south side. Without

management intervention, new south-side Denali destinations will develop on their own in locations relatively accessible by road, water, and air such as Windy Creek, Dunkle Hills, Tokositna River, the Chelatna Lake area, and glacier landing areas near Talkeetna.

- 4) Scenic air tour and air taxi services will be among the most popular of the activities sought by visitors. Although the number of passenger landings on glaciers was flat from 2001–2004, overall passenger growth from 1999–2004 was 38% and growth in landings 11% (2.1% growth in flights with landings, 6.6% annual growth in passenger volume), associated with the opening of new hotel rooms serving package tour travelers in the South Denali area (see Table 3-16).

While much of the scenic tour traffic will continue to originate from Talkeetna and the park entrance, scenic air tours from more distant locations such as Anchorage and Fairbanks will continue to increase, serving Alaska visitors who do not travel closer to Denali than these two cities. The growth in scenic tour plane traffic will be mitigated somewhat by the increasing efficiency of the air tour operators, who will fill a higher percentage of seats on every flight and fly larger planes. For example, among concession flights that landed on glaciers between 1999 and 2004, the average passengers per flight increased from 3.6 to 4.5 (Table 3-16). However, even with an average 3.5% annual growth rate the amount of air traffic over the park would double by 2025.

- 5) The number of general aviation landings and overflights in the Denali area will remain small relative to the number of commercial scenic tours and air taxi traffic.
- 6) Overnight independent use of the Old Park backcountry will fluctuate within the same range as it has for the past 15 years (30,000–40,000 user nights), perhaps with some slight increase. Overnight use of accessible parts of the park additions, including mountaineering use on the glaciers and glaciated peaks, will continue to increase gradually. Day-hiking will increase in areas where guided hiking opportunities are available (see Table 3-9).
- 7) Over the life of the plan, only minor growth will occur in overnight stays at accommodations in the Kantishna Hills, resulting both from minor expansions of existing businesses and from the construction of a hostel as described by the 1997 *Entrance Area and Road Corridor Development Concept Plan*.
- 8) Access to and use of public lands near or adjacent to Denali will continue to improve and grow. Limited numbers of new or improved transportation facilities will be responsible for some of the growth – such as planned improvements to the Petersville Road and the gradual expansion of the road system to serve newly developed settlement areas near the Parks Highway. However, much of the increased access will occur because of continued technological improvements and

- increases in ownership of off-road vehicle transportation, including both snowmachines and wheeled or tracked all-terrain vehicles. New trail systems serving both motorized and non-motorized users may be constructed or improved on lands near the park boundary.
- 9) Winter visitation will increase. In part, this increase will occur as more Alaskans discover that Denali is open in the winter through such promotional activities as the annual Winterfest. Winter visitation also will increase along with the growth of snowmachine technology and ownership (see below). In part, the growth will occur as a larger number of out-of-state winter visitors seek winter recreational opportunities in Alaska – the number of off-season (October–April) visitors in state for reasons other than business grew from 114,000 to 142,400 between the winters of 1996–1997 and 2002–2003, an increase of 25% (ADCED 2003).
 - 10) The power, speed, and range of the average snowmachine in Alaska and at Denali will continue to increase. The number of people using these snowmachines recreationally in Alaska will continue to increase. Most of the use in the Denali area will continue to be on the south side of the Alaska Range from late February through the end of April. The majority of use within park boundaries does not have characteristics that would meet the definition of “traditional activities” presently applied in the Old Park.
 - 11) Adoption of low-impact technology for motorized forms of access – airplane, snowmachine, motorboat – will generally not occur without incentives or regulations.
 - 12) Modes of access to the backcountry such as mountain bike, pack animal (horse, llama), or motorboat that have been only rarely used at Denali may become more popular over the lifetime of the plan.

BACKGROUND FOR ANALYSIS OF CUMULATIVE EFFECTS

Cumulative effects are defined as incremental impacts on the environment that result from adding the proposed action to other past, present, and reasonably foreseeable future actions (also referred to as regional actions), including those taken by both federal and nonfederal agencies, as well as actions undertaken by individuals. The next section outlines the actions considered in this analysis for the Denali Backcountry Plan. Cumulative impacts may result from singularly minor but collectively significant actions taking place over a period of time (CEQ Sec 1508.7).

This analysis evaluates the incremental contribution of impacts from the proposed action, other action alternatives, and the no-action alternative to the impacts of unrelated past and reasonably foreseeable future developments and activities in the Denali region. The analysis builds on and extends the information and analyses in the *General Management*

Plan EIS (NPS 1986), the South Side Final Development Concept Plan/EIS (NPS 1997), the Entrance Area and Road Corridor Development Concept Plan/EIS (“frontcountry” plan; NPS 1997a), the Spruce Creek Access EA (NPS 2002a) and the Environmental Assessment for the Proposed Permanent Closure of the former Mount McKinley National Park to Snowmobile Use (NPS 2000).

The time period considered under cumulative effects stretches from 1972 – the first summer season when the George Parks Highway was open – to 2025, at the end of the life of the plan.

Management Areas

- The 1976 Backcountry Management Plan established backcountry units for the Old Park and quotas for overnight use in many of the units. In 1984, additional units were added to the system and quotas modified.

Access

- The 1986 General Management Plan for Denali established a cap of 10,512 round-trip vehicle trips on the Denali park road per summer season. This cap regulation went into effect in 2000.
- In 1995, the National Park Service began requiring registration 60 days in advance of the expedition start date for climbing either Mount McKinley or Mount Foraker.
- Technological improvements in snowmachines enabled a large but unquantified expansion of snowmachine use in Denali during the 1990s. Regulations implementing ANILCA section 1110 permit the use of snowmachines for traditional activities (where such activities are permitted by ANILCA or other law) but did not define traditional activities. Consequently, the expansion in use has been generally unmanaged. The growth in popularity of snowmachines is demonstrated by an increase in the number of registrations. Since registration in Alaska became a requirement in 2000, the number of registered machines has increased from 33,576 to 41,710, an increase of 7.5% per year. Statewide, 70% of machines are registered in the area between Anchorage and Fairbanks. (DMV 2004)
- In 2000, the National Park Service closed the former Mount McKinley National Park to snowmachine access.
- In 1995, the Department of the Air Force completed an EIS for the establishment of Military Operations Areas and Military Training Routes (MOAs and MTRs) in Alaska. This EIS included the Susitna MOA, which authorizes daily flights over a portion of the southwest Denali preserve and park additions south of the Alaska

Range and east to the Tokositna area as depicted in Map 3-9 (U.S. Department of Defense 1995).

- Since 1980, new housing and commercial development has occurred in the Nenana Canyon north of the park entrance, the Yanert Valley east of the park boundary, in the eastern part of the Stampede Road corridor and around Cantwell, and along the Petersville Road. This development has resulted in minor expansion of local road networks or improvements of existing roads. The gradual development spreading out from the Parks Highway corridor is likely to continue, creating increased access to the eastern and southern boundaries of the national park, particularly the park additions.
- Concern for the safety of park visitors prompted the National Park Service to initiate a closure to the discharge of firearms in the Kantishna area in 2000. The restriction on the discharge of firearms applies on federal public lands within 1 mile of the Kantishna road right-of-way from the former Mount McKinley National Park boundary at mile 87.9 to the north end of the Kantishna airport. The firearm restriction is in effect from September 1 through September 15 each year. During the period of the firearms discharge restriction, subsistence harvests utilizing other methods and means of harvest may still take place according to federal subsistence management regulations.
- The National Park Service is evaluating additional information about whether off-road vehicles (ORVs) were traditionally employed for subsistence purposes in portions of the park additions, particularly on two informal trails in the Cantwell area. This determination has not been made, so at present all of the park and preserve backcountry is closed to all ORV use as described in Chapter 1.

Commercial Services

- The National Park Service has awarded new concession contracts and allowed increased service levels for guided hiking and other activities associated with the expansion of private lodges in Kantishna. Additional activities are primarily in Kantishna, but include more than twice the authorized guided hikes offered by the historic concession operator within the Old Park.
- Lodge owners or property owners in Kantishna have occasionally speculated that they might provide accommodations for winter visitors. Although there are no known plans, it remains a reasonably foreseeable action.
- During the 1990s the number of glacier landings by air taxi operators significantly expanded, primarily in response to an increase in the number of park visitors interested in scenic tours rather than mountaineering. This rapid growth led to a conversion of the air taxi Incidental Business Permits to concession contracts in 1998 to limit the number of business enterprises able to offer this service.

- In 1998 and again in 2004, the NPS authorized three overnight guided dog-mushing concessions and one day-tour guided dog-mushing concession. Presently, only two of these concessions are active.
- In 1980, the NPS discontinued a permit for pack animal freighting that had been issued originally in 1970. In the early 1980s a dog-mushing concession was authorized to provide this freighting service.
- Developing a winter tourism industry catering either to Alaskans in the major population centers of Anchorage, Fairbanks, and the Mat-Su Valley or to an out-of-state clientele is a possibility. This is a goal frequently expressed by the Healy-Denali Chamber of Commerce and some private business owners. The National Park Service and its partners have assisted in promoting winter visitation in the park entrance area by hosting an annual Winterfest that began in 2001. Further development of winter tourism could happen at many different scales and could involve both motorized and non-motorized recreation, including the potential for snowmachine rentals.

Facilities

- The National Park Service completed the *Entrance Area and Road Corridor Development Concept Plan* in 1997, which specified several new trails in the Old Park. Some of these trails have been constructed and the NPS intends to complete the remainder as funding allows.
- The National Park Service completed the *South Side Denali Development Concept Plan* in 1997, which specified new and improved road access and a visitor facility in the Peters Hills/Dutch Hills; new trails entering the park from the Peters Hills, Dunkle Hills, and Chelatna Lake area; and new campsites and six public use cabins in the Chelatna Lake and Peters Hills areas. A *South Denali Implementation Plan/Draft Environmental Impact Statement* is presently under development. This analysis will examine a south Curry Ridge site for visitor facility development as an alternative to the Peters Hills area.
- In 2004 a “spring trail” was constructed from Park Headquarters to Mile 7 of the park road to allow for winter access from headquarters to treeline so that winter activities such as dog mushing and skiing can continue from Park Headquarters even if the road is plowed.
- Proposals have been advanced to clear an existing trail from Nenana to allow for winter access to Lake Minchumina. If the trail clearance occurs and services are provided at Minchumina, the community could become a much more popular jumping-off spot for winter trips into Denali.

Administration

- The National Park Service and its partners have greatly increased the amount of research, resource management, and monitoring activity taking place in the park since 1970. The first regular use of airplanes for research activity began in the early 1970s. In 1978, the first administrative airplane became available to the park, although it left in 1981. The summer of 1981 saw the first research use of helicopters, followed shortly afterwards by the stationing of a Firepro helicopter at Denali that has since been used for fire management and many other research and administrative projects. In the late 1980s, the park acquired two airplanes. The present aviation program expanded in 1991 with the annual contracting of a high-altitude Lama helicopter to support the mountaineering program on Mount McKinley and soon after with the increase in mountaineering patrols, which required additional contract aircraft to move rangers, volunteers, and temporary camps on and off the mountain.
- In the 1997 *Entrance Area and Road Corridor Development Concept Plan*, the National Park Service committed to establishing a center for research and education. The Murie Science and Learning Center program is now evolving, but presently includes field-based educational and research programs on trails as well as use of the backcountry. Future programs could include field research and other guided activities in the backcountry.
- The Bear-Human Conflict Management Plan of 1983 established methodologies for preventing conflicts between people and bears by prescribing appropriate methods of food storage and other behavior for people and by specifying protocols for addressing “problem” bears.

ICE-RICH PERMAFROST SOILS

The first part of this section provides an overview of the methodology used to evaluate impacts on ice-rich permafrost soils and water quality, including a literature review of the types of impacts that could result from actions proposed in the plan. The second part is an analysis of the impacts likely to occur under each alternative.

GENERAL IMPACTS BASED ON LITERATURE REVIEW

Analysis of impacts of recreational and administrative activities on ice-rich permafrost soils in Denali National Park and Preserve has relied primarily on a literature review of the types of impacts that can occur and on consultation with NPS subject matter experts and resource managers.

Ice-rich permafrost soils exist in the area between the Stampede mine, the Sushana River, and the Wyoming Hills. They also exist in the flat areas west of Kantishna and north of Purkeypile. Ice-rich permafrost soils could be affected in several ways by the actions proposed in the backcountry management plan and from the no-action alternative. Compaction of insulative surface cover, including vegetation and snow, over ice-rich permafrost soils can lead to premature warming of soils that can lead to ice degradation and thermokarsting. Melting of the ice in ice-rich permafrost soils can lead to a lowering of the ground level, creation of sag ponds and wetlands, thermokarst development, and associated changes in the vegetation regime.

Snowmachines may affect ice-rich permafrost soils indirectly by compacting snow, thereby altering snowmelt, increasing soil moisture, reducing the length of the growing season, and lowering soil temperatures beneath the trail and altering physical processes (Neumann and Merriam 1972; Pesant et al. 1985; Pesant 1987). Impacts on ice-rich permafrost soils from snowmachine use include temperature reductions in soil, which can change soil surface microstructure, which reduces the suitability of a site for seed germination and spring flower viability (Wanek and Schumacher 1975; Keddy et al. 1979). Soil compaction, because of snowmachine use, increases surface runoff, reduces infiltration, and impedes gas exchange between soil and air (Keddy et al. 1979). Compacted soils inhibit root growth and adversely affect soil organisms.

Dog-sled use may have a similar effect on ice-rich permafrost soils, by compaction of insulative layers (snow and soil), causing thermokarsting and ensuing changes in the vegetation regime. Impacts on soils from snowmachine use and dog-sled use would occur primarily in those areas that may become snow-free during certain periods in the winter or that have a thin snow cover that can be reduced further from snowmachine passes (Greller 1974). Areas of thin snow cover include mountain passes and exposed ridges. In addition, steep south-facing slopes tend to become snow-free sooner than other areas in the spring, and low snow years are common. Ice-rich permafrost soils that would normally be protected under snow may become exposed in areas with heavy snowmachine traffic.

ALTERNATIVE 1 (NO ACTION)

The following analysis shows impacts to ice-rich permafrost soils under Alternative 1 would be moderate because this alternative allows for large increases in use of snowmachines and dog sleds. Repeated passes of snowmachines and dog sleds over ice-rich permafrost soils would damage these soils. Impacts would be of medium intensity, long-term duration, and would affect an important park resource.

The no-action alternative represents no change from current management as outlined by the General Management Plan (1986) and the Strategic Plan (1997). This alternative would allow for substantial increases in types and levels of use; without management area prescriptions, desired future conditions, and indicators and standards, the park would have no formal process to determine when impact levels become severe enough to warrant management action. More people recreating in the backcountry would affect ice-rich permafrost soils because there would be more potential for degradation of these resources. Unless otherwise stated, all impacts would occur throughout the life of the plan.

Under this alternative, snowmachine use would increase substantially over current numbers, so localized impacts on ice-rich permafrost soils from snowmachine use would continue to increase where ice-rich permafrost soils are prevalent (between the Stampede mine, Sushana River, and Wyoming Hills; and also in the flat areas west of Kantishna and north of Purkeypile). Impacts would be confined to routes where multiple passes are made.

While snowmachine use would continue to be prohibited in the Old Park (35% of the total park area), use could occur throughout the remaining 3,707,535 acres. As more people use snowmachines in the backcountry, and as technological advances allow riders to cover greater distances, more riders would travel over ice-rich permafrost soils. While the adequate snow cover requirement (see Chapter 3: Affected Environment) is intended to prevent these types of impacts, they are still possible because of the wide variety of terrain and climatic conditions of the park additions and preserve and because the determination of adequate snow cover applies to relatively large areas.

Most mushing in the park starts from the Healy area or the park entrance area to Wonder Lake either via the park road or via the Stampede/Clearwater/Moose Creek route. Some mushing also occurs in the northwest preserve and in the Windy/Riley drainages. Except for the park road, these mushing routes cover extensive areas of permafrost soils. Impacts to ice-rich permafrost soils from dog sleds are similar to those described for snowmachines. Mushers tend to use established trails rather than construct new ones, and multiple passes over ice-rich permafrost soils damage insulating layers of snow, vegetation, and soil. This increases potential for permafrost degradation and the associated natural resource concerns of changes in hydrology and vegetation regimes.

Cumulative Effects

Both technological improvements and community growth have led to an expansion of snowmachine use in the Denali park additions, including the northeastern additions west of Healy where ice-rich permafrost soils are found. In addition, the potential trail clearance to Lake Minchumina could result in increasing snowmachine use in the northwestern park additions and preserve. The NPS authorization of dog freight and guided dog mushing concessions originating from the Stampede Road and Lake Minchumina also provided additional activity in the same ice-rich permafrost areas.

These actions have resulted in a moderate adverse impact to ice-rich permafrost soils. Implementing Alternative 1 alone would have moderate adverse impacts on ice-rich permafrost soils. The cumulative adverse impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be major because additional acres of ice-rich permafrost soils would be affected.

Conclusion

Impacts to ice-rich permafrost soils under Alternative 1 would be moderate because this alternative allows for substantial increases in use of snowmachines and dog sleds. Repeated passes of snowmachines and dog sleds over ice-rich permafrost soils would damage these soils. Impacts would be of medium intensity, long-term duration, and would affect an important park resource. The cumulative impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be major. The level of impacts to ice-rich permafrost soils anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the natural integrity of the park.

ALTERNATIVE 2

The following analysis shows impacts to ice-rich permafrost soils under Alternative 2 would be negligible. Impacts would affect an important park resource over a long period but would be of low intensity. Use of snowmachines would be reduced and use of dog sleds would be managed to minimize negative impacts. There would be few repeated passes of snowmachines and dog sleds over ice-rich permafrost soils. Unless otherwise stated, all impacts would occur throughout the life of the plan.

Under this alternative, areas of the park that contain ice-rich permafrost soils would be zoned as Management Area OP1, OP2, or Management Area E. These management areas allow for very low to medium encounters, no landscape modifications, and low to medium trail and campsite disturbance (which includes signs of social trails, campsites, or cut or broken vegetation). If standards in these categories are approached or exceeded, use would be curtailed or mitigated. Only 60 linear miles would be zoned as a corridor, which would accommodate higher levels of use. Since these higher use areas are not located where ice-rich permafrost soils are abundant, impacts to ice-rich permafrost soils would be minimal.

Under this alternative, access by snowmachine to the park additions and preserves would only be allowed for traditional activities as defined for the Old Park. Damage to ice-rich permafrost soils from snowmachine use would be reduced since the number of riders engaged in traditional activities would be less than the current number of riders. Fewer snowmachine users in areas where ice-rich permafrost soils are prevalent (between the Stampede mine, Sushana River, and Wyoming Hills; and also in the flat areas west of Kantishna and north of Purkeypile) equates to fewer impacts to ice-rich permafrost soils.

Most dog mushing in the park starts from the Healy area or the park entrance area to Wonder Lake either via the park road or via the Stampede/Clearwater/Moose Creek route. Except for the park road, these mushing routes cover extensive areas of permafrost soils. Impacts to ice-rich permafrost soils from dog sleds are similar to those described for snowmachines. Mushers tend to use established trails rather than construct new ones, and multiple passes over ice-rich permafrost soils damage insulating layers of snow, vegetation, and soil. This increases potential for permafrost degradation and the associated natural resource concerns of changes in hydrology and vegetation regimes.

Levels of dog-sled use could increase slightly above current numbers but impacts would be minimal because use would still be low and the Kantishna and Stampede areas would be zoned as Management Areas E and OP1, which accommodates low signs of human presence, and low trail and campsite disturbance. If impacts to soils approach or exceed standards, use would be curtailed or mitigated to reduce impacts.

Cumulative Effects

Both technological improvements and community growth have led to an expansion of snowmachine use in the Denali park additions, including the northeastern additions west of Healy where ice-rich permafrost soils are found. In addition, the potential trail clearance to Lake Minchumina could result in increasing snowmachine use in the northwestern park additions and preserve. The NPS authorization of dog freight and guided dog mushing concessions originating from the Stampede Road and Lake Minchumina also provided additional activity in the same ice-rich permafrost areas.

These actions have resulted in a moderate adverse impact to ice-rich permafrost soils. Implementing Alternative 2 alone would have negligible adverse impacts on ice-rich permafrost soils. Together—with the activities previously described, there would be moderate adverse cumulative impacts to physical resources, none of which are attributable to the actions in this alternative.

Conclusion

Impacts to ice-rich permafrost soils under Alternative 2 would be negligible because use of snowmachines would be reduced and use of dog sleds would be managed to minimize negative impacts. There would be few repeated passes of snowmachines and dog sleds over ice-rich permafrost soils. Under this alternative, recreational and administrative

activities would be reduced from current levels, and recreational users may be subject to additional conditions on use. This alternative would have the least impact on ice-rich permafrost soils of all the alternatives because the levels of some activities, particularly snowmachine use, would be reduced in the park additions and preserve. Reducing use would reduce impacts on ice-rich permafrost soils. The cumulative impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be moderate. The level of impacts to ice-rich permafrost soils anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the natural integrity of the park.

ALTERNATIVE 3

The following analysis shows impacts to ice-rich permafrost soils under Alternative 3 would be negligible. Impacts would affect an important park resource over a long period but would be of low intensity. Use of snowmachines and dog sleds would increase slightly above current levels, and repeated passes of snowmachines and dog sleds over ice-rich permafrost soils would damage these soils. However, use would be mitigated or restricted if standards outlined for Management Areas D, E, OP1, and OP2 are approached or exceeded.

Under this alternative, areas of the park that contain ice-rich permafrost soils would be zoned as Management Areas D, E, OP1, or OP2. These management areas allow for very low to medium encounters, no landscape modifications, and low to medium trail and campsite disturbance (which includes signs of social trails, campsites, or cut or broken vegetation). If standards in these categories are approached or exceeded, use would be curtailed or mitigated. Higher use levels would be accommodated along 147 linear miles of corridors in summer and 157 miles in winter. Since these higher use areas are not located where ice-rich permafrost soils are abundant, impacts to ice-rich permafrost soils would be minimal. All impacts would persist for the duration of the plan unless otherwise stated.

Snowmachine use would increase over current numbers only in corridors (because the definition of traditional activities, as defined for the Old Park, would be applied to areas outside of corridors). Impacts would be confined to routes where multiple passes are made.

While the adequate snow cover requirement (see Chapter 3: Affected Environment) is intended to prevent these types of impacts, they are still possible because of the wide variety of terrain and climatic conditions of the park additions and preserve and because the determination of adequate snow cover applies to relatively large areas.

Most mushing in the park starts from the Healy area or the park entrance area to Wonder Lake via either the park road or via the Stampede/Clearwater/Moose Creek route. Use is also common from the Stampede area up the Toklat River. Except for the park road,

these mushing routes cover extensive areas of permafrost soils. Impacts to ice-rich permafrost soils from dog sleds are similar to those described for snowmachines. Mushers tend to use established trails rather than construct new ones, and multiple passes over ice-rich permafrost soils damage insulating layers of snow, vegetation, and soil. This increases potential for permafrost degradation and the associated natural resource concerns of changes in hydrology and vegetation regimes.

Levels of dog-sled use could increase slightly above current numbers but impacts would be minimal because the Kantishna and Stampede areas would be zoned as Management Areas D and OP1, which accommodates low signs of human presence, and low trail and campsite disturbance. If impacts to soils approach or exceed standards, use would be curtailed or mitigated to reduce impacts.

Cumulative Effects

Both technological improvements and community growth have led to an expansion of snowmachine use in the Denali park additions, including the northeastern additions west of Healy where ice-rich permafrost soils are found. In addition, the potential of trail clearance to Lake Minchumina could result in increasing snowmachine use in the northwestern park additions and preserve. The NPS authorization of dog freight and guided dog mushing concessions originating from the Stampede Road and Lake Minchumina also provided additional activity in the same ice-rich permafrost areas.

These actions have resulted in a moderate adverse impact to ice-rich permafrost soils. Implementing Alternative 3 alone would have negligible adverse impacts on ice-rich permafrost soils. Together—with the activities previously described, there would still be only moderate adverse impacts to these physical resources, few of which are attributable to the actions under this alternative.

Conclusion

There would be negligible adverse impacts to ice-rich permafrost soils under Alternative 3. Use of snowmachines and dog sleds would increase slightly above current levels, and repeated passes of snowmachines and dog sleds over ice-rich permafrost soils would damage these soils. However, use would be mitigated or restricted if standards outlined for Management Areas D, E, OP1, and OP2 are approached or exceeded. The cumulative adverse impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be moderate. The level of impacts to ice-rich permafrost soils anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the natural integrity of the park.

ALTERNATIVE 4 (PREFERRED ALTERNATIVE)

The following analysis shows that there would be minor adverse impacts to ice-rich permafrost soils under Alternative 4. Impacts would be of low intensity, long-term duration, and would affect an important park resource. Use of snowmachines and dog sleds would increase above current levels, and repeated passes of snowmachines and dog sleds over ice-rich permafrost soils would damage these soils. However, use would be mitigated or restricted if standards outlined for Management Areas D, OP1, and OP2 are approached or exceeded.

Under this alternative, areas of the park that contain ice-rich permafrost soils would be zoned as Management Area D, OP1, or OP2. These management areas allow for very low to medium encounters, no landscape modifications, and low to medium trail and campsite disturbances (which include signs of social trails, campsites, or cut or broken vegetation). If standards in these categories are approached or exceeded, use would be curtailed or mitigated. Higher use levels would be accommodated along 147 linear miles of corridors in summer and 157 miles in winter. Since these higher use areas are not located where ice-rich permafrost soils are abundant, impacts to ice-rich permafrost soils would be minimal. While the types of management areas assigned to areas of the park that contain ice-rich permafrost soils are similar to those in alternatives 2 and 3, the application of those management areas allows for overall slightly higher levels of use in areas of the park that contain ice-rich permafrost soils (see management area maps in Chapter 2). Unless otherwise stated, all impacts would occur throughout the life of the plan.

Snowmachine use would increase over current numbers. Thus, localized impacts on ice-rich permafrost soils from snowmachine use would increase where ice-rich permafrost soils are prevalent (between the Stampede mine, Sushana River, and Wyoming Hills; and also in the flat areas west of Kantishna and north of Purkeypile). Impacts would be confined to routes where riders make multiple passes.

While the adequate snow cover requirement (see Chapter 3: Affected Environment) is intended to prevent these types of effects, they could occur because of the wide variety of terrain and climatic conditions of the park additions and preserve and because the determination of adequate snow cover applies to relatively large areas.

Most mushing in the park starts from the Healy area or the park entrance area to Wonder Lake either via the park road or via the Stampede/Clearwater/Moose Creek route. Use is also common from the Stampede area up the Toklat River. Except for the park road, these mushing routes cover extensive areas of permafrost soils. Impacts to ice-rich permafrost soils from dog sleds are similar to those described for snowmachines. Mushers tend to use established trails rather than construct new ones, and multiple passes over ice-rich permafrost soils damage insulating layers of snow, vegetation, and soil. This increases potential for permafrost degradation and the associated natural resource concerns of changes in hydrology and vegetation regimes.

Levels of dog-sled use could increase slightly above current numbers but impacts would be minimal because the Kantishna and Stampede areas would be zoned as Management Areas D and OP1, which accommodate low signs of human presence, and low trail and campsite disturbance. If impacts to ice-rich permafrost soils approach or exceed standards, use would be curtailed or mitigated to reduce impacts.

Cumulative Effects

Both technological improvements and community growth have led to an expansion of snowmachine use in the Denali park additions, including the northeastern additions west of Healy where ice-rich permafrost soils are found. In addition, the potential of trail clearance to Lake Minchumina could result in increasing snowmachine use in the northwestern park additions and preserve. The NPS authorization of dog freight and guided dog mushing concessions originating from the Stampede Road and Lake Minchumina also provided additional activity in the same ice-rich permafrost areas.

These actions have resulted in a moderate adverse impact to ice-rich permafrost soils. Implementing Alternative 4 alone would have minor adverse impacts on ice-rich permafrost soils. Together—with the activities previously described, there would still be only moderate adverse impacts to these physical resources, few of which are attributable to the actions under this alternative.

Conclusion

Impacts to ice-rich permafrost soils under Alternative 4 would be minor. Use of snowmachines and dog sleds would increase above current levels, and repeated passes of snowmachines and dog sleds over ice-rich permafrost soils would damage these soils. However, use would be mitigated or restricted if standards are approached or exceeded. There would be moderate adverse cumulative impacts of this alternative plus the aforementioned past, present, and reasonably foreseeable actions. The level of impacts to physical resources anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the natural integrity of the park.

ALTERNATIVE 5

Impacts to ice-rich permafrost soils under Alternative 5 would be moderate. Impacts would be of medium intensity, long term, and would affect an important park resource. Use of snowmachines and dog sleds would increase above current levels, and repeated passes of snowmachines and dog sleds over ice-rich permafrost soils would damage these soils. A corridor would be established in an area with abundant ice-rich permafrost soils, allowing for relatively high-use levels. However, use in the rest of the northern additions would be mitigated or restricted if standards outlined for Management Area B or D are approached or exceeded.

In this alternative, the old Mount McKinley National Park and the Denali additions north of the Alaska Range would be managed primarily for dispersed, self-reliant travel although no areas would be managed specifically to preserve opportunities for extended expeditions in remote locations. Areas along the park road and in Kantishna that presently receive a relatively high volume of use and large parts of the additions south of the Alaska Range would be managed for a greater intensity and variety of appropriate recreational activities and would have more visible management presence and opportunities for more services and facilities.

Under this alternative, areas of the park that contain ice-rich permafrost soils would be zoned as Management Area B or D. These management areas allow for low to medium encounters, no landscape modifications, and low trail and campsite disturbances (which include signs of social trails, campsites, or cut or broken vegetation). If standards in these categories are approached or exceeded, use would be curtailed or mitigated. Higher use would occur along 147 linear miles of summer corridors and 204 linear miles of winter corridors. The corridor designation would be applied to the area from Stampede to Kantishna, where ice-rich permafrost soils are abundant. Unless otherwise stated, all impacts would occur throughout the life of the plan.

Snowmachine use would increase greatly over current numbers, so localized impacts on ice-rich permafrost soils from snowmachine use would increase where ice-rich permafrost soils are prevalent (between the Stampede mine, Sushana River, and Wyoming Hills; and also in the flat areas west of Kantishna and north of Purkeypile). Impacts would be confined to routes where riders make multiple passes. A winter season corridor for recreation-related snowmachine access would be established to Kantishna from the Sushana River. This high-use area is located where ice-rich permafrost soils are prevalent.

While the adequate snow cover requirement (see Chapter 3: Affected Environment) is intended to prevent these types of impacts, they are still possible because of the wide variety of terrain and climatic conditions of the park additions and preserve and because the determination of adequate snow cover applies to relatively large areas.

Most mushing in the park starts from the Healy area or the park entrance area to Wonder Lake either via the park road or via the Stampede/Clearwater/Moose Creek route. Use is also common from the Stampede area up the Toklat River. Except for the park road, these mushing routes cover extensive areas of permafrost soils. Impacts to ice-rich permafrost soils from dog sleds are similar to those described for snowmachines. Mushers tend to use established trails rather than construct new ones, and multiple passes over ice-rich permafrost soils damage insulating layers of snow, vegetation, and soil. This increases potential for permafrost degradation and the associated natural resource concerns of changes in hydrology and vegetation regimes.

Levels of dog-sled use could increase above current numbers. The Kantishna and Stampede areas would be zoned as Management Area B, which allows for very little

evidence of modern human use and few encounters (visitors will occasionally encounter other parties). If impacts to ice-rich permafrost soils approach or exceed standards, use would be curtailed or mitigated to reduce impacts. Zoning in this alternative allows for more use than does the zoning in all other action alternatives (which zone the Kantishna and Stampede areas as Management Areas D and OP1).

Cumulative Effects

Both technological improvements and community growth have led to an expansion of snowmachine use in the Denali park additions, including the northeastern additions west of Healy where ice-rich permafrost soils are found. In addition, the potential of trail clearance to Lake Minchumina could result in increasing snowmachine use in the northwestern park additions and preserve. The NPS authorization of dog freight and guided dog mushing concessions originating from the Stampede Road and Lake Minchumina also provided additional activity in the same ice-rich permafrost areas.

These actions have resulted in a moderate adverse impact to ice-rich permafrost soils. Implementing Alternative 5 alone would have moderate adverse impacts on ice-rich permafrost soils because additional acres of ice-rich permafrost soils would be affected. The cumulative adverse impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be major.

Conclusion

Moderate adverse impacts to ice-rich permafrost soils would occur under Alternative 5. Use of snowmachines and dog sleds would increase above current levels, and repeated passes of snowmachines and dog sleds over ice-rich permafrost soils would damage these soils. A high-use corridor would be established in an area with abundant ice-rich permafrost soils. In other locations in the northern additions, use would be mitigated or restricted if standards outlined for Management Area B or D are approached or exceeded. The cumulative adverse impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be major. The level of impacts to physical resources anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the natural integrity of the park.

VEGETATION

This section analyzes the probable impacts to vegetation from the potential actions identified in this plan. For this analysis, vegetation includes vascular and non-vascular flora of Denali National Park and Preserve. The first part of this section provides an overview of the methodology used to evaluate impacts on vegetation, including a literature review of the types of impacts that could result from actions proposed in the plan. The second part is an analysis of the impacts likely to occur under each alternative.

GENERAL IMPACTS BASED ON LITERATURE REVIEW

Analysis of impacts of recreational and administrative activities on vegetation in Denali National Park and Preserve has relied primarily on a literature review of the types of impacts that can occur and on consultation with NPS subject matter experts and resource managers.

Loss of Vegetation

A variety of activities can contribute to loss of vegetation in the Denali backcountry. In severely impacted areas, the direct effects to vegetation from snowmachine use include the creation of trails where vegetation has been eliminated. Hiking and overnight camping activities can create informal trails that become established. These trails are typically devoid of vegetation and may gully and impound (in lowland areas).

Impacts to vegetation and wetlands in the Denali backcountry from facility construction can be assessed based on several decades of experience elsewhere in the park. The principal impact of visitor facilities on vegetation is the loss of vegetation as a result of facility construction.

Vegetation can also be lost due to human-caused fires. After examining the Yellowstone Fire Reports from 1931–2000, Warthin (2002) concluded that incidents of human-caused fire in Yellowstone National Park were higher near trails, roads, and campsites because human use is focused in these places. Fire history at Denali National Park indicates a similar trend (Dan Warthin, pers. comm.).

Trampling and Damage

The direct impacts to vegetation from snowmachine use include structural damage to plant tissues (compression, abrasion, stem breakage) (Neumann et al. 1974, Roland 2000). In ice-rich permafrost areas, trails can form impoundments, which can change plant community composition and promote erosion. Indirect impacts of snowmachine use include changes in the distribution of snow cover and in the thermal properties of the snow from compaction (Pesant et al. 1985). These changes in snow properties can

prematurely expose shrubs normally covered by snow; decrease snow density, reducing the insulating value of the snow (Wanek and Schumacher 1975); and increase the duration of snow cover on trails, thereby shortening the growing season for plants in those areas (Pesant et al. 1985).

The plant species most sensitive to these impacts are those species whose canopy extends above the snowline and/or that are common in thin snow areas. These species include willows (*Salix* spp.) and shrub birch (*Betula glandulosa*), mountain avens (*Dryas octopetala*), and blueberries (*Vaccinium* spp). Although no quantitative studies have been completed on the impacts of snowmachine use on vegetation in the Denali National Park area, visual assessments of effects have been made in the Bull River/Foggy Pass area and the Windy–Foggy–Easy Pass area (Roland 2000). Broken shrub stems, stripped bark (from abrasion), trail development, and late-melting snow were evident in high-use snowmachine areas. A Canadian study of the ecological effects of snowmachines found that, after a single pass in a stand of tree saplings, over 78% of the saplings were damaged, and woody stems up to 2.5 cm in diameter were susceptible to damage (Neumann and Merriam 1972).

Hiking and overnight camping activities can affect vegetation in several different ways. In some cases, trails can widen eventually (Lance et al. 1989), especially in moist meadows and bogs, and trail braiding will develop with increased traffic on wet or steep slopes. Shrub-dominated communities are slower to recover than grass-dominated communities (Cloe and Trull 1992). Lichens are particularly sensitive to trampling (Tietz 1996) and may not recover for several years in high-use trail areas in the alpine zone. In areas where camping is frequent, bare mineral surfaces can form from compaction and trampling (Monti and Mackintosh 1979).

Introduction of Exotic Species

Densmore, et al. (2001) inventoried exotic species in Denali National Park and Preserve and found that the park maintains the very fortunate position of not having a serious exotic species problem. Unlike most parks outside Alaska, Denali currently does not endure the financial burden associated with eradication efforts.

Pack animals and trails contribute to the introduction and spread of exotic species (Campbell and Gibson 2001, Hammit and Cole 1987, Benniger 1989). Examples of exotic species that could be introduced into Denali National Park and Preserve include *Hordeum* and *Chenopodium album*, or any other variety of agricultural weed that could end up in pack animal forage. Dust effects promote the establishment of invasive plant species, such as dandelion (*Taraxacum officinale*) that compete well in areas experiencing continued disturbance. Exotic plants have been seen on floatplanes in Alaska (pers comm.. Carl Roland 3/14/05). *Myriophyllum spicatum* is one example of an aquatic plant that has been introduced via airplane.

Denali National Park and Preserve's invasive species control plan consists primarily of monitoring invasive species along the park road corridor. Resource specialists react to

problems as they arise. For example, volunteers pull dandelions along the road corridor, and park staff have eradicated *Crepis tectorum* from the sewage lagoon area in the park's frontcountry.

Many natural landscapes in western North America are covered in exotic plant species, and that trend is starting to occur in Alaska. Resource experts believe that Alaska is on the cusp of a situation where species are starting to creep into interior Alaska at unprecedented rates (pers comm. Carl Roland 3/15/05). As exotic plants become more widespread, the probability of exotics spreading into Denali National Park and Preserve increases. Exotics currently exist at low densities in source areas like Fairbanks, but as densities of exotics increase in source areas, the probability of exotics spreading into the park increases. There are many indications that species are becoming invasive. Resource experts are particularly concerned about white sweet clover (*melilotus spp.*), which has become established on riverbars on the Nenana River and Teklanika River outside the park, and about bird vetch (*Vicia cracca*), which has invaded natural areas around Fairbanks and has appeared three times in the park (pers comm. Carl Roland 3/15/05).

ALTERNATIVE 1 (NO ACTION)

The following analysis shows that impacts to vegetation under Alternative 1 would be major because of loss of vegetation, trampling and, most importantly, introduction of exotic species from floatplane use and other vectors. While most of this resource is common, some impacts would be of high intensity and result in permanent change. This alternative would allow for substantial increases in types and levels of use; without management area prescriptions, desired future conditions, and indicators and standards, the park would have no formal process to determine when impact levels become severe enough to warrant management action. More people recreating in the backcountry would create more impacts to vegetation because of the potential for more physical trauma to sensitive plants and potential for more introduction of exotic and invasive species. Unless otherwise stated, all impacts would occur throughout the life of the plan.

Loss of Vegetation

In areas that are used commonly and repeatedly by visitors and large groups, such as along the park road and in the Kantishna area, repeated use would lead to loss of vegetation and social trail formation. Impacts would occur only in a localized area.

Trampling

Snowmachine use would cause trampling of vegetation in some areas with thin snow cover if use is heavy. As more users ride in popular snowmachine areas (Broad Pass and Tokositna areas, for example), more vegetation would be trampled. Both white spruce (*Picea glauca*) and willow (*Salix spp.*) up to 5 cm in diameter have been observed to have been run over (stems broken) by snowmachines on state lands west of Healy (Steve Carwile, pers. comm.).

The greatest potential for trampling and compacting vegetation would occur at the southern and eastern edges of the park where current snowmachine use is common and is expected to increase, and where sensitive peat communities exist. Sensitive peat communities exist south of the Alaska Range on older landscape surfaces, on elevations less than 3,000 feet, and in wetlands areas. They are generally clustered around the southern boundary of the park in the Yentna, Ruth, Tokositna, and Kahiltna lowlands.

Other communities that could be damaged by snowmachine use include restricted alpine communities, calcareous alpine sites, and sensitive areas north of the Stampede Road. Snowmachines can affect lowland vegetation by compacting snow, which changes temperature regimes and soil structure, thereby altering plant communities. Changes in relative abundance of species could occur, thereby changing the natural pattern of distribution. Snowmachine use would continue to be prohibited in the Old Park (35% of the total park area), but use would occur throughout the remaining 3,707,535 acres. As more users ride in popular snowmachine areas (Broad Pass and Tokositna areas, for example), more vegetation would be damaged, which could result in severe but localized impacts at some sites within those areas, especially in riparian areas where use is concentrated. The peat bogs along the southern boundary of the park would be especially susceptible, since these communities do not recover from disturbance very readily. These communities grow slowly because they exist in waterlogged soils in a nutrient-poor environment. Peat communities are rare in the park but occur elsewhere in the state. The adequate snow-cover requirement would be expected to mitigate most of these impacts.

Impacts to vegetation from snowmachine use are most likely to occur in high-use areas that can become snow-free during certain periods in the winter, or that have a thin snow cover that can be reduced further or compacted from snowmachine passes. Sensitive alpine plant communities and calcareous alpine sites are particularly vulnerable since these communities do not recover from disturbance very easily and because these alpine environments sometimes have lighter snow cover than surrounding areas. Areas of thin snow cover include mountain passes, exposed ridges, terraced edges, and areas with wind channeling. In addition, steep, south-facing slopes tend to become snow-free sooner than other areas in the spring. Also, because much of Denali National Park and Preserve has a continental climate, snow accumulation is highly variable from year to year. Low snow years are common, and vegetation that would normally be protected under snow may become exposed in areas with even light snowmachine traffic. While the adequate snow cover requirement (see Chapter 3: Affected Environment) is intended to prevent these types of impacts, they are still possible in some places because of the wide variety of terrain and climatic conditions of the park additions and preserve and because the determination of adequate snow cover applies to relatively large areas.

Trampling of vegetation, including wetland vegetation, would also occur from increases in hiking and camping. There would continue to be no limit on the number of times guided hiking groups could visit a particular area, and the group size limit would not apply to non-commercial groups. Impacts would be concentrated in high-use areas and

backcountry access points along the park road (around Polychrome, Stony, and Eielson) and in the Kantishna area (localized areas within about 3% of the total park area). These areas would have increasing foot traffic associated with established campgrounds and rest areas along the park road, and lodges in Kantishna, resulting in a radiating network of social trails. Similar impacts would increase eventually at popular destinations in the south additions, especially in the upper Tokositna River area including the Bear and Wildhorse Creek drainages (impacts would occur in localized areas within about 1% of the total park area). Impacts in all of these areas would increase in time because of unregulated day use, and—in the case of the south additions—the lack of management area designations and registration for backcountry camping. Eventually, as use increases and remains unregulated in the additions, high-use areas could be found at localized areas within more than 25% of the park (based on current use trends and access points); impacts would be concentrated at several individual sites within this portion of the park. Severe damage to vegetation would occur in areas of varying sizes, ranging up to several acres.

Increased use of mountain bikes would affect vegetation; however, use levels are currently presumed to be low as off-trail riding is very difficult. Severe but localized damage would occur at and near common access points (such as along the park road corridor and Kantishna) from vegetation crushing and development of trails that channel drainage and promote erosion. The affected area would likely be only a small part of the park (such as within 84,000 acres in the Kantishna Hills).

Pack animal use would increase over time leading to the crushing of vegetation. Increases in pack animal use would likely occur in Kantishna, the southwest preserve in connection with hunting, and the Cantwell area. The effected area would likely be only a small part of the park (such as localized areas within the Kantishna Hills, which is about 5% of the total park area); however, impacts could occur throughout most vegetated park areas.

Most dog mushing in the park starts from the Healy area or the park entrance area to Wonder Lake either via the park road or via the Stampede/Clearwater/Moose Creek route. Some mushing also occurs in the northwest preserve and in the Windy/Riley drainages. Impacts to vegetation from dog sleds are similar to those described for snowmachines, except that the extent of the disturbance would be less because dog sleds glide over the surface more easily than heavier snowmachines and they do not spin tracks. Stem breakage and abrasion are the most common impacts. Mushers tend to use established trails rather than break new ones, so the impacts would be confined to a smaller total area. In addition, mushing typically is confined to valleys and passes, rather than high alpine areas, so travel in windswept, snow-free areas is limited (Karen Fortier, pers. comm.). Consequently, alpine tundra is less affected by dog sleds than it would be by snowmachines. Dog sleds would crush vegetation along the park road corridor and along the north boundary of the park, but the impact would be focused on a very small area of the park.

Skiers generally use the park road and the Riley/Windy area. Levels of skier use would increase over current numbers, but impacts would be minimal because use of the park by skiers is generally low, and because skis by their very nature generally have negligible impacts on vegetation.

Introduction of Invasive Plant Species

The most severe adverse impact to vegetation would result from the introduction of exotic plant species from airplane landings, which would initially occur on the numerous lakes and ponds throughout the northern additions, and on tundra benches and along gravel bars in the southern additions. Exotics could be carried in by airplanes landing on dry ridges or at non-glaciated landing areas in the Dunkle, Yentna, Tokositna, Stampede, and Kantishna areas. Over time, invasive species could spread to most non-glaciated areas of the park. The introduction of invasive plant species would increase eventually and could displace native vegetation, alter the composition of plant communities, and disrupt ecological functions. Widespread plant invasions would be very difficult to control or reverse.

Pack animal use, hiking, mountain biking, and boat use would also increase over time leading to the introduction of invasive plant species. Likely locations of impacts resulting from introduction of exotics by pack animals would include the Kantishna Hills, parts of the southwest preserve, the Cantwell area, and areas of both the Old Park and park additions around the Stampede trail corridor. These are areas that have been used by pack animals in the past or would be easily accessed by pack animals in the future. The introduction of invasive plants from feeds that are not weed-free is one of the greatest impacts from use of pack animals. Without management area prescriptions, desired future conditions, and indicators and standards, the park would have no formal process to determine when impact levels become severe enough to warrant management action. The introduction of exotics from boat use would likely be localized to the streams where such use occurs.

Cumulative Effects

The expansion of communities and local road networks near the park's eastern and southern boundaries combined with technology improvements have enhanced access by snowmachine and dog sled in winter, raising use levels and the associated potential for trampling vegetation. This trend is likely to continue in the future and will be supplemented by access improvements and increased visitation associated with South Side Denali plan implementation, and possibly some level of legal ORV use associated with subsistence use, all of which could increase the potential for introducing exotic species as well as increased trampling both summer and winter. Trail construction within the Old Park and additional planned trail construction associated with both the 1997 *South Side Denali* and the 1997 *Entrance Area and Road Corridor* plans has resulted (and will result) in the direct removal of vegetation. Timber harvest for subsistence also removes vegetation.

These actions will result in moderate adverse impacts to the vegetation resources of the park. Implementing Alternative 1 could result in major adverse impacts on vegetation. There would be major adverse cumulative impacts from this alternative plus the aforementioned past, present, and reasonably foreseeable actions, of which this alternative accounts for the majority of impacts.

Conclusion

Under Alternative 1, major adverse impacts to vegetation would result from substantial increases in types and levels of use; without management area prescriptions, desired future conditions, and indicators and standards, the park would have no formal process to determine when impact levels become severe enough to warrant management action. More people recreating in the backcountry would create more impacts to vegetation because there would be more potential for physical trauma to sensitive plants and more potential for the introduction of exotic and invasive species (colonization of exotics could be very difficult to control or reverse). The cumulative adverse impact of this alternative plus past, present, and reasonably foreseeable actions would be major. The level of impacts to vegetation anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the natural integrity of the park.

ALTERNATIVE 2

The following analysis shows impacts to vegetation under Alternative 2 would be negligible because very little vegetation would be lost, trampling would occur only in small areas, and the introduction of exotic species would be unlikely. Impacts would be low in intensity, temporary, and would affect a resource that is considered common. Under this alternative, recreational and administrative activities would be reduced from current levels, and recreational users may be subject to additional conditions on use. This alternative would have the least impact to vegetation of all the alternatives because the levels of some activities, particularly snowmachine use, would be reduced in the park additions and preserve. Reducing use would reduce impacts on vegetation.

Under this alternative, 65% (3,920,360 acres) of the park would be zoned as Management Area D, OP2, or Management Area E. These management areas allow for low encounters, very little evidence of modern human use, no landscape modifications, and little, if any, trail and campsite disturbance (which includes signs of social trails, campsites, or cut or broken vegetation). If standards in these categories are approached or exceeded, use would be curtailed or mitigated. Only 60 linear miles would be zoned as a corridor, which would accommodate higher levels of use. Therefore, minimal adverse impacts to vegetation are likely to occur.

Unless otherwise stated, all impacts would occur throughout the life of the plan.

Loss of Vegetation

Adverse impacts from hiking and camping would be concentrated in high-use areas and backcountry access points along the park road (around Polychrome, Stony, and Eielson) and in the Kantishna area (impacts would occur at localized areas within about 3% of the park). Heavily used areas include places that are easily accessed from the park road like the Polychrome area, Stony, Eielson, and Wonder Lake/Kantishna areas. In these areas, some social trails would form; however, the impact would be mitigated by education and day-use registration in these areas. Registration would provide information that could be used to correlate visitation trends with impacts to vegetation and to help managers choose an appropriate access management tool if impacts exceed standards. Impacts would also be mitigated by the guided hiking requirement: the number of guided hikes to a particular location *for all guided groups together* would be strictly limited to two per season, except for hikes on gravel streambeds and in hiker areas (on constructed trails). This parkwide requirement would encourage use of hardened surfaces and dispersal of use. This requirement would substantially reduce the potential for social trail formation. The strategy to prevent social trail formation (see Chapter Two, Common to All Action Alternatives) would also help mitigate loss of vegetation by reducing the potential for social trail establishment.

In the northern park additions, winter trails established by snowmachine or dog sled are slower to melt out than the surrounding area. Slower melt out reduces the length of the summer season along these trails. Over time, plants may not be able to be as viable in these areas.

Trampling

Under this alternative, access by snowmachine, airplane, or motorboat to the park additions and preserves would only be allowed for traditional activities, as defined for the Old Park, except for airplanes at Portals. Trampling of vegetation from snowmachine use would be reduced since the number of riders engaged in traditional activities would be less than the number of riders that currently use the park. That, in addition to management area zoning, would reduce current levels of snowmachine use throughout the park additions and preserve. Fewer machines equate to fewer impacts to vegetation.

Additionally, airplanes and motorboats would not be allowed for recreational access to the Old Park, except that airplane access to the McKinley and Kantishna airstrips for recreation would continue. Guided activities and commercial services would be limited to the same volume of use that occurred in 2001, and the number of guided hikes to a particular location *for all guided groups together* would be strictly limited to two per season, except hikes on gravel streambeds and in hiker areas (on constructed trails). This restriction would apply parkwide. Collectively, these actions would result in a reduction in use and an emphasis on dispersed use. Less use and dispersed use mean fewer instances of trampling and compacting vegetation than occur presently.

Registration would be required for day-hiking in the Old Park outside of hiker areas during summer months, for day use in the southern park additions east of and including the Kahiltna Glacier during winter months, and for all overnight camping in the park and preserve. The registration requirement would allow park staff to better educate the visitor about low-impact techniques, thereby mitigating adverse impacts to vegetation. Registration would also provide information that could be used to correlate visitation trends with impacts to vegetation and help managers choose an appropriate access management tool if impacts exceed standards.

Climbers and mountaineers spend most of their time in un-vegetated, rocky, or glaciated terrain, thus their activities would minimally affect vegetation and wetlands. Only a small fraction of the mountaineering population starts their climbs in the shrub and forested zones. Indirect impacts, such as trampling, associated with these activities would result from the mode of access.

Damage to vegetation from mountain bike use would be minimal since very little off-trail riding would be expected to occur due to difficulty of riding off-trail. If standards in the trail disturbance category are approached or exceeded, use would be curtailed or mitigated.

Most mushing in the park starts from the Healy area or the park entrance area to Wonder Lake via the park road or the Stampede/Clearwater/Moose Creek route. Some mushing also occurs in the northwest preserve, in the Windy/Riley drainages, and from the Stampede area up the Toklat River. Impacts to vegetation from dog sleds would be similar to those described for snowmachines, except that the extent of the disturbance would be less because dog sleds glide over the surface more easily than heavier snowmachines and do not spin tracks. Stem breakage and abrasion are the most common impacts. Mushers tend to use established trails rather than construct new ones, so the impacts would be confined to a smaller total area. In addition, mushing typically is confined to valleys and passes, rather than high alpine areas, thus travel in windswept, snow-free areas is limited (Karen Fortier, pers. comm.). Consequently, alpine tundra is less affected by dog sleds than it would be by snowmachines.

Dog sleds would crush vegetation along the park road corridor and along the north boundary of the park, but the impact would focus on a very small area of the park. Use in areas such as Stampede and Kantishna that currently see the most use would not reach levels high enough to cause substantial impacts. Levels of dog-sled use could increase slightly above current numbers but impacts would be minimal because the Kantishna and Stampede areas would be zoned as Management Area D, which accommodates low encounters, low signs of human presence, and low trail and campsite disturbance. If impacts to vegetation approach or exceed standards, use would be curtailed or mitigated.

Skiers generally use the park road and the Riley/Windy area. Levels of skier use would probably not increase over current numbers, and impacts would be minimal because much of the park would be zoned as Management Area D, which accommodates low

encounters, and low trail and campsite disturbance. If impacts to vegetation approach or exceed standards, use would be curtailed or mitigated.

Introduction of Exotic Species

Because use of the park would be reduced from current levels, there would be less potential than currently exists for the introduction of exotic species. Under this alternative, the park would have a formal process to determine when impacts from the introduction of exotic species via pack animals become severe enough to warrant management action. Under this alternative, access by snowmachine, airplane, or motorboat to the park additions and preserves would only be allowed for traditional activities except for airplanes at portals, which are typically on glaciers where exotic species are less of a threat. Additionally, airplanes and motorboats would not be allowed for recreational access to the Old Park. These actions would reduce the potential for spread of exotics, especially introduction of aquatic exotics via float-plane landings.

Cumulative Effects

The expansion of communities and local road networks near the park's eastern and southern boundaries combined with technology improvements have enhanced access by snowmachine and dog sled in winter, raising use levels and the associated potential for trampling vegetation. This trend is likely to continue in the future and will be supplemented by access improvements and increased visitation associated with South Side Denali plan implementation, and possibly some level of legal ORV use associated with subsistence use, all of which could increase the potential for introducing exotic species as well as increased trampling both summer and winter. Trail construction within the Old Park and additional planned trail construction associated with both the 1997 *South Side Denali* and the 1997 *Entrance Area and Road Corridor* plans has resulted (and will result) in the direct removal of vegetation. Timber harvest for subsistence also removes vegetation.

These actions will result in moderate adverse impacts to the vegetation resources of the park. Implementing Alternative 2 alone would have negligible adverse impacts on vegetation. There would still be a moderate adverse cumulative impact of this alternative along with the aforementioned past, present, and reasonably foreseeable actions, none of which is attributable to the actions in this alternative.

Conclusion

Under this alternative, impacts to vegetation would be negligible because very little vegetation would be lost, trampling would occur only in small areas, and the introduction of exotic species would be unlikely. Recreational and administrative activities would be reduced from current levels, and recreational users could be subject to additional conditions on use. This alternative would have the least impact to vegetation of all the alternatives because the levels of some activities would be reduced in the park additions

and preserve. Reducing use would reduce physical trauma to vegetation and would reduce the risk of exotic species spreading into and throughout the park. There would still be a moderate adverse cumulative impact to vegetation resources. The level of impacts to vegetation anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the natural integrity of the park.

ALTERNATIVE 3

The following analysis shows impacts to vegetation under Alternative 3 would be minor because very little vegetation would be lost, trampling would occur only in small areas, and the potential for introduction of exotic species would exist but would not be high. Impacts to this common resource would be low to medium in intensity, and, should exotic species become introduced, impacts could persist over a long duration. Under this alternative, higher use would be focused along the park road, in Kantishna near the park road, and around the Ruth Glacier (along with existing mountaineering activity on the Kahiltna Glacier).

Under this alternative, 57% (3,396,305 acres) of the park would be zoned as Management Areas D, E, or OP2. These management areas allow for low encounters, very little evidence of modern human use, no landscape modifications, and little, if any, trail and campsite disturbance (which includes signs of social trails, campsites, or cut or broken vegetation). In addition, under this alternative, 33% (1,940,685 acres) of the park would be zoned as Management Area OP1 or Management Area B. These management areas allow for very little evidence of modern human use, no landscape modifications, and few encounters (visitors will almost always be alone). If standards in these categories are approached or exceeded, use would be curtailed or mitigated. Higher use levels would be accommodated in 4% of the park (259,552 acres) which is zoned as Management Area A and along 147 linear miles of corridors in summer and 157 linear miles in winter.

Unless otherwise stated, all impacts would occur throughout the life of the plan.

Loss of Vegetation

Under this alternative, the NPS would designate summer season corridor management areas on Skyline Drive, Moose Creek, and Eldorado mining access routes within Management Area A in Kantishna and seasonal hiker areas on a number of existing Kantishna trails used by guided hiking concessions in the area. Management area zoning would allow for a slight increase in hiking and camping use above current levels, thus some trampling and social trail formation would be expected near access corridors along the park road and in the upper Tokositna drainage on the south side of the park. In these areas, social trails are likely to form, resulting in lost vegetation along the trail. Also, established trails and corridors tend to create pressure for new trails, which would result in additional losses to vegetation. While these impacts would be noticeable in the Kantishna area, the area of impact would be small on a parkwide scale.

Impacts would be mitigated by education and day-use registration in these areas. Registration would provide information that could be used to correlate visitation trends with impacts to vegetation and help managers choose an appropriate access management tool if impacts exceed standards. Also, the strategy to prevent social trail formation (see Chapter Two, Common to All Action Alternatives) would help mitigate loss of vegetation by reducing the potential for social trail establishment.

Up to five designated campsites would be created in conjunction with the corridor areas in the Kantishna Hills. Where trails and campsites occur, vegetation would be lost. Increased incidents of human-caused fire are likely to occur near trails and campsites, resulting in burned vegetation. This loss would occur primarily in the Kantishna area.

In the northern park additions, winter trails established by snowmachine or dog sled are slower to melt out than the surrounding area. Slower melt out reduces the length of the summer season along these trails. Over time, plants may not be able to be as viable in these areas.

In the northern park additions, winter trails established by snowmachine or dog sled are slower to melt out than the surrounding area. Slower melt out reduces the length of the summer season along these trails. Over time, plants may not be in these areas.

Trampling

Under this alternative, access by snowmachine to the park additions and preserves would only be allowed for traditional activities, as defined for the Old Park, except on designated winter corridors. Trampling of vegetation from snowmachine use would be reduced throughout the park since the number of riders engaged in traditional activities would be less than the number of riders who currently use the park.

Establishing corridors would channel snowmachine use in the Broad Pass area; to the toes of the Ruth, Tokositna, and Kanikula glaciers from the Tokositna River; and along the Yentna, Tokositna, and Kantishna/Muddy Rivers. This would increase use in these areas and would lead to trampling of vegetation in areas that are very heavily used. The corridor designation allows for landscape modifications, very high encounter rate, and occasional social trails and cut or broken vegetation. Use of snowmachines along corridors would continue to increase and cause impacts until standards for these indicators are approached or exceeded.

Heavily used routes can have long-term effects on vegetation due to crushing and elimination of vegetation, and, in the most severe cases, changes in vegetation community structure. While the adequate snow cover requirement (see Chapter 3: Affected Environment) is intended to prevent these types of impacts, they are still possible in some places because of the wide variety of terrain and climatic conditions of the park additions and preserve and because the determination of adequate snow cover applies to relatively large areas.

Airplanes and motorboats would not be allowed for recreational access to the Old Park, except that airplane access to the McKinley and Kantishna airstrips for recreation would continue. Guided activities and commercial services would be limited to the same volume of use that presently occurs. These actions prevent areas from becoming overly used. This translates into fewer instances of trampling and compacting vegetation than if no new management action were taken.

Registration would be required for day-hiking in the Old Park outside of hiker areas during summer months, for day use in the southern park additions east of and including the Kahiltna Glacier during winter months, and for all overnight camping in the park and preserve. The registration requirement, along with operating a public lands information center at Broad Pass, would allow park staff to better educate the visitor about low-impact techniques, thereby mitigating adverse impacts to vegetation. Registration would provide information that could be used to correlate visitation trends with impacts to vegetation and help managers choose an appropriate access management tool if impacts exceed standards.

Climbers and mountaineers spend most of their time in un-vegetated, rocky, or glaciated terrain, so impacts to vegetation and wetlands from their activities would be minimal. Only a small fraction of the mountaineering population starts their climbs in the shrub and forested zones. Indirect impacts, such as trampling, associated with these activities would result from the mode of access.

Damage to vegetation from mountain bike use would be minimal since very little off-trail riding would be expected to occur due to difficulty of riding off-trail. If standards in the trail disturbance category are approached or exceeded, use would be curtailed or mitigated.

Most mushing in the park starts from the Healy area or the park entrance area to Wonder Lake via the park road or the Stampede/Clearwater/Moose Creek route. Some mushing also occurs in the northwest preserve, in the Windy/Riley drainages, and from the Stampede area up the Toklat River. Impacts to vegetation from dog sleds would be similar to those described for snowmachines, except that the extent of the disturbance would be less because dog sleds glide over the surface more easily than heavier snowmachines and do not spin tracks. Stem breakage and abrasion are the most common impacts. Mushers tend to use established trails rather than construct new ones, so the impacts would be confined to a smaller total area. In addition, mushing typically is confined to valleys and passes, rather than high alpine areas, thus limiting travel in windswept, snow-free areas (Karen Fortier, pers. comm.). Consequently, alpine tundra is less affected by dog sleds than it would be by snowmachines.

Dog sleds would crush vegetation along the park road corridor and along the north boundary of the park, but the impact would focus on a small area of the park. Use in areas such as Stampede and Kantishna that currently see the most use would not reach levels high enough to cause substantial impacts. Levels of dog-sled use would increase

slightly above current numbers but impacts would be minimal because the Kantishna and Stampede areas would be zoned as Management Area D, which accommodates low encounters, low signs of human presence, and low trail and campsite disturbance. If impacts to vegetation approach or exceed standards, use would be curtailed or mitigated.

Skiers generally use the park road and the Riley/Windy area. Levels of skier use could increase to slightly more than current numbers, but impacts would be minimal because much of the park would be zoned as Management Area D, which accommodates low encounters, and low trail and campsite disturbance. If impacts to vegetation approach or exceed standards, use would be curtailed or mitigated.

Operating a public lands information center at Broad Pass would provide an opportunity to educate winter recreationists about low-impact techniques, thereby helping to mitigate adverse impacts to vegetation from winter uses such as snowmachine use and dog mushing.

Introduction of Exotic Species

Through management area zoning, this alternative would allow increases in levels of use in most parts of the park additions and preserve. Increased use of pack animals, hikers, and airplanes would increase the potential for introduction of exotic species because there would be more vectors to transport exotics. In addition, trail construction would contribute to the potential for introduction of exotics because materials used in trail construction could contain exotic species. The National Park Service would designate hiker areas and (if needed) improve some social trails presently used by guided hiking concessions within Management Area A in Kantishna. Trails provide easier access so they typically attract greater numbers of people than off-trail areas. More trails equate to higher use and higher use creates a greater potential for the introduction of exotics. Trails are especially susceptible to colonization of exotics because exotics can more easily colonize disturbed areas that are free of vegetation. The introduction of exotic plant species could displace native vegetation, alter the composition of plant communities, and disrupt ecological functions.

Under this alternative, airplane landings and motorboat access to the Old Park would not be allowed. This would decrease the potential for introduction of exotic species, especially aquatic species that could be introduced via motorboats or float planes. In addition, the park would have a formal process to determine when impacts from the introduction of exotic species via pack animals become severe enough to warrant management action.

Cumulative Effects

The expansion of communities and local road networks near the park's eastern and southern boundaries combined with technology improvements have enhanced access by snowmachine and dog sled in winter, raising use levels and the associated potential for

trampling vegetation. This trend is likely to continue in the future and will be supplemented by access improvements and increased visitation associated with South Side Denali plan implementation, and possibly some level of legal ORV use associated with subsistence use, all of which could increase the potential for introducing exotic species as well as increased trampling both summer and winter. Trail construction within the Old Park and additional planned trail construction associated with both the 1997 *South Side Denali* and the 1997 *Entrance Area and Road Corridor* plans has resulted (and will result) in the direct removal of vegetation. Timber harvest for subsistence also removes vegetation.

These actions will result in moderate adverse impacts to the vegetation resources of the park. Implementing Alternative 3 alone would have minor adverse impacts on vegetation. Taken together, there would be moderate adverse cumulative impacts of this alternative plus the aforementioned past, present, and reasonably foreseeable actions, of which this alternative would contribute only a small portion.

Conclusion

Under this alternative, impacts to vegetation would be minor because very little vegetation would be lost, trampling would occur only in small areas, and the potential for introduction of exotic species would exist but would not be high. Snowmachine use would be reduced in the park additions and preserve, and guided hiking would remain at current levels. These actions would have a beneficial effect on vegetation compared to the current condition. However, establishing higher use corridors and zoning the park to accommodate higher use levels in some areas would increase the potential for trampling of vegetation and introduction of exotic species. Disturbance would occur at access points (such as social trail formation in the Old Park from hikers) and along snowmachine corridors, but the affected area would be small when compared to the rest of the park. The cumulative impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be moderate. The level of impacts to vegetation anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or are essential to the natural integrity of the park.

ALTERNATIVE 4 (PREFERRED ALTERNATIVE)

The following analysis shows that impacts to vegetation under this alternative would be moderate because some vegetation would be lost, trampling would occur in various locations throughout roughly eleven percent of the park, and the potential for introduction of exotic species is considerable. This alternative would provide a variety of appropriate wilderness recreational activities and experiences by establishing areas to serve those visitors who want to experience the wilderness resource values of the Denali backcountry but require services, assistance, or short time-commitments. The areas would be focused along the park road; in Kantishna near the park road; at the Ruth, Tokositna, and Kahiltna Glaciers; and in the Dunkle Hills/Broad Pass area.

Under this alternative, 55% of the park (3,313,878.5 acres) would be zoned as Management Area D or OP2. These management areas allow for low encounters, very little evidence of modern human use, no landscape modifications, and few, if any, trail and campsite disturbances (which include signs of social trails, campsites, or cut or broken vegetation). In addition, under this alternative, 29% of the park (1,738,804 acres) would be zoned as Management Area OP1 or Management Area B. These management areas allow for very little evidence of modern human use, no landscape modifications, and few encounters (visitors will almost always be alone). If standards in these categories are approached or exceeded, use would be curtailed or mitigated. Therefore, minimal adverse impacts to vegetation are likely to occur in a large portion of the park (84% of the total park area falls within one of the aforementioned management areas).

Under this alternative, 11% of the park (668,314 acres) would be designated as Management Area A, and 147 linear miles of summer corridors and 157 linear miles of winter corridors would be designated. The expectation in these areas would be to encounter up to five parties a day in Management Area A and up to ten parties a day along a corridor. These areas also allow for occasional trails, campsites, or cut or broken vegetation before use would be curtailed or the impacts mitigated. The remaining four percent of the park would be zoned as Management Area C; this area would accommodate higher use levels, but this region of the park is largely un-vegetated.

Unless otherwise stated, all impacts would occur throughout the life of the plan.

Loss of Vegetation

The National Park Service would designate hiker areas and (if needed) construct or improve the following:

- some of the existing social trails within Management Area A in Kantishna.
- the trail from Eielson Visitor Center to Gorge Creek
- the trail from the water tower above Wonder Lake Campground up to the bench west of Wonder Lake
- the Mount Healy trail extension
- the area along Wildhorse Creek connecting to trails associated with the South Denali visitor facilities development.

Constructing trails in these areas would require removing vegetation.

Management area zoning would allow for increases in hiking and camping so some trampling and social trail formation would be expected around Kantishna, near access corridors along the park road, and in the upper Tokositna drainage on the south side of the park. In these areas, social trails are likely to form, resulting in lost vegetation along the trail. Also, established trails and corridors tend to create pressure for new trails, which would result in additional losses to vegetation. While these impacts would be noticeable in the Kantishna area and along the park road corridor, the area of impact would be small on a parkwide scale.

Impacts would be mitigated by the requirement that all guided cross-country hikes would be subject to the group size limit of 12 including guides and would be required to have a group leader who is trained in leave-no-trace principles for tundra environments generally and Denali National Park in particular. The strategy to prevent social trail formation (see Chapter Two, Common to All Action Alternatives) would help mitigate loss of vegetation by reducing the potential for social trail establishment.

Up to five designated campsites would be created in conjunction with the corridor areas in the Kantishna Hills. Where trails and campsites occur, vegetation would be lost. Increased incidents of human-caused fire are likely to occur near trails and campsites, resulting in burned vegetation. Summer corridor areas would receive high levels of use and social trails would form in these areas. Loss of vegetation would occur primarily in the Kantishna area, along the park road corridor, and in the Wildhorse Creek drainage on the south side (impacts would occur at localized areas within about 16% of the total park area).

In the northern park additions, winter trails established by snowmachine or dog sled are slower to melt out than the surrounding area. Slower melt out reduces the length of the summer season along these trails. Over time, plants may not be able to be as viable in these areas.

Trampling

Under this alternative, access by snowmachine to the park additions and preserves would be allowed to continue and to grow. Designating corridors for winter use would focus snowmachine use in the following places: from the southern park boundary to the Old Park boundary near the West Fork Chulitna and Cantwell Creek; to the toes of the Ruth, Tokositna, and Kanikula glaciers from the Tokositna River; along the Yentna, Tokositna, and Kantishna/Muddy Rivers. In a future wilderness proposal, accommodation would be made as necessary for recreational snowmachine access along winter corridors and throughout those areas designated as Management Area A (11% of the total park area and along 157 linear miles of corridors). Trampling of vegetation from snowmachine use would increase as use increases. Vegetation in these high-use areas would be trampled and compacted by repeated passes of snowmachines. The peat lands along the southern boundary of the park would be especially susceptible because they are inherently susceptible to trampling and because use in these areas is expected to increase.

Heavily used routes can have long-term effects on vegetation due to crushing and elimination of vegetation, and, in the most severe cases, changes in vegetation community structure. While the adequate snow cover requirement (see Chapter 3: Affected Environment) is intended to prevent these types of impacts, they are still possible in some places because of the wide variety of terrain and climatic conditions of the park additions and preserve and because the determination of adequate snow cover applies to relatively large areas.

Registration would be required for overnight use east of and including the Kahiltna Glacier. The registration requirement, along with operating a public lands information center at Broad Pass, would allow park staff to better educate the visitor about low-impact techniques, thereby helping to mitigate adverse impacts to vegetation from hiking and winter uses such as snowmachine use and dog mushing. Registration would provide information that could be used to correlate visitation trends with impacts to vegetation and help managers choose an appropriate access management tool if impacts exceed standards.

Damage to vegetation from mountain bike use would be minimal since very little off-trail riding would be expected to occur due to difficulty of riding off-trail. If standards in the trail disturbance category are approached or exceeded, use would be curtailed or mitigated.

Most mushing in the park starts from the Healy area or the park entrance area to Wonder Lake via the park road or the Stampede/Clearwater/Moose Creek route. Some mushing also occurs in the northwest preserve, in the Windy/Riley drainages, and from the Stampede area up the Toklat River. Impacts to vegetation from dog sleds would be similar to those described for snowmachines, except that the extent of the disturbance would be less because dog sleds glide over the surface more easily than heavier snowmachines and do not spin tracks. Stem breakage and abrasion are the most common impacts. Mushers tend to use established trails rather than construct new ones, so the impacts would be confined to a smaller total area. In addition, mushing typically is confined to valleys and passes, rather than high alpine areas, thus travel in windswept, snow-free areas is limited (Karen Fortier, pers. comm.). Consequently, alpine tundra is less affected by dog sleds than it would be by snowmachines.

Dog sleds would crush vegetation along the park road corridor and along the north boundary of the park, but the impact would be focused on a small area of the park. Use in areas such as Stampede and Kantishna that currently see the most use would not reach levels high enough to cause substantial impacts. Levels of dog-sled use would increase slightly above current numbers but impacts would be minimal because most of the Kantishna and Stampede areas would be zoned as Management Area B, which accommodates medium encounters, low signs of human presence, and low trail and campsite disturbance. If impacts to vegetation approach or exceed standards, use would be curtailed or mitigated.

Skiers generally use the park road and the Riley/Windy area. Levels of skier use would increase to slightly more than current numbers, but impacts would be minimal because much of the park would be zoned as Management Area D, which accommodates low encounters, and low trail and campsite disturbance. If impacts to vegetation approach or exceed standards, use would be curtailed or mitigated.

Operating a public lands information center at Broad Pass would provide an opportunity to educate winter recreationists about low-impact techniques, thereby helping to mitigate adverse impacts to vegetation from winter uses like snowmachine use and dog mushing.

Introduction of Exotic Species

Through management area zoning, this alternative would allow for increases in levels of use throughout the park additions and preserve. Increased use from pack animals, hikers, boats, and airplanes would increase the potential for introduction of exotic species. However, the park would have a formal process to determine when impacts from the introduction of exotic species via pack animals and other vectors become severe enough to warrant management action.

The most severe adverse impact to vegetation would result from the introduction of exotic plant species from airplane landings. Introduction of aquatic exotic species could become especially problematic in the northern addition where increases in motorboat use and float plane landings could increase the spread of exotics. Exotics could also be carried in by airplanes landing on dry ridges or at non-glaciated landing areas in the Dunkle, Yentna, Tokositna, Stampede, and Kantishna areas.

Trail construction would also contribute to the potential for introduction of exotics because materials used in trail construction could contain exotic species. The National Park Service would designate hiker areas and (if needed) construct or improve the following:

- some of the existing social trails within Management Area A in Kantishna.
- the trail from Eielson Visitor Center to Gorge Creek
- the area from the water tower above Wonder Lake Campground up to the bench west of Wonder Lake
- the Mount Healy trail extension
- the area along Wildhorse Creek connecting to trails associated with the South Denali visitor facilities development.

Trails provide easier access so they typically attract greater numbers of people than off-trail areas. More trails equate to higher use and higher use creates a greater potential for the introduction of exotics. Trails are especially susceptible to colonization of exotics because exotics can more easily colonize disturbed areas that are free of vegetation. Trails that originate along the road corridor (at Eielson, Wonder Lake, and Kantishna) would connect a disturbed area (the park road corridor) to an undisturbed area, facilitating the spread of exotics into the backcountry. The introduction of exotic plant species could displace native vegetation, alter the composition of plant communities, and disrupt ecological functions.

Impacts from exotic species in a management scenario that uses a formal process, such as management area zoning and the use of indicators and standards that is proposed under Alternative 4, would be less than in a situation where no formal process exists and managers react to impacts on a case by case basis. A formal process to guide management decisions would allow managers to focus monitoring and mitigation efforts. Still, under this alternative, it could be difficult to monitor all areas that would be most susceptible to the spread of exotic species because there are many areas and some are very remote.

Cumulative Effects

The expansion of communities and local road networks near the park's eastern and southern boundaries combined with technology improvements have enhanced access by snowmachine and dog sled in winter, raising use levels and the associated potential for trampling vegetation. This trend is likely to continue in the future and will be supplemented by access improvements and increased visitation associated with South Side Denali plan implementation, and possibly some level of legal ORV use associated with subsistence use, all of which could increase the potential for introducing exotic species as well as increased trampling both summer and winter. Trail construction within the Old Park and additional planned trail construction associated with both the 1997 *South Side Denali* and the 1997 *Entrance Area and Road Corridor* plans has resulted (and will result) in the direct removal of vegetation. Timber harvest for subsistence also removes vegetation.

These actions will result in moderate adverse impacts to the vegetation resources of the park. Implementing Alternative 4 would have moderate adverse impacts on vegetation. The cumulative adverse impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be major.

Conclusion

Under this alternative, impacts to vegetation would be moderate because some vegetation would be lost, trampling would occur in various areas throughout roughly 11% of the park, and the potential for introduction of exotic species from new trail construction is considerable. This alternative would provide a variety of appropriate wilderness recreational activities and experiences by establishing areas to serve those visitors who want to experience the wilderness resource values of the Denali backcountry but require services, assistance, or short time-commitments. These areas would be focused along the park road; in Kantishna near the park road; at the Ruth, Tokositna, and Kahiltna Glaciers; and in the Dunkle Hills/Broad Pass area. Increases in use would be expected to increase parkwide; however, use would be curtailed or mitigated if impacts to vegetation approach or exceed standards outlined in chapter 2. The cumulative adverse impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be major. The level of impacts to vegetation anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the natural integrity of the park.

ALTERNATIVE 5

The following analysis shows that impacts to vegetation under this alternative would be major because some vegetation would be lost, trampling would occur in localized areas within roughly eighteen percent of the park, and the potential for introduction of exotic species from new trail construction and increased use is high. Impacts to this resource

would be of high intensity, and some changes would be permanent. In this alternative, the old Mount McKinley National Park and the Denali additions north of the Alaska Range would be primarily managed for dispersed, self-reliant travel although no areas would be managed specifically to preserve opportunities for extended expeditions in remote locations. Areas along the park road and in Kantishna that presently receive a relatively high volume of use and large parts of the additions south of the Alaska Range would be managed for a greater intensity and variety of appropriate recreational activities and would have more visible management presence and opportunities for more services and facilities.

Under this alternative, vegetation impacts would be greater than in the other action alternatives because of management area zoning and additional trail and campsite development. Under this alternative, only 16% of the park (941,624 acres) would be zoned as Management Area D or OP2. These management areas allow for low encounters, very little evidence of modern human use, no landscape modifications, and few, if any, trail and campsite disturbances (which include signs of social trails, campsites, or cut or broken vegetation). Another 66% of the park (3,956,539 acres) would be zoned as Management Area B. This management area would allow for very little evidence of modern human use, no landscape modifications, and few encounters (visitors will almost always be alone). If standards in these categories are approached or exceeded, use would be curtailed or mitigated. Under this alternative, 18% of the park (1,066,218 acres) would be zoned as Management Area A, and there would be 147 linear miles of summer corridors and 204 linear miles of winter corridors. The expectation in these areas would be to encounter up to five parties a day in Management Area A and up to ten parties a day along a corridor. These areas also allow for occasional trails, campsites, or cut or broken vegetation before use would be curtailed or the impacts mitigated.

Unless otherwise stated, all impacts would occur throughout the life of the plan.

Loss of Vegetation

Management area zoning would allow for increases in hiking and camping, consequently some trampling and social trail formation would be expected around Kantishna, near access corridors along the park road, and in the upper Tokositna drainage on the south side of the park. In these areas, social trails are likely to form, resulting in lost vegetation along the trail. Also, established trails and corridors tend to create pressure for new trails, which would result in additional losses to vegetation. These impacts would be noticeable in the Kantishna area, along the park road corridor and in the southern portion of the park designated as Management Area A.

The National Park Service would designate hiker areas and (if necessary) construct or improve the following:

- some existing social trails within Management Area A in Kantishna
- a trail from Eielson Visitor Center to Gorge Creek

- a trail from the water tower above Wonder Lake Campground up to the bench west of Wonder Lake
- a trail from the west end of Thorofare Bluffs down to the Thorofare River bar
- the Mount Healy trail extension
- the area along Wildhorse Creek connecting to trails associated with the South Denali visitor facilities development.

If demand is sufficient, additional trails could be constructed and hiker or corridor management areas could be designated in the future within the designated Management Area A in the lowland areas surrounding the lower Kahiltna, Tokositna, and Ruth glaciers. The National Park Service would establish additional designated trails in other locations designated Management Area A only if necessary to prevent resource damage. The NPS would designate and brush ski trails in the entrance area (Riley Creek area) of the park. The spring multi-use trail would be upgraded to make it usable in early winter low-snow conditions, and it would be extended from Mile 7 to Savage Campground. These actions would result in the permanent removal of vegetation along the proposed trails. Trail development in some of these places would unavoidably go through wetlands (for example, near Wonder Lake and the Thorofare River).

The impacts from social trail formation would be somewhat mitigated by the requirement that all guided cross-country hikes would be subject to the group size limit of 12 including guides and would be required to have a group leader who is trained in Leave-No-Trace principles for tundra environments generally and Denali National Park in particular. The strategy to prevent social trail formation (see Chapter Two, Common to All Action Alternatives) would help mitigate loss of vegetation by reducing the potential for social trail establishment.

Up to five designated campsites would be created in conjunction with the corridor areas in the Kantishna Hills and up to three sites would be created in conjunction with the corridor area in the Wildhorse Creek drainage. Where trails and campsites occur, vegetation would be lost. Increased incidences of human-caused fire are likely to occur near trails and campsites, resulting in burned vegetation. Summer corridor areas would receive high levels of use and social trails would form in these areas. Loss of vegetation would occur primarily in the Kantishna area, along the park road corridor, and in the Wildhorse Creek drainage on the south side (impacts could be expected in localized areas within about 19% of the total park area).

In the northern park additions, winter trails established by snowmachine or dog sled are slower to melt out than the surrounding area. Slower melt out reduces the length of the summer season along these trails. Over time, plants may not be able to be as viable in these areas.

Trampling

Under this alternative, access by snowmachine to the park additions and preserves would be allowed to continue and to grow. Designating corridors for winter use would focus snowmachine use in the following places: from the southern park boundary to the Old Park boundary near the West Fork Chulitna and Cantwell Creek; to the toes of the Ruth, Tokositna, and Kanikula glaciers from the Tokositna River; to Kantishna from the Sushana River; along the Yentna, Tokositna, and Kantishna/Muddy Rivers. In a future wilderness proposal, accommodation would be made as necessary for recreational snowmachine access along the winter season corridors and throughout those areas designated as Management Area A (18% of the total park area plus 204 linear miles of winter corridors). Trampling of vegetation from snowmachine use would increase as use increases. Vegetation in these high-use areas would be trampled and compacted by repeated passes of snowmachines. The peat lands along the southern boundary of the park would be especially susceptible because they are inherently susceptible to trampling and because use in these areas is expected to increase.

Heavily used routes can have long-term effects on vegetation due to crushing and elimination of vegetation, and, in the most severe cases, changes in vegetation community structure. While the adequate snow cover requirement (see Chapter 3: Affected Environment) is intended to prevent these types of impacts, they are still possible in some places because of the wide variety of terrain and climatic conditions of the park additions and preserve and because the determination of adequate snow cover applies to relatively large areas.

Operating a public lands information center at Broad Pass would provide an opportunity to educate winter recreationists about low-impact techniques, thereby helping to mitigate adverse impacts to vegetation from winter uses such as snowmachine use and dog mushing.

The NPS would designate summer season corridor management areas on Skyline Drive, Moose Creek, and Eldorado mining access routes within Management Area A in Kantishna, and along Wildhorse Creek connecting to trails associated with the South Denali visitor facilities development. Increases in use in these areas would lead to trampling of vegetation along these corridors.

Climbers and mountaineers spend most of their time in un-vegetated, rocky, or glaciated terrain, so impacts to vegetation and wetlands from their activities would be minimal. Only a small fraction of the mountaineering population starts their climbs in the shrub and forested zones. Indirect impacts associated with these activities would result from the mode of access.

Damage to vegetation from mountain bike use would be minimal since very little off-trail riding would be expected to occur due to difficulty of riding off-trail. If standards in the trail disturbance category are approached or exceeded, use would be curtailed or mitigated.

Most mushing in the park starts from the Healy area or the park entrance area to Wonder Lake via the park road or the Stampede/Clearwater/Moose Creek route. Some mushing also occurs in the northwest preserve, in the Windy/Riley drainages, and from the Stampede area up the Toklat River. Impacts to vegetation from dog sleds would be similar to those described for snowmachines, except that the extent of the disturbance would be less because dog sleds glide over the surface more easily than heavier snowmachines and do not spin tracks. Stem breakage and abrasion are the most common impacts. Mushers tend to use established trails rather than construct new ones, so the impacts would be confined to a smaller total area. In addition, mushing typically is confined to valleys and passes, rather than high alpine areas, thus travel in windswept, snow-free areas is limited (Karen Fortier, pers. comm.). Consequently, alpine tundra is less affected by dog sleds than it would be by snowmachines.

Dog sleds would crush vegetation along the park road corridor and along the north boundary of the park, but the impact would be focused on a small area of the park. Use in areas such as Stampede and Kantishna that currently see the most use would not reach levels high enough to cause substantial impacts. Levels of dog-sled use would increase slightly above current numbers but impacts would be minimal because most of the Kantishna and Stampede areas would be zoned as Management Area B, which accommodates medium encounters, low signs of human presence, and low trail and campsite disturbance. The Windy/Riley area would be zoned as Management Area A, which would accommodate higher levels of use. If impacts to vegetation approach or exceed standards, use would be curtailed or mitigated.

Skiers generally use the park road and the Riley/Windy area. Levels of skier use would increase to slightly more than current numbers, but impacts would be minimal because much of the park would be zoned as Management Area D, which accommodates low encounters, and low trail and campsite disturbance. If impacts to vegetation approach or exceed standards, use would be curtailed or mitigated.

Introduction of Invasive Species

Through management area zoning, this alternative would allow for increases in levels of use throughout the park additions and preserve. Increased use from pack animals, hikers, boats, and airplanes would increase the potential for introduction of exotic species. Exotic species could displace natural native plant species and disrupt ecological functions. However, the park would have a formal process to determine when impacts from the introduction of exotic species via pack animals and other vectors become severe enough to warrant management action.

The most severe adverse impact to vegetation would result from the introduction of exotic plant species from airplane landings and from trails. Introduction of aquatic exotic species could become especially problematic in the northern addition where increases in motorboat use and float-plane landings could increase the spread of exotics. Exotics could be carried in by airplanes landing on dry ridges or at non-glaciated landing areas in the Dunkle, Yentna, Tokositna, Stampede, and Kantishna areas.

Trail construction would contribute to the potential for introduction of exotics because materials used in trail construction could contain exotic species. Trail construction would occur primarily in areas zoned as Management Area A (about 18% of the park), primarily in the Kantishna area and in the lowland areas surrounding the lower Kahiltna, Tokositna, and Ruth glaciers. Trails provide easier access so they typically attract greater numbers of people than off-trail areas. More trails equate to higher use and higher use creates a greater potential for the introduction of exotics. Trails are especially susceptible to colonization of exotics because exotics can more easily colonize disturbed areas that are free of vegetation. Parklands along the southern boundary would be especially susceptible to invasion by non-native species if they were connected via a trail to a non-park area that harbors invasive species. Trails that originate along the road corridor (at Eielson, Thorofare, Wonder Lake, and Kantishna) would connect a disturbed area (the park road corridor) to an undisturbed area, facilitating the spread of exotics into the backcountry.

Impacts from exotic species in a management scenario that uses a formal process, such as management area zoning and the use of indicators and standards that is proposed under Alternative 5, would be less than in a situation where no formal process exists and managers react to impacts on a case by case basis. A formal process to guide management decisions would allow managers to focus monitoring and mitigation efforts. Still, under this alternative, it could be very difficult to monitor all areas that would be most susceptible to the spread of exotic species because there are many areas and trails, and many of the areas are very remote. Under this management scenario, high use levels and development of trails could lead to a situation whereby exotic species are introduced and become very difficult to eradicate. This could have severe implications for a park that until now has had only few problems with exotic species invasions.

Cumulative Effects

The expansion of communities and local road networks near the park's eastern and southern boundaries combined with technology improvements have enhanced access by snowmachine and dog sled in winter, raising use levels and the associated potential for trampling vegetation. This trend is likely to continue in the future and will be supplemented by access improvements and increased visitation associated with South Side Denali plan implementation, and possibly some level of legal ORV use associated with subsistence use, all of which could increase the potential for introducing exotic species as well as increased trampling both summer and winter. Trail construction within the Old Park and additional planned trail construction associated with both the 1997 *South Side Denali* and the 1997 *Entrance Area and Road Corridor* plans has resulted (and will result) in the direct removal of vegetation. Timber harvest for subsistence also removes vegetation.

These actions will result in moderate adverse impacts to the vegetation resources of the park. Implementing Alternative 5 would have major adverse impacts on vegetation. The cumulative adverse impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be major.

Conclusion

Under this alternative, impacts to vegetation would be major because some vegetation would be lost, trampling would occur in various areas throughout roughly 18% percent of the park, and most importantly, the potential for introduction of exotic species from new trail construction and increased use levels is very high. The most severe impacts would occur at access points and along snowmachine corridors. Increases in both winter and summer recreational activities across the entire park and preserve would cause adverse impacts to vegetation. Social trail formation would occur along the park road, around Kantishna, and along the Wildhorse Creek drainage. Snowmachine use would be widespread, with the greatest impacts occurring throughout large corridors. New trail construction would lead to loss of vegetation. The cumulative impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be major. The level of impacts to vegetation anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or are essential to the natural integrity of the park.

WILDLIFE

The wildlife section presents a literature review of the types of impacts on wildlife that can result from the various visitor activities that could occur in the park and preserve, outlines the impacts thresholds used to determine the magnitude of effects on wildlife, and provides an analysis of the impacts likely to occur under each alternative.

GENERAL IMPACTS ON WILDLIFE

Analysis of impacts of recreational activities on wildlife in Denali National Park and Preserve has relied primarily on:

- studies and reports compiled for an environmental assessment of closure of the Old Park in Denali National Park and Preserve to snowmachine use
- a review of the effects of winter recreation on wildlife in Yellowstone National Park (Oliff et al. 1999)
- studies and reports cited in the draft environmental impact statement for the winter use plan for Yellowstone and Grand Teton National Parks
- studies and reports cited in *Effects of Recreation on Rocky Mountain Wildlife: A Review for Montana* (Joslin and Youmans, 1999)
- a book on wildlife and recreational use (Knight and Gutzwiller 1995)

In combination, these references provide an excellent summary of the available literature on effects of recreational activities on wildlife. The environmental consequences to wildlife of recreational activities outlined in the Denali Backcountry Management Plan would vary for different species and activities.

Specific research on the effects of backcountry recreational activities on wildlife in Denali National Park and Preserve includes a wolf study by Chapman (1977) and several analyses of the effects of visitor use along the road corridor. Research on the effects of the park road and vehicular traffic with its associated human activities includes several studies over the past 25 years: Tracy 1977, Dean and Tracy 1979, Singer and Beattie 1986, Dalle-Molle and Van Horn 1991, Taylor et al. 1997, and Burson et al. 2000.

Snowmachine Use and other Winter Activities

Several studies have been conducted that show the direct impact of repeated snowmachine use on wildlife behavior and levels of physiological stress (Aune 1981; Dorrance et al., 1975; Freddy et al., 1986; Moen et al., 1982; Neumann and Merriam, 1972; Rudd and Irwin, 1985; Simpson 1987; Tyler 1991; Voyageurs National Park 1996). These studies indicate that exposure of wildlife to snowmachine use can result in behavioral alteration, habitat avoidance, and increased energy expenditures. These changes could occur at critical times when animals are under extreme stress, especially during winter, when energy conservation is crucial. As winter progresses, animals can experience an energy deficit, as more energy is used to survive than is replenished. The

survival of individual animals depends on the severity of energy expenditures as well as the animal's energy stores.

Ungulates: Caribou, Dall Sheep, Moose

Creel et al. (2002) completed a study of the effects of snowmachine activity on elk and wolves, focusing on the occurrence of stress-related hormones (glucocorticoids [GCs]) in fecal samples in areas with differing levels of snowmachine use in Yellowstone, Voyageurs, and Isle Royale national parks. Chronically elevated GC levels have been associated with a variety of problems including reduced reproduction, ulcers, muscle wasting, and immune suppression. This study found significantly higher levels of GCs in elk in Yellowstone during the snowmachine season and when daily numbers of snowmachines increased. In summary, Creel et al. (2002: 812) reports that the data "...show that stress-hormone levels correlate with snowmobile usage on both short (daily) and long (annual) time scales." Although these increased GC levels indicate a clear physiological stress response to snowmachines, no perceptible impacts on population size have been recorded in these parks, which the authors suggest indicates that the elk and wolf populations are able to compensate for the current levels of snowmachine activity.

Observations by Alaska Department of Fish and Game biologists in the Talkeetna Mountains near Denali National Park and Preserve indicate that increasing recreational snowmachine use is beginning to alter moose use of preferred treeline willow habitats (Herman Griesse, pers. comm.). Dog-sled use and showshoeing can also increase negative interactions of human visitors with moose encountered on the trails.

Several sources cite the loss of habitat and the use of traditional migration routes as concerns associated with bighorn sheep (Constan 1975; Horejsi 1976; Reisenhoover et al. 1988; EPFW 1993). Various recreational activities are known to cause displacement from preferred habitats (Horejsi 1976; Hicks and Elder 1979) and fleeing when approached by people (MacArthur et al. 1982). Similar reactions by Dall sheep could be expected when confronted with other forms of human activity, such as the presence of snowmachines, snowshoers, skiers, and dog teams.

Compacted trails also change distribution patterns of animals by providing energy efficient travelways that alter winter survival rates, predation rates, distribution patterns, availability of carrion for use by other species, and levels of human conflict (Meager et al. 1994). Compaction of snow in forage areas can also have other negative effects on wildlife foraging. It increases energy expenditures by ungulates, such as caribou, that must dig for vegetation in extremely stressful winter months (Fancy and White 1995).

Research at Denali also indicates that snow depth and winter travel conditions are important factors in winter survival for ungulates and the predators that depend on them (Adams and Dale 1998). Traveling through snow compacted by a snowmachine can cost caribou 2–4 times as much energy as traveling through uncrusted snow (Fancy and White 1985).

In certain situations, a snowmachine can be less disturbing than a cross-country skier. As referenced by Joslin and Youmans (1999), Parker et al. (1984:484) observed, “Flight distances decline from early to late winter as the animals become habituated and as body energy reserves are depleted. Greater flight distances occur in response to skiers or individuals on foot than to snowmachines, suggesting that the most detrimental disturbance to the wintering animal is that which is unanticipated.” Observations in locations other than well-used trails, where all types of use were equally unfamiliar to animals or not restricted to trails, such as the Denali situation, demonstrate equal or greater responses to snowmachines (Aune 1981). More importantly, the speed and range of snowmachines mean that they have the potential to disturb wildlife over a much larger geographic range than non-motorized travel.

The lack of an overt behavioral response does not necessarily indicate an absence of disturbance. According to Chabot (1991), elk heart rate data showed an increase in heart rates even when their behavior did not demonstrate a response.

Large Carnivores: Black Bear, Brown/Grizzly Bear, Wolf

Research indicates that additional stress from disturbance by increased human activity could have a detrimental effect on bears during critical times (Goodrich and Berger 1994; Watts and Jonkel 1989). Goodrich and Berger (1994) showed that some bears abandoned dens and cubs in response to disturbance.

A four-year study at Voyageurs National Park, Minnesota, found that snowmachines were adversely affecting wolves through displacement and disturbance (Voyageurs National Park 1996). Creel et al. (2002) completed a study of the effects of snowmachine activity on elk and wolves, focusing on the occurrence of stress-related hormones (glucocorticoids [GCs]) in fecal samples in areas with differing levels of snowmachine use in Yellowstone, Voyageurs, and Isle Royale national parks. Chronically elevated GC levels have been associated with a variety of problems including reduced reproduction, ulcers, muscle wasting, and immune suppression. In Voyageurs National Park, a 37% decrease in snowmachine use was accompanied by a 37% decrease in GC levels in wolves, indicating a strong relationship between these parameters. In summary, Creel et al. (2002: 812) reports that the data “...show that stress-hormone levels correlate with snowmobile usage on both short (daily) and long (annual) time scales.” Although these increased GC levels indicate a clear physiological stress response to snowmachines, no perceptible impacts on population size have been recorded in these parks, which the authors suggest indicates that the elk and wolf populations are able to compensate for the current levels of snowmachine activity.

Compacted trails also change distribution patterns of animals by providing energy efficient travelways that alter winter survival rates, predation rates, distribution patterns, availability of carrion for use by other species, and levels of human conflict (Meager et al. 1994). Some activities, such as dog-sledding and snowshoeing, may change movement patterns of some wildlife species such as wolves that use the packed trails.

Joslin and Youmans (1996) referenced several studies to summarize how wolves use snowmachine trails:

Wolves often take advantage of easy travel on compacted snowmobile trails. Traveling on human-compacted routes has both positive and negative impacts on wolves. Human activities that compact snow (e.g., snowmobiling, cross-country skiing, road-plowing) provide easy travel routes for wolves into areas that would otherwise be difficult to reach in deep snow (Paquet et al. 1996). Wolves have a lighter foot loading than most ungulates (Telfer and Kelsall 1984) and often travel on snow that will not support their prey (Peterson 1977, Paquet 1989). Wolves have difficulty moving in snow deeper than 50 cm (Pulliainen 1965) and normally avoid areas of consistently deep snow. The ease of travel along travel routes compacted by humans may increase the effects of predation on ungulates (O’Karma et al. 1995) as previously unexploited ungulate ranges are discovered by wolves.

Domestic dogs in backcountry areas can negatively affect wildlife by disturbance and disease transmission (Mech and Goyal, 1993; Sime 1999).

Small and Mid-sized Carnivores: Lynx, Coyote, Fox, Mustelids

Hornocker and Hash (1981) suggested that human access via snowmachine or all-terrain vehicles in winter or early spring could disturb wolverines, and in the Lolo National Forest, Montana, denning wolverines appear sensitive to the slightest human disturbance in the denning area (USDA Forest Service 1998). Copeland (1996) believes that technological advances in over-snow vehicles and increased interest in winter recreation has likely displaced wolverines from potential denning habitat and will continue to threaten a possibly limited resource. This could result in lower reproductive success and/or kit survival. In the Lolo National Forest female wolverines in the area are presumed to have abandoned any potential denning areas that experience snowmachine use (USDA Forest Service 1998). Copeland (1996) also found that snowshoers caused den abandonment in a cirque basin.

Characteristics of snowmachine use, including dispersal over the landscape, operation at night when lynx are active, alteration of the mobility and distribution of snowshoe hares, and winter operations all point to this form of recreation as being potentially adverse to lynx (Olliff et al. 1999). Snowmachine use has affected red fox mobility (Schmid 1983). Dog-sledding and snowshoeing may change movement patterns of coyotes, and foxes that use the packed trails.

Lynx are specialized deep-snow predators, an adaptation that permits them to live year-round at high elevations, thereby minimizing competition during the physically stressful winter months. Snowmachine or cross-country ski trails allow lynx competitors to infiltrate high-elevation habitats during winter, thereby increasing competition for a limited food supply (Idaho Department of Fish and Game et al. 1995).

Compacted trails also change distribution patterns of animals by providing energy efficient travelways that alter winter survival rates, predation rates, distribution patterns, availability of carrion for use by other species, and levels of human conflict (Meagher et al. 1994).

Rodents, Lagomorphs, and Insectivores

Snowmachine use has affected snowshoe hare mobility (Schmid 1983). Neumann and Merriam (1972) found snowshoe hares reducing their use of habitat near snowmachine trails.

Small mammals inhabiting the subnivean environment are adversely affected by snowmachine use. Jarvinen and Schmid (1971) noted increased small mammal mortality beneath compacted snow. Some of the possible changes in snow conditions resulting from snow compaction include a decrease in subnivean air space, a change in temperature, and accumulation of toxic air under the snow (Jarvinen and Schmid 1971, Schmid 1971a and b). Multiple passes over the same track will have more impact than a single pass, and the larger the area of compaction, the greater the possible affect to subnivean fauna (Halfpenny and Ozanne 1989).

Fish and Aquatic Life

Snowmachine use could affect fish and other aquatic species through increased use, including at stream crossings, and the possibility of contaminants [fuel spills and unburned fuel deposited by two-stroke engines (EPA, 2001)]. Pollutants from snowmachine emissions, including highly persistent polycyclic aromatic hydrocarbons, can remain within the snowpack until they are released during snowmelt, causing elevated acidity levels in surrounding waterways, which could result in adverse effects on fish (Adams 1975) or higher death rates for aquatic insects. The severity of these occurrences would depend on the level of use near waterways.

Non-motorized forms of winter recreation, such as dog sledding, skijoring, cross-country skiing, and snowshoeing, would cause minimal levels of noise and physical disturbance to aquatic habitats under adequate snow and ice cover.

Hiking, Backpacking and Camping

Knight and Cole (1995b) reviewed literature on the effects to wildlife by humans on foot and found that most responses of wildlife are behavioral and of short duration.

Ungulates: Caribou, Dall Sheep, Moose

Studies of the effects of hikers on large mammals have included several studies on species of horned sheep (Dall sheep and relatives). MacArthur et al. (1982), in a study of the differences in response of mountain sheep in Alberta, found little reaction of sheep to hikers approaching from parked vehicles, but responses increased markedly when sheep were approached from above (from out of view). Papouchis et al. (2001) found that hikers in Canyonlands National Park elicited more severe responses from bighorn sheep

(animals fled in 61% of encounters) than did either vehicles (17%) or mountain bikers (6%), and they speculated that part of the reason for the difference in response was that approaches by hikers were more unpredictable.

Large Carnivores: Black Bear, Brown/Grizzly Bear, Wolf

Grizzly bears are sensitive to human disturbance. However, they will readily habituate to ongoing and predictable human activity. Habituation can be both negative and positive. Habituation can be positive in that human activity will not displace bears from preferred foraging areas or disrupt crucial life processes. Habituation can be negative in areas where human activity is not closely regulated because habituation is usually accompanied by food conditioning. Habituated and food-conditioned bears are dangerous because they have come to associate humans with food (Joslin and Youmans 1999).

In several parks and other protected areas, backcountry units have been closed to hiking and other recreation to protect wolf dens and wolf pups from human disturbance and habituation (Chapman 1977, Fritts, et al. 2003, NPS 2002e, NPS 2003).

Birds

Some recent research has focused on the effects of hiking and recreational trails on bird populations, where effects of disturbance may be subtler, such as changes in diversity, nesting success, or distribution. In Colorado, recreational trails adversely affected both the numbers and breeding success of some bird species using habitats adjacent to trails, although it was not clear whether those effects were due primarily to the edge effect of the trail or to human disturbance (Miller et al. 1998). Visitor levels in Colorado were significantly higher (more than 1 million visits per year) than would be expected in Denali National Park and Preserve. In contrast, Miller and Hobbs (2000) found that nest predation was less near trails along a riparian area in Colorado (use averaged 16–22 people/hectare) but increased in adjacent habitats, apparently because of mammalian predators being displaced from areas near the trail. These studies suggest that the habitats likely to receive the greatest disturbance are those where hikers are concentrated, such as at trailheads, or where larger party sizes return frequently, such as with guided tours.

Steidl et al. (1993) found that human disturbance (such as camping at 400 m from nests) negatively affected nesting behaviors of golden eagles. Adults spent less time near their nests, fed their young less frequently, and fed themselves and their young up to 67% less food when observers were camped 400 m from nests than when observers were camped 800 m from nests. The potential impacts from the reduction in food alone could have substantial long-term effects on the golden eagle population (Steidl et al. 1993).

Aircraft

The primary disturbance to wildlife from aircraft (fixed-wing and helicopter) operations is noise. Noise generated by airplanes can be separated into two general components: (1) noise associated with take-offs, landings, and taxiing, where maximum noise levels are generated relatively close to the ground and on the airstrip, and (2) noise generated by airplanes flying over the park.

Ungulates: Caribou, Dall Sheep, Moose

Research on the effects of low-altitude military aircraft on caribou concluded that behavioral impacts generally were mild, but that female caribou reacted to the noise of jet aircraft overflights by lying less and moving more, and that these responses were most prevalent in June when newborn calves were present (Murphy et al. 1993). Other research on northern mammals has focused on low-flying helicopters and the effects of low-level aerial surveys (Klein 1973, McCourt and Horstman 1974, Calef et al. 1976). These studies provide a framework for how different species are affected by aircraft noise and aircraft activity in general.

Although rare, collisions of aircraft with wildlife are possible either while landing or taking-off at airstrips and while in flight (Cleary et al. 2002). Some animals may be attracted to airstrips by forage availability (willows for moose) or insect-relief habitat (caribou) that places them in locations where aircraft strikes are possible during landings or take-offs.

Watercraft

Motorized boating on rivers can have localized impacts on some wildlife species. Knight and Cole (1995b) found that motorized boating tended to be more disturbing to wildlife than non-motorized boating because it presented not only a visual stimulus (movement), but caused noise as well, which increased disturbance to wildlife.

Birds

Motorized and non-motorized boating on lakes, ponds, and rivers can disturb nesting waterfowl and shorebirds that use those wetlands. Reactions of waterfowl to boating activities can range from swimming away from the disturbance to flying (Hockin et al. 1992, Madsen 1998). Bald eagles were sensitive to boating activities along narrow river corridors and to noisy boats, but responses varied seasonally (Anthony et al. 1995). Motorboat traffic can have negative impacts on loon nests and nesting success (Vermeer 1973).

Fish and Aquatic Life

Motorboat use may cause degradation of fish and wildlife habitats in heavily used areas by destroying vegetation, introducing invasive species, degrading soils, or adversely affecting water quality.

Sport Hunting and Fishing

Sport hunting and fishing (including guided hunting and fishing) result in mortalities (and occasionally injuries) for target animal and fish species. In addition, non-target wildlife may experience short-term behavioral disturbance or displacement from noise and human activity associated with guided hunts.

ALTERNATIVE 1 (NO ACTION)

The no-action alternative represents no change from current management as outlined by the *General Management Plan* (1986) and the *Strategic Plan* (1997). Although this alternative provides a baseline for evaluating the changes and impacts of the other action alternatives, the overall environmental consequences to wildlife of this alternative would increase as visitor levels and recreational activities, and their associated disturbances of wildlife, increase in Denali National Park and Preserve.

Under Alternative 1, wildlife would be adversely affected in some areas of the park during summer from noise generated by aircraft operations and by human activities in the park such as hiking and camping. During winter, wildlife would be affected primarily by snowmachine use and to a much lesser extent by non-motorized activities. These impacts would not be uniformly distributed across the park but would affect wildlife in areas such as under flight corridors between Healy, Talkeetna, and Mt. McKinley, at landing sites, and at access points and routes and areas heavily used by snowmachines on the south side of the Alaska Range. The overall level of adverse impact would therefore be moderate. Other activities in the park would have negligible to minor impacts on wildlife populations.

General Impacts: Wildlife

Increasing levels of aircraft activity and additions of new airstrips or landing areas to the park under Alternative 1 would increase exposure of wildlife to noise and visual disturbances associated with aircraft, and increase the negative effects on wildlife (disturbance such as displacement, potential for mortality). Most disturbances are likely to be noise-related and short-term in duration, but some mortalities or injuries to individuals are possible if aircraft-wildlife collisions occur at airstrips. The effects would be short term under current numbers of landings, but could increase during the next 20 years at some specific locations in the park, such as along the West Fork of the Yentna River in the southwest preserve.

Under Alternative 1, snowmachine use would continue to increase and expand into more locations in the park additions and preserve. Heavy use would occur at some popular destinations, such as Broad Pass southwest of Cantwell, along the Upper and Lower Tokositna River, and along the Stampede Trail corridor (about 25% of the total park area). Use would expand in area (as 64% of the total park area would be open to snowmachine use) and in density. Several different impacts to wildlife populations and habitats could be expected. Encounters with wildlife in the backcountry would cause behavioral disturbance, increase stress levels, and temporarily displace wildlife from areas where snowmachines are regularly used. In some cases, wildlife mortality or injury to species could occur from wildlife-snowmachine collisions. Snowmachine trails would enhance or modify movements of wildlife by providing packed trails that make movements easier and that allow access to new areas. Over the next 20 years there would be short-term changes in wildlife populations and habitat at several distinct localities in the park and preserve.

In the park additions and preserve, there would continue to be no management provisions for dispersing visitor use, and hiking and camping can be expected to increase in the next 20 years with concentration at popular destinations. Impacts to wildlife would be behavioral reactions of short duration and low intensity that would not have long-term impacts on wildlife populations. The greatest impacts are likely to occur in areas where human use is concentrated, such as access corridors, airplane landing sites, and popular camping locations, such as the base of the Tokositna Glacier and the Bear Creek/Wildhorse Creek area. This would mainly affect species such as caribou and grizzly bears that are particularly sensitive to human disturbance. Sensitive species and habitats are likely to be affected at several distinct locations in the park additions and preserve.

Ungulates: Caribou, Dall Sheep, Moose. Several different impacts to ungulate populations and habitats could be expected from the increase of snowmachine use. Encounters with wildlife in the backcountry would cause behavioral disturbance, increase stress levels, and temporarily displace wildlife, such as moose and caribou, from areas where snowmachines are regularly used. The snowmachine trails could also increase predation by wolves who take advantage of traveling along the hard-packed trails. Increased snowmachine use in late winter and early spring would be occurring when ungulates are in their worst health. Because of existing regulations, wildlife populations would not be adversely affected by harvest from guided hunts. Encounters of ungulates with dog teams and skiers would cause short-term displacement, but the limited number of users and the typically short distance covered would limit this impact. Over the next 20 years there would be short-term changes in wildlife populations and habitats at several distinct locations in the park and preserve.

Large Carnivores: Black Bear, Brown/Grizzly Bear, Wolf. Several different impacts to large carnivore populations and habitats could be expected from the increase in snowmachine use. Encounters with wildlife in the backcountry would cause behavioral disturbance, increase stress levels, and temporarily displace wildlife, such as moose and caribou (prey species), from areas where snowmachines are regularly used. In some cases, wildlife mortality or injury to species, such as wolves, would occur from wildlife-snowmachine collisions. Snowmachine trails would enhance or modify wolf movements by providing packed trails that make movements easier and that allow access to new areas. Snowmachines could also be used to illegally chase canid species (such as wolves) and grizzly bears emerging from their dens, which would increase stress levels and reduce fat stores. Snowmachine use could displace denning bears and lead to den abandonment. Because of existing regulations, wildlife populations would not be adversely affected by harvest from guided hunts. There would be short-term changes in wildlife populations and habitats at several distinct locations in the park and preserve over the next 20 years.

Small and Mid-sized Carnivores: Lynx, Coyote, Fox, Mustelids. Several different impacts to small and mid-sized carnivore populations and habitats could be expected from the increase in snowmachine use. Snowmachine trails would enhance or modify movements of wildlife, such as coyote, fox, and lynx, by providing packed trails that

make movements easier and that allow access to new areas. Snowmachines could also be used to illegally chase canid species (such as coyote and fox), which would increase stress levels and reduce fat stores. There would be short-term changes in wildlife populations and habitats at several distinct locations in the park and preserve over the next 20 years.

Birds. Increased motorboat use could be expected and would increase disturbance and displacement of waterfowl, which could lead to increased nest abandonment and predation. There would be short-term changes in waterfowl populations and habitats at distinct locations in the park and preserve over the next 20 years, but longer-term impacts to certain species, such as swans, could occur in certain locations, particularly along the Tokositna, Yentna and Kantishna/Muddy Rivers.

Fish. Increased snowmachine use under this alternative could affect fish and other aquatic species through the accumulative effects of contaminant fuel spills and unburned fuel deposited by two-stroke engines in the areas of highest use, such as near Broad Pass and on the upper Tokositna River.

Sport fishing in the park and preserve would not result in adverse impacts on fish populations. Dispersed use, restricted use areas, and fish regulations all decrease the relative magnitude of these effects in the park.

Cumulative Effects

Impacts to wildlife in the vicinity of Denali National Park and Preserve are expected to increase as additional development occurs along the Parks Highway corridor and private and commercial activities increase at the southern end of the park. Development on the south side is likely to continue in and adjacent to Denali State Park and in gateway communities such as Petersville, Trapper Creek, and Talkeetna. Continued residential growth, recreational use, and sport hunting from the Healy area west along the Stampede Trail could also result in moderate impacts to wildlife. Commercial rafting on the Nenana River and non-commercial boating on some rivers and lakes would generate noise and cause temporary displacement of wildlife along the riparian zone, resulting in a minor impact.

Subsistence hunting and trapping, including the potential use of off-road vehicles for subsistence uses (along Cantwell and Windy Creeks) would result in minor adverse impacts on wildlife abundance because of short-term reduction in population of some species such as marten or moose in small areas. Motorized uses, including where permitted for access (Dunkle Hills, Kantishna Hills), can cause noise and visual stimuli that result in behavioral disturbance and temporary displacement of some wildlife species on a seasonal basis. These effects on wildlife species would continue at specific locations throughout the life of the plan.

These activities would result in loss of habitat, behavioral changes such as avoiding developed areas, human-generated noise, and other disturbances to wildlife near Denali National Park and Preserve. Under Alternative 1, increasing recreational activities are likely throughout the park as described above, and these would add to the cumulative effects of visitor activities on wildlife populations in the park and the surrounding region. The combination of impacts from activities in the park under Alternative 1 and the impacts of other activities, including those outside the park that directly affect park wildlife, would result in substantial impacts at several distinct locations. For example, wildlife in the Tokositna area could be affected by increased recreational use inside and outside the park, development of new visitor facilities such as a visitor center and campground, and development on private land outside the park. Similar effects could be expected from increased snowmachine use in the Broad Pass, Stampede, and Kantishna areas. Overall, cumulative impacts under Alternative 1 would be moderate because detectable disturbance to important wildlife resources would occur on an annual basis at many different locations, but sufficient habitat would remain functional to maintain viability of all native species. The types and levels of use proposed under Alternative 1 would contribute a moderate portion of the overall cumulative impacts to wildlife.

Conclusion

Under Alternative 1, wildlife would be adversely affected in some areas of the park during summer from noise generated by aircraft operations and by human activities in the park such as hiking and camping. During winter, wildlife would be affected primarily by snowmachine use and to a much lesser extent by non-motorized activities. These impacts would not be uniformly distributed across the park but would affect wildlife in areas such as under flight corridors between Healy, Talkeetna, and Mount McKinley, at landing sites, and at access points and routes and areas heavily used by snowmachines on the south side. The overall level of adverse impact would therefore be moderate. Other activities in the park would have negligible to minor impacts on wildlife populations.

The level of impacts to wildlife anticipated from Alternative 1 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are essential to the natural integrity of the park. However, moderate impacts to wildlife species and wildlife habitat are likely as a result of cumulative impacts as described above.

ALTERNATIVE 2

The impacts to wildlife populations and habitats under Alternative 2 would generally be negligible because of limits on numbers and types of backcountry uses. Minor impacts are possible from activities, but even then would be limited to short-term effects that would be localized in scope.

General Impacts: Wildlife

Snowmachine use under Alternative 2 would be limited to subsistence and other traditional activities in the park additions and preserve. Therefore, there would be an immediate decrease in recreational snowmachine use at popular destinations such as the Broad Pass area southwest of Cantwell. Encounters with wildlife in the backcountry would decrease from current levels, resulting in fewer incidents of behavioral disturbance, increased stress levels, and temporary displacement of wildlife. Cases of wildlife mortality or injury would be extremely rare, except from subsistence. There would be few snowmachine trails to enhance or modify movements of wildlife.

Airplanes would not be allowed for recreation access to the Old Park, except that airplane access to the McKinley and Kantishna airstrips for recreation would continue. Under Alternative 2 there would be limits on airplane landings for scenic tours, and air taxi landings would continue to be allowed everywhere in the park additions and preserve, but not in the Old Park. Scenic tour landings would be allowed at Ruth Amphitheater (1,900 per season) and Kahiltna Base Camp (200 per season) from 9am to 9pm only, and noise standards would require overflights to diminish or disperse in some areas, such as over the Old Park. These limits would reduce the exposure of wildlife to noise and visual disturbances associated with aircraft and reduce the negative effects on wildlife (disturbance, potential for mortality). Disturbances would generally be noise-related and short-term (five minutes or less each time).

Motorboats would not be allowed for recreation access in the park and preserve. This would reduce the amount of noise and visual stimuli that result in behavioral disturbance and temporary displacement of some wildlife species, such as moose and caribou, on a seasonal basis.

The types of impacts to wildlife that could occur from hiking and camping would include behavioral reactions of short duration and low intensity that would not have long-term impacts on wildlife populations. These impacts would occur only occasionally at different locations throughout the life of the plan.

Ungulates: Caribou, Dall Sheep, Moose. With the decrease in recreational snowmachine use at popular destinations such as the Broad Pass area southwest of Cantwell, encounters with moose and caribou in the backcountry would decrease from current levels, resulting in fewer incidents of behavioral disturbance, increased stress levels, and temporary displacement of wildlife. There would be few snowmachine trails either to detract from natural movements of ungulates or to enhance or modify movements of predators of ungulates (such as wolves). Encounters of ungulates with dog teams and skiers would cause short-term displacement, but the limited number of users and the typically short distance covered would limit this impact.

Under Alternative 2 there would be limits on airplane landings for scenic tours and noise standards would require overflights to diminish or disperse in some areas, such as over

the Old Park. These limits would reduce the exposure of wildlife to noise and visual disturbances associated with aircraft and reduce the negative effects on wildlife (disturbance, potential for mortality). Disturbances from airplane landings and aircraft overflights would generally be noise-related and short-term (five minutes or less each time).

Because of existing regulations, wildlife populations would not be adversely affected by harvest from guided hunts.

Large Carnivores: Black Bear, Brown/Grizzly Bear, Wolf. Under Alternative 2, snowmachine use would be limited to subsistence and other traditional activities. Therefore, there would be an immediate decrease in recreational snowmachine use at popular destinations such as the Broad Pass area southwest of Cantwell. Encounters with wolves and bears in the backcountry would decrease from current levels, resulting in fewer incidents of behavioral disturbance, increased stress levels, and temporary displacement. Denning bears would be at less risk from disturbance from snowmachines. Because of existing regulations, wildlife populations would not be adversely affected by harvest from guided hunts.

Small and Mid-sized Carnivores: Lynx, Coyote, Fox, Mustelids. The decrease in recreational snowmachine use would result in few snowmachine trails to enhance or modify movements of wildlife such as coyotes, foxes, and lynx by providing packed trails. Encounters with small and mid-sized carnivores would decrease from current levels, resulting in fewer incidents of behavioral disturbance, increased stress levels, and temporary displacement of wildlife.

Birds. Motorboats would not be allowed for recreation access in the park and preserve. This would reduce the disturbance and displacement of waterfowl

Fish. Significantly decreased snowmachine use under this alternative would benefit fish and other aquatic species by removing potential contaminant fuel spills and unburned fuel deposited by two-stroke engines, especially in the areas of highest use, such as near Broad Pass and on the upper Tokositna River.

Sport fishing in the park and preserve would not result in adverse impacts on fish populations. Dispersed use, restricted use areas, and fish regulations all decrease the relative magnitude of these effects in the park.

Cumulative Effects

Impacts to wildlife in the vicinity of Denali National Park and Preserve are expected to increase as additional development occurs along the Parks Highway corridor and private and commercial activities increase at the southern end of the park. Development on the south side is likely to continue in and adjacent to Denali State Park and in gateway communities such as Petersville, Trapper Creek, and Talkeetna. Continued residential

growth, recreational use, and sport hunting from the Healy area west along the Stampede Trail could also result in moderate impacts to wildlife. Commercial rafting on the Nenana River and non-commercial motorboat use for guaranteed access on some park rivers and lakes would generate noise and cause temporary displacement of wildlife along the riparian zone, resulting in minor impacts.

Subsistence hunting and trapping, including the potential use of off-road vehicles for subsistence uses (along Cantwell and Windy Creeks) would result in minor adverse impacts on wildlife abundance because of short-term reductions in population of some species such as marten or moose in small areas. The use of motor vehicles for access (Dunkle Hills, Kantishna Hills), can cause noise and visual stimuli that result in behavioral disturbance and temporary displacement of some wildlife species on a seasonal basis. These effects on wildlife species would continue at specific locations throughout the life of the plan.

These activities would result in loss of habitat, behavioral changes such as avoiding developed areas, human-generated noise, and other disturbances to wildlife in the vicinity of Denali National Park and Preserve. (Other disturbances could include introduction of parvovirus and other diseases to wildlife species in Denali from outside sources.) Under Alternative 2, the growth in recreational activities would be managed throughout the park and preserve as described above, and these limitations would help mitigate the impacts from other activities on wildlife populations. At the regional level, this mitigation may not be as large as expected if limitations on activities such as snowmachine use inside the park simply displace users to adjacent non-park lands, increasing disturbance and negative impacts to wildlife in those areas.

The combination of impacts from other activities, including those outside the park that directly affect park wildlife, and the management provisions under Alternative 2, would result in moderate impacts overall, since there would be medium intensity, long-term changes in important wildlife resources. The types and levels of use proposed under Alternative 2 would contribute a negligible portion of the overall cumulative impacts to wildlife.

Conclusion

The impacts to wildlife populations and habitats under Alternative 2 would generally be negligible because of limits on numbers and types of backcountry uses. Minor adverse impacts are possible from some activities, but even then would be limited to short-term effects that would be very localized in scope.

The level of impacts to wildlife anticipated from Alternative 2 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are essential to the natural integrity of the park.

ALTERNATIVE 3

There would be minor adverse impacts to wildlife populations and habitats under Alternative 3 because limits on numbers and types of backcountry uses would result in only low-intensity, non-permanent disturbances to wildlife.

General Impacts: Wildlife

Snowmachine use, under Alternative 3, would be limited to subsistence and other traditional activities in the park additions and preserve, and to established winter corridors for recreational use. Therefore, there would be an immediate decrease in dispersed recreational snowmachine use throughout the park and preserve, but the winter corridors would result in areas of more concentrated snowmachine use. Encounters with wildlife in the backcountry would cause behavioral disturbance, increase stress levels, and temporarily displace wildlife from areas where snowmachines are regularly used. In some cases, wildlife mortality or injury to species would occur from wildlife-snowmachine collisions. Snowmachine trails would enhance or modify movements of wildlife by providing packed trails that make movements easier and that allow access to new areas. There would be short-term changes in wildlife populations and habitats at several distinct locations in the park and preserve over the next 20 years.

Under Alternative 3, there would be limits on airplane landings for scenic tours, and air taxi landings would continue to be allowed everywhere in the park additions and preserve, but not in the Old Park. Scenic tour landings would be allowed at Ruth Amphitheater, Ruth Gorge, and Kahiltna Base Camp from 9am to 9pm only and noise standards would require overflights to diminish or disperse in some areas, such as over the Old Park. These limits would reduce the exposure of wildlife to noise and visual disturbances associated with aircraft and reduce the negative effects on wildlife (disturbance, potential for mortality). Disturbances would generally be noise-related and short-term (five minutes or less each time).

The types of impacts to wildlife that could occur from hiking and camping would include behavioral reactions of short duration and low intensity that would not have long-term impacts on wildlife populations. Areas designated as Management Area A (4% of the park and preserve) would allow for encounter rates of up to five parties per day, with two parties of up to six people. The increased density of visitors in these areas could result in increased wildlife disturbance, habituation, and food-conditioning. These impacts would occur only occasionally at localized areas.

Ungulates: Caribou, Dall Sheep, Moose. Winter corridors would be established for recreation-related snowmachine access to the Old Park boundary in the Broad Pass area and to the toes of the Ruth, Tokositna, and Kanikula glaciers from Tokositna River. Snowmachine use along the winter corridors would cause behavioral disturbance, increase stress levels, and temporarily displace ungulates, particularly moose and caribou, from areas where snowmachines are regularly used. In some cases, ungulate

mortality or injury would occur from wildlife-snowmachine collisions. Encounters of ungulates with dog teams and skiers would cause short-term displacement, but the limited number of users and the typically short distance covered would limit this impact. Because of existing regulations, wildlife populations would not be adversely affected by harvest from guided hunts. There would be short-term changes in wildlife populations and habitats at several distinct locations in the park and preserve over the next 20 years.

Large Carnivores: Black Bear, Brown/Grizzly Bear, Wolf. Snowmachine use along the winter corridors would cause behavioral disturbance, increase stress levels, and temporarily displace large carnivores from areas where snowmachines are regularly used. In some cases, mortality or injury would occur from wildlife-snowmachine collisions. Snowmachine trails would enhance or modify movements of large carnivores, such as wolves, by providing packed trails that make movements easier and that allow access to new areas. Snowmachine use along the corridors could displace bears denning along or near the winter corridors and lead to den abandonment. Because of existing regulations, wildlife populations would not be adversely affected by harvest from guided hunts. There would be short-term changes in wildlife populations and habitats at several distinct locations in the park and preserve over the next 20 years.

Small and Mid-sized Carnivores: Lynx, Coyote, Fox, Mustelids. Snowmachine use along the winter corridors would cause behavioral disturbance, increase stress levels, and temporarily displace small and mid-sized carnivores from areas where snowmachines are regularly used. In some cases, mortality or injury would occur from wildlife-snowmachine collisions. Snowmachine trails would enhance or modify movements of some species, such as lynx and their competitors (coyotes and foxes), by providing packed trails that make movements easier and that allow access to new areas. There would be short-term changes in wildlife populations and habitats at several distinct locations in the park and preserve over the next 20 years.

Birds. Motorboats would not be allowed for recreation access in the Old Park, but existing use in the park additions and preserve would continue and likely increase. This increased use would increase disturbance and displacement of waterfowl, which could lead to increased nest abandonment and predation. There would be short-term changes in waterfowl populations and habitats at distinct locations in the park and preserve over the next 20 years, but longer-term impacts to certain species, such as swans, could occur in certain locations, particularly along the Tokositna, Yentna and Kantishna/Muddy Rivers.

Fish. Decreased snowmachine use under this alternative would benefit fish and other aquatic species by removing potential contaminant fuel spills and unburned fuel deposited by two-stroke engines. Continued snowmachine use in the proposed access corridors, such as near Broad Pass and the upper Tokositna River would require additional monitoring to protect aquatic resources.

Cumulative Effects

Impacts to wildlife in the vicinity of Denali National Park and Preserve are expected to increase as additional development occurs along the Parks Highway corridor and private and commercial activities increase at the southern end of the park. Development on the south side is likely to continue in and adjacent to Denali State Park and in gateway communities such as Petersville, Trapper Creek, and Talkeetna. Continued residential growth, recreational use, and sport hunting from the Healy area west along the Stampede Trail could also result in moderate impacts to wildlife. Commercial rafting on the Nenana River and non-commercial boating on some park rivers and lakes would generate noise and cause temporary displacement of wildlife along the riparian zone, resulting in a minor impact.

Subsistence hunting and trapping, including the potential use of off-road vehicles for subsistence uses (along Cantwell and Windy Creeks) would result in minor adverse impacts on wildlife abundance because of short-term reductions in population of some species such as marten or moose in small areas. Motorized uses, including where permitted for access (Dunkle Hills, Kantishna Hills), can cause noise and visual stimuli that result in behavioral disturbance and temporary displacement of some wildlife species on a seasonal basis. These effects on wildlife species would continue at specific locations throughout the life of the plan.

These activities would result in loss of habitat, behavioral changes such as avoiding developed areas, human-generated noise, and other disturbances to wildlife in the vicinity of Denali National Park and Preserve. (Other disturbances could include introduction of parvovirus and other diseases to wildlife species in Denali from outside sources.) Under Alternative 3, the growth in recreational activities would be managed throughout the park and preserve as described previously, and these limitations would help mitigate the impacts from other activities on fish and wildlife populations. At the regional level, this mitigation may not be as large as expected if limitations on activities such as snowmachine use inside the park simply displace users to adjacent non-park lands, increasing disturbance and negative impacts to wildlife and fish in those areas.

The combination of impacts from other activities, including those outside the park that directly affect park wildlife, and the management provisions under Alternative 3, would result in moderate impacts overall, since there would be medium intensity, long term changes in important wildlife resources. The types and levels of use proposed under Alternative 3 would contribute a minor portion of the overall cumulative impacts to wildlife and other aquatic species.

Conclusion

There would be minor adverse impacts to wildlife populations and habitats under Alternative 3 because limits on numbers and types of backcountry uses would result in only low-intensity, non-permanent disturbances to wildlife. The level of impacts to

wildlife anticipated from Alternative 3 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are essential to the natural integrity of the park.

ALTERNATIVE 4 (PREFERRED ALTERNATIVE)

There would generally be minor to moderate adverse impacts to wildlife populations and habitats under Alternative 4 because of the impacts of increased snowmachine and motorboat use on various wildlife species.

General Impacts: Wildlife

Under Alternative 4, snowmachine use would continue to increase and expand into more locations in the park additions and preserve. Use would expand in area (as 64% of the total park area would be open to snowmachine use) and in density. In addition to dispersed use, winter corridors would be established from the southern park boundary to the Old Park boundary near the West Fork Chulitna, Bull River, and Cantwell Creek. If demand is sufficient, Alternative 4 also allows for the establishment of winter corridors to the toes of the Ruth, Tokositna, and Kanikula glaciers from the Tokositna River. Winter corridors would result in areas of more concentrated snowmachine use and areas designated as Management Area A (11% of the park and preserve) would allow for an encounter rate of up to five parties per day, including two parties of up to six people. Areas designated Management Area B (5%) would allow an encounter rate of up to two parties per day, including parties of up to six people.

Several different impacts to wildlife populations and habitats could be expected from the increased numbers and density of snowmachine use. Encounters with wildlife in the backcountry would cause behavioral disturbance, increase stress levels, and temporarily displace wildlife from areas where snowmachines are regularly used. In some cases, wildlife mortality or injury to species would occur from wildlife-snowmachine collisions. Snowmachine trails would enhance or modify movements of wildlife by providing packed trails that make movements easier and that allow access to new areas. There would be short-term changes in wildlife populations and habitats at several distinct locations in the park and preserve over the next 20 years.

Under Alternative 4, scenic air tour landings would be allowed on all glaciers in areas designated as Management Area A, with no daily time restrictions. Noise standards would require overflights to diminish or disperse in some areas, such as over the Old Park. Disturbances would generally be noise-related and short-term (five minutes or less each time).

The types of impacts to wildlife that could occur from hiking and camping would include behavioral reactions of short duration and low intensity that would not have long-term impacts on wildlife populations. Areas designated as Management Area A (11% of the

park and preserve) would allow for encounter rates of up to five parties per day, with two parties of up to six people. The increased density of visitors in these areas could result in increased wildlife disturbance, habituation, and food-conditioning. These impacts would occur only occasionally at localized areas throughout the life of the plan.

Ungulates: Caribou, Dall Sheep, Moose. Snowmachine use under Alternative 4 would cause behavioral disturbance, increase stress levels, and temporarily displace ungulates, particularly moose and caribou, from areas where snowmachines are regularly used. In some cases, ungulate mortality or injury would occur from wildlife-snowmachine collisions. Because of existing regulations, wildlife populations would not be adversely affected by harvest from guided hunts. Encounters of ungulates with dog teams and skiers would cause short-term displacement, but the limited number of users and the typically short distance covered would limit this impact. There would be short-term changes in wildlife populations and habitats at several distinct locations in the park and preserve over the next 20 years.

Large Carnivores: Black Bear, Brown/Grizzly Bear, Wolf. Snowmachine use under Alternative 4 would cause behavioral disturbance, increase stress levels, and temporarily displace large carnivores from areas where snowmachines are regularly used. In some cases, mortality or injury would occur from wildlife-snowmachine collisions. Snowmachine trails would enhance or modify movements of large carnivores, such as wolves, by providing packed trails that make movements easier and that allow access to new areas. Snowmachine use would displace denning bears and lead to den abandonment. Because of existing regulations, wildlife populations would not be adversely affected by harvest from guided hunts. There would be short-term changes in wildlife populations and habitats at several distinct locations in the park and preserve over the next 20 years.

Small and Mid-sized Carnivores: Lynx, Coyote, Fox, Mustelids. Snowmachine use under Alternative 4 would cause behavioral disturbance, increase stress levels, and temporarily displace small and mid-sized carnivores from areas where snowmachines are regularly used. In some cases, mortality or injury would occur from wildlife-snowmachine collisions. Snowmachine trails would enhance or modify movements of some species, such as lynx and their competitors (coyotes and foxes), by providing packed trails that make movements easier and that allow access to new areas. There would be short-term changes in wildlife populations and habitats at several distinct locations in the park and preserve over the next 20 years.

Birds. Increased motorboat use could be expected and would increase disturbance and displacement of waterfowl, which could lead to increased nest abandonment and predation. There would be short-term changes in waterfowl populations and habitats at distinct locations in the park and preserve, but long-term impacts to certain species, such as swans, could occur in the designated corridors of the Tokositna, Yentna and Kantishna/Muddy Rivers.

Fish. Under this alternative, growth in snowmachine use in the areas of highest present use, such as near Broad Pass and on the upper Tokositna River, would be constrained or dispersed. This would minimize adverse impacts to fish and other aquatic species by reducing potential contaminant fuel spills and unburned fuel deposited by two-stroke engines. Snowmachine use in the proposed access corridors, such as near Broad Pass and the upper Tokositna River, would require additional monitoring to protect aquatic resources. Use in other areas would gradually increase over present use levels, but periodic monitoring of areas would alert managers to any changes in resource health.

Sport fishing in the park and preserve would not result in adverse impacts on fish populations. Dispersed use, restricted use areas, and fish regulations all decrease the relative magnitude of these effects in the park.

Cumulative Effects

Impacts to wildlife in the vicinity of Denali National Park and Preserve are expected to increase as additional development occurs along the Parks Highway corridor and private and commercial activities increase at the southern end of the park. Development on the south side is likely to continue in and adjacent to Denali State Park and in gateway communities such as Petersville, Trapper Creek, and Talkeetna. Continued residential growth, recreational use, and sport hunting from the Healy area west along the Stampede Trail could also result in moderate impacts to wildlife. Commercial rafting on the Nenana River and non-commercial boating on some park rivers and lakes would generate noise and cause temporary displacement of wildlife along the riparian zone, resulting in a minor impact.

Subsistence hunting and trapping, including the potential use of off-road vehicles for subsistence uses (along Cantwell and Windy Creeks) would result in minor adverse impacts on wildlife abundance because of short-term reductions in population of some species such as marten or moose in small areas. Motorized uses, including where permitted for access (Dunkle Hills, Kantishna Hills), can cause noise and visual stimuli that result in behavioral disturbance and temporary displacement of some wildlife species on a seasonal basis. These effects on wildlife species would continue at specific locations throughout the life of the plan.

These activities would result in loss of habitat, behavioral changes such as avoiding developed areas, human-generated noise, and other disturbances to wildlife in the vicinity of Denali National Park and Preserve. (Other disturbances could include introduction of parvovirus and other diseases to wildlife species in Denali from outside sources.)

The combination of impacts from other activities, including those outside the park that directly affect park wildlife, and the management provisions under Alternative 4, would result in moderate impacts overall, since there would be medium intensity, long-term changes in important wildlife resources. The types and levels of use proposed under Alternative 4 would contribute a minor portion of the overall cumulative impacts to wildlife.

Conclusion

There would be minor to moderate adverse impacts to wildlife populations and habitats under Alternative 4 because of increased snowmachine and motorboat use on various wildlife species. The level of impacts to wildlife anticipated from Alternative 4 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are essential to the natural integrity of the park.

ALTERNATIVE 5

There would be moderate adverse impacts to wildlife populations and habitats under Alternative 5 because of the impacts of increased snowmachine and motorboat use on various wildlife species.

General Impacts: Wildlife

Under Alternative 5, snowmachine use would continue to increase and expand into more locations in the park additions and preserve. Use would expand in area (as 64% of the total park area would be open to snowmachine use) and in density. In addition to dispersed use, winter corridors would be established from the southern park boundary to the Old Park boundary near the West Fork Chulitna, Bull River, and Cantwell Creek. If demand is sufficient, Alternative 5 allows for the establishment of winter corridors to the toes of the Ruth, Tokositna, and Kanikula glaciers from the Tokositna River and to Kantishna from the Sushana River. Winter corridors would result in areas of more concentrated snowmachine use and areas designated as Management Area A (18% of the park and preserve) would allow for an encounter rate of up to five parties per day, including two parties of up to six people. Areas designated Management Area B (66%) would allow an encounter rate of up to two parties per day, including parties of up to six people.

Several different impacts to wildlife populations and habitats could be expected from the increase in numbers and density of snowmachine use throughout the park additions and preserve. Encounters with wildlife in the backcountry would cause behavioral disturbance, increase stress levels, and temporarily displace wildlife from areas where snowmachines are regularly used. In some cases, wildlife mortality or injury to species would occur from wildlife-snowmachine collisions. Snowmachine trails would enhance or modify movements of wildlife by providing packed trails that make movements easier and that allow access to new areas. There would be short-term changes in wildlife populations and habitats at several distinct locations in the park and preserve over the next 20 years.

Under Alternative 5, scenic air tour landings would be allowed on all glaciers in areas designated as Management Area A, with no daily time restrictions. Natural sound disturbance standards would generally allow the same amount or increases in aircraft

overflights parkwide. Disturbances would generally be noise-related and short-term (five minutes or less each time).

The types of impacts to wildlife that could occur from hiking and camping would include behavioral reactions of short duration and low intensity that would not have long-term impacts on wildlife populations. Areas designated as Management Area A (18% of the park and preserve) would allow for encounter rates of up to five parties per day, with two parties of six people. The increased density of visitors in these areas could result in increased wildlife habituation and food conditioning. These impacts would occur only occasionally at very localized areas throughout the life of the plan.

Ungulates: Caribou, Dall Sheep, Moose. Snowmachine use under Alternative 5 would cause behavioral disturbance, increase stress levels, and temporarily displace ungulates, particularly moose and caribou, from areas where snowmachines are regularly used. In some cases, ungulate mortality or injury would occur from wildlife-snowmachine collisions. Encounters of ungulates with dog teams and skiers would cause short-term displacement, but the limited number of users and the typically short distance covered would limit this impact. Because of existing regulations, wildlife populations would not be adversely affected by harvest from guided hunts. There would be short-term changes in wildlife populations and habitats at several distinct locations in the park and preserve over the next 20 years.

Large Carnivores: Black Bear, Brown/Grizzly Bear, Wolf. Snowmachine use under Alternative 5 would cause behavioral disturbance, increase stress levels, and temporarily displace large carnivores from areas where snowmachines are regularly used. In some cases, mortality or injury would occur from wildlife-snowmachine collisions. Snowmachine trails would enhance or modify movements of large carnivores, such as wolves, by providing packed trails that make movements easier and that allow access to new areas. Snowmachine use would displace denning bears and lead to den abandonment. Because of existing regulations, wildlife populations would not be adversely affected by harvest from guided hunts. There would be short-term changes in wildlife populations and habitats at several distinct locations in the park and preserve over the next 20 years.

Small and Mid-sized Carnivores: Lynx, Coyote, Fox, Mustelids. Snowmachine use under Alternative 5 would cause behavioral disturbance, increase stress levels, and temporarily displace small and mid-sized carnivores from areas where snowmachines are regularly used. In some cases, mortality or injury would occur from wildlife-snowmachine collisions. Snowmachine trails would enhance or modify movements of some species, such as lynx and their competitors (coyotes and foxes), by providing packed trails that make movements easier and that allow access to new areas. There would be short-term changes in wildlife populations and habitats at several distinct locations in the park and preserve over the next 20 years.

Birds. Increased motorboat use could be expected and would increase disturbance and displacement of waterfowl, which could lead to increased nest abandonment and predation. There would be short-term changes in waterfowl populations and habitats at distinct locations in the park and preserve, but long-term impacts to certain species, such as swans, could occur in the designated corridors of the Tokositna, Yentna and Kantishna/Muddy Rivers.

Fish. Under this alternative, growth in snowmachine use in the areas of highest present use, such as near Broad Pass and on the upper Tokositna River, would be constrained or dispersed. This would minimize adverse impacts to fish and other aquatic species by reducing potential contaminant fuel spills and unburned fuel deposited by two-stroke engines. Use in other areas would gradually increase over present use levels, but periodic monitoring of areas would alert managers to any changes in resource health.

Sport fishing in the park and preserve would not result in adverse impacts on fish populations. Dispersed use, restricted use areas, and fish regulations all decrease the relative magnitude of these effects in the park.

Cumulative Effects

Impacts to wildlife in the vicinity of Denali National Park and Preserve are expected to increase as additional development occurs along the Parks Highway corridor and private and commercial activities increase at the southern end of the park. Development on the south side is likely to continue in and adjacent to Denali State Park and in gateway communities such as Petersville, Trapper Creek, and Talkeetna. Continued residential growth, recreational use, and sport hunting from the Healy area west along the Stampede Trail could also result in moderate impacts to wildlife. Commercial rafting on the Nenana River and boating on some park rivers and lakes would generate noise and cause temporary displacement of wildlife along the riparian zone, resulting in a minor impact.

Subsistence hunting and trapping, including the potential use of off-road vehicles for subsistence uses (along Cantwell and Windy Creeks) would result in minor adverse impacts on wildlife abundance because of short-term reductions in population of some species such as marten or moose in small areas. Motorized uses, including where permitted for access (Dunkle Hills, Kantishna Hills), can cause noise and visual stimuli that result in behavioral disturbance and temporary displacement of some wildlife species on a seasonal basis. These effects on wildlife species would continue at specific locations throughout the life of the plan.

These activities would result in loss of habitat, behavioral changes such as avoiding developed areas, human-generated noise, and other disturbances to wildlife in the vicinity of Denali National Park and Preserve. (Other disturbances could include introduction of parvovirus and other diseases to wildlife species in Denali from outside sources.)

The combination of impacts from other activities, including those outside the park that directly affect park wildlife, and the management provisions under Alternative 5, would result in moderate impacts overall, since there would be medium intensity, long-term changes in important wildlife resources. The types and levels of use proposed under Alternative 5 would contribute a moderate portion of the overall cumulative impacts to wildlife.

Conclusion

There would generally be moderate adverse impacts to wildlife populations and habitats under Alternative 5 because of increased snowmachine and motorboat use on various wildlife species. Although most impacts would be limited to short-term effects, there would be some persistent population-level effects in higher use areas such as Broad Pass, Dunkle Hills, Kantishna Hills, and lower elevations on the south side of the Alaska Range.

The level of impacts to wildlife anticipated from Alternative 5 would not result in an impairment of park resources that fulfill specific purposes identified in the enabling legislation or that are essential to the natural integrity of the park.

NATURAL SOUNDSCAPES

As described in Chapter 1, NPS Management Policies and Directors Order #47 establish that natural soundscapes are intrinsic elements of the park environment, and thus are part of the resources and values that the NPS is responsible for protecting, no less so than wildlife or other natural features of the parks. At Denali, the sounds of wolves howling, marmots whistling, white-crowned sparrows singing, water rushing through streambeds, wind in the aspen trees, and absolute stillness and quiet are among the natural sounds that are potentially impacted by actions proposed in the alternatives for this plan. Intrusions on the natural soundscape are sounds generated by human activity, much of which qualifies as “noise” under the definition provided by Directors Order #47 that reads, “noise is generally defined as an unwanted or undesired sound, often unpleasant in quality, intensity or repetition.” Noises that obscure natural sounds are of particular concern, primarily those generated by mechanical and motorized devices such as aircraft, snowmachines, motorboats, or chainsaws.

METHODOLOGY

Although the science of measuring noise impacts from motorized vehicles, aircraft, or other equipment is well developed, the research applies mostly to industrial and urban situations and is not particularly useful in evaluating impacts to national parks or other natural areas. Three relevant research approaches have been used:

- 1) Impacts on the natural sound environment, which can be determined by acoustics alone
- 2) Impacts on visitor enjoyment (e.g. Andersen 1993, Gramann 1999);
- 3) Impacts on wildlife (e.g. Fletcher 1978, Radle 1997).

This analysis addresses only the first of these topics, impacts to the natural sound environment itself. The other two topics are addressed in the Recreational Opportunity and the Wildlife sections of this chapter as appropriate.

The analysis explores the questions of intensity, duration, and context for this topic by answering four questions for each alternative:

- How much motorized noise disturbance is allowed? This information is specified by standards associated with management area designations.
- How do these desired future conditions compare to current conditions? Information about current conditions is incomplete, but sufficient data is available to at least indicate the relationship if not to draw firm conclusions.
- How much motorized noise disturbance is likely to occur? This information is derived from trends described in chapter 3 and the Assumptions listed at the beginning of this chapter, combined with the guidance from management area designations and other access management actions.

Natural sounds are a component of Denali's wilderness resource values, which are identified as resources in the park's enabling legislation. In some park locations, such as the Old Park, natural sounds are a unique resource; in other park locations natural sounds are at least an important resource in terms of the definitions provided at the beginning of the chapter. Natural sound disturbances do not represent permanent changes in park resources; however, if plan actions allow indefinitely recurring seasonal disturbances the affects would be considered long term.

Sound Monitoring Stations

As a resource for the analysis in Alternatives 2–5, Table 4-1 shows how existing data for several locations in Denali National Park and Preserve matches the desired future conditions of each management area. The data were collected through the placement of automated sound stations that measure sound levels and make 5-second digital recordings every 5 minutes (12 samples per hour). The numbers in the table are expressed as a percentage of the samples that exceed desired future conditions for natural sounds. Except for some of the Portal areas, each of these locations has at least two possible designations presented in the alternatives. While the data are illustrative, the sample sizes are generally small and most of the areas sampled are known to have among the highest levels of motorized access (such as established airplane landing areas at Kahiltna Base Camp and the Ruth Amphitheater).

Table 4-1: Percentage of Sample Hours, Days, or Events that Measured Condition Exceeds Standard, by Location and Management Area

Desired Noise Condition Management Areas	Low			Medium			High			Very High		
	D, E, OP1, OP2			B, C			A, Portal, Corridor West Buttruss SUA			Ruth Glacier SUA Portal – Major Landing Area		
Location/Sample Size	% time audible ¹	# motor noises ²	max sound level ³	% time audible ¹	# motor noises ²	max sound level ³	% time audible ¹	# motor noises ²	max sound level ³	% time audible ¹	# motor noises ²	max sound level ³
Kahilna Base Camp 5 days 5/02	40%	80%	31%	31%	80%	31%	24%	80%	2%	6%	0%	2%
Dunkle Hills 5 days 5/01	24%	40%	6%	16%	0%	6%	8%	0%	0%	0%	0%	0%
Dunkle Hills 5 days 2-3/02	38%	100%	3%	30%	60%	3%	21%	0%	0%	6%	0%	0%
Dunkle Hills 6 days 8/02	28%	83%	8%	16%	0%	8%	10%	0%	0%	2%	0%	0%
Pika Glacier 4 days 7/02	8%	100%	27%	3%	0%	27%	0%	0%	0%	0%	0%	0%
Pika Glacier 9 days 8/02	21%	100%	19%	14%	11%	19%	11%	11%	3%	3%	0%	3%
Ruth Amphitheater 9 days 5/02	45%	89%	33%	40%	89%	33%	34%	89%	4%	18%	0%	4%
Ruth Amphitheater 7 days 6/02	36%	86%	38%	31%	57%	38%	30%	57%	5%	23%	29%	5%
Ruth Amphitheater 7 days 7/02	43%	100%	34%	40%	100%	34%	38%	71%	4%	24%	57%	4%
Stampede Airstrip 13 days 9/02	9%	62%	11%	6%	0%	11%	3%	0%	4%	1%	0%	4%
Stampede Airstrip 31 days 10/02	4%	13%	6%	2%	0%	6%	1%	0%	0%	0%	0%	0%
Stampede Airstrip 20 days 11/02	8%	35%	3%	4%	0%	3%	2%	0%	0%	1%	0%	0%
Stampede Airstrip 15 days 4/03	3%	53%	10%	2%	0%	10%	1%	0%	0%	0%	0%	0%
Stampede Airstrip 31 days 5/03	3%	32%	9%	1%	0%	9%	0%	0%	0%	0%	0%	0%
Stampede Airstrip 29 days 6/03	2%	34%	18%	1%	0%	18%	0%	0%	3%	0%	0%	0%

¹The indicator is the percentage of each hour that a motorized noise is heard. Because the data collection method presently used records five seconds out of every five minutes, the indicator essentially refers to the percentage of 5-second samples during which a motorized noise is heard, with 12 such samples each hour. The number in this column refers to the percentage of hours when the standard for the management area would be exceeded.

²The indicator is the number of motorized noises heard during the course of a 24-hour day. The number in this column reflects the percentage of days when the standard for the management area would be exceeded.

³The indicator is the maximum measured sound level of a motorized event. The number in this column reflects the percentage of motorized events for which the sound level would exceed the standard for the management area.

For all locations except the Dunkle Hills area, all of the identifiable motorized noises were aircraft. For the Dunkle Hills in February–March, 37% of the identifiable noises were aircraft, 34% were snowmachines, and 29% were trains. In May, 94% of the noises were aircraft, 5% were snowmachines, and 1% was trains. In August, 66% of the noises were aircraft, 19% were vehicles, and 15% were trains.

Backcountry Ranger Observational Data

In addition to the information collected at automated sound stations, backcountry rangers made systematic observations of motorized noise intrusions during the summer seasons of 1999 and 2000 in the backcountry of the Old Park (Morgan and Van Horn 2001). Although not reported in the same format as this plan's indicators and standards, these observations provide some information by which to evaluate the application of standards in this part of the park and preserve, where no data is yet available from automated sound stations.

Data were collected from 6/12/99 to 9/5/99 and again from 5/28/2000 to 9/5/2000 within the Denali Wilderness, primarily from patrols from the park road corridor, and are thus primarily relevant to the eastern side of the Old Park. Rangers were instructed to listen for aircraft throughout as much of the patrol day as possible, including periods of time when they were around their camp. Each patrol recorded the overall time of the sample period that they (the rangers were usually in pairs) were actively listening for aircraft. While the sampling was opportunistic and statistically non-random, it did parallel the times and locations that park visitors travel through the backcountry.

Within the overall sample period, the observers recorded the start and stop times of audible aircraft noise. This period of time, which could include overlapping noise from several successive aircraft, was labeled an "overflight event." The observers recorded the number and type of aircraft for each overflight event. They also rated the intensity of the noise for each overflight event. The rating for each overflight event was based on the peak noise level that occurred during the event. Key statistics included the following:

- There was an average of 19.5 overflight events (25 aircraft) per patrol, an average of 9.1 overflight events (11.7 aircraft) per day, and an average of 1.4 events (1.8 aircraft) per hour.
- The average duration of overflight events per day of sampling was 32.1 minutes.
- An average sampling day lasted 6.6 hours.
- The average duration of overflight events per hour of sampling was 4.8 minutes.
- The average duration of a single overflight event was 3.4 minutes.

Maximums noted included:

- 8 overflights in an hour that lasted for nearly 30% of that hour
- 31 overflight events (51 separate aircraft) in a day
- Aircraft noise audible for 30% of the time during an afternoon hike.

The patrol rangers rated sound level on a three-part scale as follows:

- 1 – Faint, barely audible, aircraft might be only heard and difficult to locate visually.
- 2 – Clearly audible above-normal background noise.
- 3 – Distracting for conversation, completely dominates soundscape drowning out even loud sounds of nature such as wind or sounds of water.

Table 4-2 summarizes the sound level observations of aircraft events.

Table 4-2: Number of Overflight Events by Intensity Rating.

Intensity Rating	Number of Events	Percentage of Total
1	660	43.4
2	695	45.7
3	160	10.5

Backcountry Visitor Survey

One further study provides data about the amount of noise heard in the Denali backcountry. *A Survey of Overnight Backcountry Visitors to Denali National Park and Preserve* conducted in 2000 asked questions of respondents about the number of aircraft encountered while hiking in the backcountry. Because the universe of survey respondents was limited to visitors who obtain a permit for overnight camping during summer months, the response primarily reflects conditions in the backcountry of the eastern side of the Old Park.

Out of 190 hiking parties surveyed, the average number of aircraft seen per day of the trip was 4.87. The average number of aircraft seen or heard per day as a percentage of hiking parties were as follows:

Table 4-3: Average Number Of Aircraft Seen Per Trip Day By Percent Of Hiking Parties

Average Number of Aircraft Seen Per Trip Day	Percent of Hiking Parties*
10 or more	11.1%
6 to 9.99	21.7%
3 to 5.99	33.6%
1 to 2.99	22.1%
less than 1	11.5%

*Survey response included 190 hiking parties. The number indicated reflects the percent of the total that experienced the average number of aircraft per day in the left hand column.

ALTERNATIVE 1 (NO ACTION)

This alternative would result in major adverse impacts to the natural soundscape of Denali and could result in impairment of the soundscape resource because of cumulative adverse impacts, primarily from airplane and snowmachine noise.

In this alternative, there would be no standards set for natural sound disturbance for any part of the national park and preserve. The NPS would not have clear goals for different areas of the park and preserve, or a tool for communicating desired conditions to visitors, concessioners, aircraft operators, contractors and NPS staff, or others whose activities affect the natural soundscape of the park and preserve.

Motorized noise would increase roughly in parallel with the growth in motorized access, proceeding from the predictions in the Assumptions section of this chapter. As detailed in the table below, natural sound conditions would deteriorate from existing conditions in all areas of the park and preserve where the proposed standards can be compared to available data, with the possible exception of the Stampede mine.

Location	Natural Sound Disturbance Standard	Comparison of Existing Conditions to Standard
Eastern portion of Old Park	No standard	The amount of air traffic and related noise over the eastern portion of the Old Park would at least double in the life of the plan. Data from backcountry ranger patrols and the backcountry visitor survey demonstrate that on average visitors in 2000 were hearing 5-10 airplanes per day in this area, and more than 11% were hearing more than 10. With an average duration of 4.8 minutes per overflight event and an hourly average of 1.4 overflights, simple math shows an "average" hour has audible motorized noise 11% of the time. In reality, many hours measure lower than 11% but many also measure above. The eastern portion of the Old Park is presently at or above the "Medium" standard for natural sound disturbance described in the plan. Projected increases in scenic air tour traffic would likely push the level of disturbance into the range covered by the "High" standard for natural sound disturbance.
Stampede Airstrip	No standard	The area around the Stampede Airstrip generally meets the standards for Medium natural sound disturbance. Increases in air traffic, particularly from the Healy airstrip could move this area into the range covered by the High standard for natural sound disturbance, although that is less likely than in the Old Park.
Dunkle Hills	No standard	Samples from the Dunkle Hills area presently show the percentage time motorized noise is audible, exceeding the standards for a High level of natural sound disturbance, particularly during winter months when samples even exceeded Very High standards. During summer months, much of the noise is faint, but samples from February/March show enough noise events more than natural ambient to exceed Medium standards, in large part because of snowmachine use inside the park. Under this alternative, unmanaged snowmachine access is likely to continue to increase, exceeding the Very High standards more regularly and over broad area.
Ruth Amphitheater	No standard	Measurements at the airstrip at the Ruth Amphitheater show that the Very High standards for natural sound disturbance are exceeded in a substantial number of samples (up to 57%). While conditions at the airstrip are noisier

		than is likely elsewhere in the Ruth Amphitheater region, these measurements demonstrate the potential for the Very High standards to be exceeded throughout the Ruth Amphitheater on days when flying is possible during the summer visitor season.
Kahiltna Base Camp	No standard	Samples from Kahiltna Base Camp already show signs of exceeding the High standards suggested by the draft plan, and 6% of sampled hours had motorized noise heard more than 50% of the time – exceeding even the Very High threshold. While conditions at the airstrip are noisier than is likely elsewhere around the upper Kahiltna Glacier, these measurements demonstrate the potential for the Very High standards to be exceeded throughout the region on days when flying is possible during the summer visitor season.
Pika Glacier	No standard	Samples near the airplane landing area on the Pika Glacier demonstrate that conditions sometimes meet Medium standards (except for the maximum sound level) but sometimes exceed High standards for natural sound disturbance. The Pika landing area is presently used for air taxis delivering climbers to Little Switzerland and as a backup scenic tour landing location when conditions at the Ruth Amphitheater or Kahiltna Base Camp do not allow for landings. However, during the year when samples were taken very few scenic landings occurred. As scenic air tour traffic increases and the Ruth Amphitheater becomes more crowded, the expectation would be for the backup landing areas such as the Pika to be used with increasing frequency, resulting in High standards for natural sound disturbance being regularly exceeded.

General aviation landings would continue to be allowed throughout the park additions and preserve consistent with existing regulations. This method of access is not expected to grow substantially over time, but this alternative would allow ongoing infrequent noise intrusions and higher sound levels in localized areas where take-offs and landings occur (lakes and other backcountry landing areas).

There would be no restrictions on landing locations for scenic air tours. As a result, scenic tour landings would continue to occur throughout the Alaska Range glaciers in the park additions, although most would occur between the Kahiltna and Eldridge Glaciers. Proceeding from the Assumptions at the start of this chapter, scenic air tour landing would be expected to double over the life of the plan. As scenic tour traffic expands, the number of landings at existing locations would increase and as crowding and landing area availability become issues, the traffic would expand to other locations such as the Eldridge and Pika Glaciers, which presently serve as backup when glacier or weather conditions make landing at the Ruth Amphitheater or Kahiltna Glaciers impossible. There would be no restriction or guidance for scenic air tours that do not land, which would also be expected to double over the life of the plan including over the designated wilderness of the Old Park. Increases in scenic air tour traffic would result in high intensity, long-term adverse impacts to this portion of the park additions during the summer season.

There would be no new limitations on overnight camping in the park and preserve. As a result, the number of overnight users would continue to increase, particularly in the southern park additions. Since access to this area is primarily by airplane, the amount of motorized noise would also increase although gradually, resulting in long-term, low-intensity natural sound disturbances.

There would be no limit on the number of climbers on Mount McKinley during the primary climbing season. As a result, at present growth rates the number of climbers would gradually increase by 8-13% over the life of the plan, or 130-195 additional climbers above the number that climbed in 2004. Assuming the same passenger capacity on airplanes as today, this would imply 75-115 flights with landings per year or a 2.5-3.8% increase in flights over 2003 with accompanying concentrated noise that represents only a medium intensity impact because it is relatively localized.

Snowmachine access would continue to increase, particularly along the south side of the Alaska Range in areas accessible in day trips from the Parks Highway such as the Dunkle Hills and Tokositna River valley, during late winter months, although there would be use during other winter months too. Based on increases in winter visitation to Alaska and on snowmachine ownership, an estimated growth rate of 5% per year is reasonable, leading to a doubling of snowmachine access and accompanying noise in 16 years. Although snow cover and short daylight hours limit riding opportunities in early and mid-winter, increasing winter visitation to Alaska will likely result in much more snowmachine access during weekdays than presently occurs.

There would continue to be noise from motorboats on major park rivers. On the Kantishna and Muddy Rivers, much of the noise occurs during subsistence and sport hunting seasons. These rivers are remote except for local use from Lake Minchumina, and are unlikely to see large increases in noise. The Tokositna River may see large increases in recreational traffic associated with access to private visitor facilities on inholdings. This increased activity would be during the summer visitor season along the lower stretch of this river, and could involve substantial increases in recurring seasonal motorized noise of low or medium intensity.

In this alternative, the park road would be maintained to Mile 7 as needed to remove ice from the roadway, but the road would not be plowed and opened until necessary to prepare the road for the summer visitor season. Continuing this policy would result in ongoing low intensity noise in backcountry areas near the road during the winter season, generally before 10am on weekdays.

There would be no backcountry trail or campsite construction in this alternative, so there would be no associated construction or maintenance noise.

There would be no new criteria attached to NPS administrative activities that would minimize noise. As a result, NPS administrative and research use of aircraft and other motorized equipment would likely increase, driven entirely by project needs. A minimum requirement/minimum tool determination would be required within the Denali Wilderness and areas determined suitable for wilderness designation.

Cumulative Impacts

Denali National Park and Preserve has become a noisier place since the park expansion in 1980. Aircraft are primarily responsible for increased natural sound disturbance,

particularly the expansion of scenic air tours since the late 1980s that are responsible for much of the existing motorized noise over the eastern portion of the Old Park, around Mount McKinley, and the south side of the Alaska Range between the Kahiltna and Eldridge Glaciers. The National Park Service has contributed by authorizing concessionaire aircraft to land on glaciers, affecting primarily the area between the Kahiltna and Eldridge Glaciers, and through its own gradual expansion of airplane and helicopter use to support research and administrative activities, which has impacts parkwide. Military use of the Susitna Military Operations Area, which has been occurring at present levels since 1995, also has a substantial adverse impact on the southwestern park and preserve extending east to the Ruth Glacier.

Snowmachine access plays a role during winter months, particularly in the Broad Pass/Dunkle Hills region and low-lying areas in and around the Tokositna River valley, which have become popular riding destinations from the Parks Highway as power and range have increased and ownership has become more common. The closure of the Old Park to snowmachine access in 2000 restricted areas that were only lightly used and primarily served to inhibit future expansion of snowmachine access and accompanying noise to new areas.

If one or more lodges in Kantishna began operating in the winter and supported snowmachine access, the levels of natural sound disturbance could increase dramatically during the late winter season in the southern Kantishna Hills and between Kantishna and the park boundary at Sushana.

Likewise, if a trail were cleared from Nenana to Lake Minchumina and services were offered to support snowmachine access, noise levels could be considerably higher in the northwestern part of the park and preserve along trails that run south almost to the Old Park boundary.

Collectively, these actions have had (and would have) a major adverse impact on the natural soundscape of Denali because of high intensity, long-term motorized disturbances in the Old Park, around Mount McKinley, in the Dunkle Hills/Broad Pass area, and over the south side glaciers. Most of the impacts are the result of past actions, so that areas like the Ruth Amphitheater, other glaciers on the south side of the Alaska Range, and even portions of the Old Park have high intensity, long-term changes in the natural sound environment caused by motorized noise. However, additional motorized noise likely to occur under this alternative could double the impacts, since more than double the use of snowmachines and aircraft is expected within the life of the plan. This alternative therefore results in major adverse cumulative impacts to the natural soundscape of the park and preserve.

Conclusion

This alternative would result in major adverse impacts to the natural soundscape of Denali because of increases in high intensity, long-term motorized noise – primarily from airplanes and snowmachines – across large portions of the park and preserve. In locations

such as the Old Park and the southern park additions between the Kahiltna and the Eldridge Glacier, the amount of summer season noise from airplane traffic could double over the life of the plan. The same is true of snowmachine noise in the Dunkle Hills and Tokositna River areas, which would also likely expand in impact beyond weekends in late winter. These areas are already severely impacted by long-term, medium to high intensity changes in the natural sound environment. As a result, assuming present trends continue the cumulative impact of this action combined with the impacts of previous actions could result in impairment of this important park resource that fulfills specific purposes specified by legislation.

ALTERNATIVE 2

This alternative would provide a major benefit to the natural sound resource at Denali by mitigating the adverse impacts caused by past increases in motorized noise; however, ongoing low to medium intensity airplane noise would still cause minor adverse cumulative impacts.

In this alternative, there would be new soundscape standards established for management areas throughout the national park and preserve and a set of tools identified for managing access to achieve the standards. The proportion of the park and preserve that falls within each standard would be as follows:

Natural Sound Disturbance	% of park backcountry
Very High	0%
High	0%
Medium	12%
Low	88%

In addition, there would be year-round corridors designated on the Kantishna, Muddy, and lower Tokositna Rivers. These 62 miles of corridor management area would allow a High level of natural sound disturbance that could have border impacts on the surrounding management areas, where a lesser degree of disturbance would be expected.

As the following table demonstrates, these standards would likely represent a substantial improvement over existing conditions in all areas of the park and preserve where the standards can be compared to available data—except at Kahiltna Base Camp. These results are particularly important for the Old Park and Stampede airstrip areas, where data is relatively plentiful and aircraft overflights are the primary motorized noise source, so the results indicate broad areas rather than just airplane landing strips. For the Dunkle Hills, a larger portion of noise is snowmachine-related in winter months, and a substantial reduction in motorized noise is indicated but based on a very small sample size. In all areas, access management tools would be applied to bring conditions into standard.

Region Identifier	Natural Sound Disturbance Standard	Comparison of Existing Conditions to Standard
Eastern portion of Old Park	Low	Both the NPS patrol observations and the report from the 2000 backpacker survey demonstrate that the eastern portion of the Old Park receives considerably more airplane noise than the Low standard for natural sound disturbance would permit. The standard would allow only 1 motorized noise per day louder than natural ambient, while the average for one survey is 9.1 per day; for the other 4.9 per day. Some of these airplane noises may not reach the natural ambient threshold, but from the sound level rating system used by the ranger patrols up to 56% of the motorized noise may reach that level. In addition, 10.5% may exceed the maximum sound level of 40 dBA.
Stampede Airstrip	Low	Data from the Stampede Mine airstrip, which is very near the Toklat Basin region, showed the number of motorized noises louder than natural ambient exceeded the Low standard between 13% and 62% of days every month for which comparative data exists. Because the motorized noise at Stampede resulted from aircraft overflights, it is likely that surrounding areas had similar amounts of natural sound disturbance.
Dunkle Hills	Medium	Data from the Dunkle Hills during winter months showed that a Medium level of natural sound disturbance is exceeded at times. In those samples, standards for the percent of time motorized noise was audible were exceeded between 30% and 60% of all hours measured.
Ruth Amphitheater landing area	Very High	Data from the Ruth Amphitheater showed that the Very High standard for the Ruth Glacier Special Use Area is exceeded between 18% and 24% of measured hours for the percent time motorized noise is audible. Standards are also sometimes exceeded for the number of motorized noises louder than natural ambient heard during the course of the day, up to 57% of days during a July sample period. Conditions at the landing area are likely to be considerably noisier than the surrounding area, however.
Kahiltna Base Camp	Very High	The small data sample at Kahiltna Base Camp shows that the Very High standard is generally met.
Pika Glacier	High	Measurements taken near the airplane landing area on the Pika Glacier – within the Portal area – show that all standards for a High level of natural sound disturbance were met during a July sampling period, however 11% of both sample hours (for percent time audible) and sample days (for number of motorized noises over natural ambient) exceeded standard in an August sampling period.

Airplane landings would be prohibited parkwide in this alternative for all except at Portals and frontcountry airstrips, or when used for access to traditional activities as presently defined for snowmachines in the Old Park. Many of the existing and future airplane landings in the park and preserve would be for purposes consistent with the “traditional activities” definition – hunting, fishing, and berry gathering being examples. This action would eliminate a small but unquantifiable amount of noise associated with landings for other non-traditional purposes, although the associated overflights above the park could still occur, resulting in a low intensity, long-term benefit to the natural soundscape.

Scenic air tour landings would be restricted to the Kahiltna Base Camp after July 1 and to the Ruth Amphitheater, and landings would be limited to 2001 numbers. Between 1999 and 2004, there were an average of 206 landings per year that took place outside of these

areas, primarily on the Pika and Eldridge Glaciers, amounting to 11% of total scenic air tour landings. However, scenic tour landings comprised 73% of all landings in these two locations, so the amount of motorized noise on the Pika and Eldridge Glaciers could be expected to decline substantially. Landings for 2001 were higher than in any succeeding year, so the limit to 2001 numbers would affect only growth, not current conditions. This action would benefit not only the natural soundscape of the Portals but also the areas surrounding the Portals and areas that the scenic tours travel over on their way to these landing locations.

Sound data for the Ruth Amphitheater in 2002 shows that all three sound standards for a Medium level of sound disturbance were exceeded between 31% and 100% of the sample hours, days, or events. For the High level of sound disturbance in Portal areas, the percent time audible per hour standard and the number of motorized noises per day standard would have been exceeded between 24% and 89% of the hours or days. Since concessions data show that 2001 landings in the Ruth Amphitheater were roughly 8% higher than 2002 (2,107 compared to 1,929), it could be anticipated that by themselves, these restrictions would not bring sound conditions into standard, so other tools would have to be employed.

Commercial air taxi landings would be restricted to designated Portals and frontcountry landing strips. Based on 1999-2003 concession reports, this would eliminate about 66 backcountry landings per year and associated motorized noise, primarily at other glacier landing areas. Some of these landings would be displaced to areas just outside of park boundaries while the associated overflights would still occur (e.g., around the southwest preserve). This action would have a negligible impact on natural soundscape.

Limiting the number of climbers on Mount McKinley to 1,300 per season would restrict growth in air taxi access to Kahiltna Base Camp. However, that limit would allow the same number of climbers as in 2001. Some noise reduction might occur as concession operators achieve more efficiency in passengers per flight, reducing the number of flights necessary to transport the same number of climbers. This action would also have a negligible impact on the natural soundscape.

This set of rules would eliminate most snowmachine access to parklands in popular areas around the Tokositna River valley and in the Dunkle Hills/Broad Pass area. Based on the small sample of motorized noise from the Dunkle Hills area above, this action would eliminate a substantial portion of the motorized noise during late winter months when snowmachine activity is normally high.

The prohibition on motorboat use except for access to traditional activities would have limited effect, primarily on potential future use. Much of the existing motorboat use in the park and preserve is to access activities such as hunting that would meet the Old Park definition of traditional activities. An exception is the Tokositna River, where some recreational access presently occurs and is expected to increase in association with access to private visitor facilities on inholdings. This action would only have an affect on future

non-traditional, recreational uses, and would have no immediate effect on the amount of natural sound disturbance in the park and preserve.

In this alternative, the park road would remain unplowed until necessary for summer season use. As a result, there would be no ground-based motorized intrusion west of Park Headquarters during the early and mid-winter months, roughly October through March, eliminating a temporary, low-intensity source of noise that presently occurs in the area between mile 3 and mile 7 of the park road.

There would be no backcountry trail or campsite construction in this alternative, so there would be no associated construction or maintenance noise.

The National Park Service would discontinue use of the temporary administrative camp at 14,000 feet on Mount McKinley. This would reduce the requirement for use of Army helicopters to install and remove the camp each year, although they would still be needed to install and remove the Kahiltna Base Camp. The noise associated with installing the 14,000-foot camp is substantial within a small area of the park during set up and removal, but the impact is confined to a relatively brief period.

The National Park Service would apply the minimum requirement process to the entire backcountry and would develop methodologies for minimizing aircraft use for administrative and research purposes. These actions should improve natural soundscape conditions in the backcountry.

Cumulative Impacts

Denali National Park and Preserve has become a noisier place since the park expansion in 1980. Aircraft are primarily responsible for increased natural sound disturbance, particularly the expansion of scenic air tours since the late 1980s, which produce much of the existing motorized noise over the eastern portion of the Old Park, around Mount McKinley, and on the south side of the Alaska Range between the Kahiltna and Eldridge Glaciers. The National Park Service has contributed by authorizing concessioner aircraft to land on glaciers, affecting primarily the area between the Kahiltna and Eldridge Glaciers, and through its own gradual expansion of airplane and helicopter use to support research and administrative activities, which has impacts parkwide. Military use of the Susitna Military Operations Area, which has been occurring at present levels since 1995, also has a substantial adverse impact on the southwestern park and preserve extending east to the Ruth Glacier.

Snowmachine access plays a role during winter months, particularly in the Broad Pass/Dunkle Hills region and low-lying areas in and around the Tokositna River valley, which have become popular riding destinations from the Parks Highway as power and range have increased and ownership has become more common. The closure of the Old Park to snowmachine access in 2000 restricted areas that were only lightly used and primarily served to inhibit future expansion of snowmachine access and accompanying noise to new areas.

If one or more lodges in Kantishna began operating in the winter, this alternative would prohibit use of snowmachines for recreational touring. Thus, there would only be additional natural sound-related impacts associated with activities that meet the “traditional activities” definition or potentially impacts associated with access to or from the private establishments. If a trail were cleared from Nenana to Lake Minchumina and services were offered to support snowmachine access, this alternative would prohibit recreational snowmachine access within park and preserve boundaries, so there would be no additional noise-related impacts except by users accessing “traditional activities.”

Collectively, these actions have had (and would have) a major adverse impact on the natural soundscape of Denali because of high intensity, long-term motorized disturbances in the Old Park, around Mount McKinley, in the Dunkle Hills/Broad Pass area, and over the south side glaciers. This alternative provides a major benefit to the natural sound resource by mitigating the impacts of some of these actions, providing a distinct reduction in sound levels in several locations over the life of the plan. As a result, there would be cumulative minor adverse impacts under this alternative because of ongoing low levels of motorized noise over the eastern and southern portions of the park and preserve with some high intensity, long-term motorized noise intrusions in localized areas, particularly at Kahiltna Base Camp and the Ruth Amphitheater landing area. The amount of motorized noise would be lower than current conditions in regions such as the eastern part of the Old Park, the Dunkle Hills, and glaciers on the south side of the Alaska Range. The actions proposed under this alternative would be responsible for none of the adverse impacts to natural soundscapes, but would primarily mitigate the affects of past actions.

Conclusion

This alternative would provide a major benefit to the natural sound resource at Denali by mitigating the adverse impacts caused by past actions, particularly by reducing existing snowmachine noise in the Tokositna and Dunkle Hills/Broad Pass areas, the noise from scenic air tour landings other than at the Ruth Amphitheater and Kahiltna Base Camp, and reducing the noise of scenic air tours over the Old Park and southern glaciers. However, there would still be minor cumulative adverse impacts to the natural soundscape of the park and preserve primarily because of low-intensity, long-term noise from air traffic over much of the eastern and southern park with higher concentrations around Kahiltna Base Camp and the Ruth Amphitheater.

The level of impacts to the natural soundscape anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the natural integrity of the park.

ALTERNATIVE 3

This alternative would provide a moderate benefit to the natural sound resource at Denali by mitigating the adverse impacts caused by past increases in motorized noise; however,

moderate adverse cumulative impacts would occur because of ongoing high intensity noise in a few specified locations and medium intensity, dispersed noise across large parts of the park additions.

In this alternative, there would be new soundscape standards established for management areas throughout the national park and preserve and a set of tools identified for managing access to achieve the standards. The proportion of the park and preserve that falls within each standard would be as follows:

Natural Sound Disturbance	% of park backcountry
Very High	<1%
High	4%
Medium	15%
Low	81%

In addition, there would be year-round corridors designated on the Kantishna, Muddy, and east and west fork of the Yentna Rivers; and winter corridors in the Dunkle Hills/ Broad Pass area. While other corridor designations in the Tokositna valley and Kantishna Hills areas would not differ in allowed natural sound disturbance from the surrounding area, these 109 miles of year-round corridors and additional 13 miles of winter season corridor would allow a High level of natural sound disturbance that could have border impacts on the surrounding management areas, where a lesser degree of disturbance would be expected.

As the table below demonstrates, these standards would likely represent a substantial improvement over existing conditions in all areas of the park and preserve where the standards can be compared to available data except at Kahiltna Base Camp. These results are particularly important for the Old Park and Stampede airstrip areas, where data are relatively plentiful and aircraft overflights are the primary motorized noise source, thus the results are indicative of broad areas instead of just airplane landing strips. For the Dunkle Hills a larger portion of noise is snowmachine-related in winter months, and a substantial reduction in motorized noise is indicated but based on a very small sample size. In all areas, access management tools would be applied to bring conditions into standard.

Region Identifier	Natural Sound Disturbance Standard	Comparison of Existing Conditions to Standard
Eastern portion of Old Park	Low	Both the NPS patrol observations and the report from the 2000 backpacker survey demonstrate that the eastern portion of the Old Park receives considerably more airplane noise than the Low standard for natural sound disturbance would permit. The standard would allow only 1 motorized noise per day with a higher sound level than natural ambient, while the average for one survey is 9.1 per day, for the other 4.9 per day. Some of these airplane noises may not be louder than the natural ambient threshold, but from the sound level rating system used by the ranger patrols up to 56% of the motorized noise may reach that level. In addition, 10.5% may exceed the maximum sound level of 40 dBA.
Stampede Airstrip	Low	Data from the Stampede Mine airstrip, which is very near the Toklat Basin region, show the number of motorized noises louder than natural ambient exceeded the Low standard between 13% and 62% of days every month for which comparative data exists. Because the motorized noise at Stampede resulted from aircraft overflights, it is likely that surrounding areas had similar amounts of natural sound disturbance.
Dunkle Hills	Medium	Data from the Dunkle Hills during winter months show that a Medium level of natural sound disturbance is exceeded at times. In those samples, standards for the percent time motorized noise was audible were exceeded between 30% and 60% of all hours measured.
Ruth Amphitheater landing area	Very High	Data from the Ruth Amphitheater show that the Very High standard for the Ruth Glacier Special Use Area is exceeded between 18% and 24% of measured hours for the percent time motorized noise is audible. Standards are also sometimes exceeded for the number of motorized noises louder than natural ambient heard during the course of the day, up to 57% of days during a July sample period. Conditions at the landing area are likely to be considerably noisier than the surrounding area, however.
Kahiltna Base Camp	Very High	The small data sample at Kahiltna Base Camp shows that the Very High standard is generally met.
Pika Glacier	High	Measurements taken near the airplane landing area on the Pika Glacier – within the Portal area – show that all standards for a High level of natural sound disturbance were met during a July sampling period; however, 11% of both sample hours (for percent time audible) and sample days (for number of motorized noises over natural ambient) exceeded standards in an August sampling period.

Airplane landings would not be allowed in the Old Park. This would eliminate a small but unknown amount of present and future noise associated with general aviation use year-round in about one-third of the park and preserve, although the associated overflights could still occur. There would be no change in the noise associated with general aviation landings elsewhere in the park and preserve.

Scenic air tour landings would be restricted to Kahiltna Base Camp after July 1, the Ruth Amphitheater, and the Ruth Gorge. Between 1999 and 2004, there were an average of 199 scenic air tour landings per year that took place outside of these areas, primarily on the Pika and Eldridge Glaciers, amounting to 10% of total scenic air tour landings. However, in these two locations the scenic tour landings accounted for 73% of all landings, so the amount of noise disturbance in these specific locations could be expected to decline substantially. Standards would constrain high-volume scenic air-tour overflights to the Ruth Glacier valley and lower Tokositna Glacier with more dispersed

use elsewhere, detectably reducing sound levels over parts of the Old Park and other portions of the southern park additions between the Kahiltna and Eldridge glaciers. However, airplane noise would be the most distinctive part of the sound environment over the Ruth Glacier during the summer visitor season.

A limit of 1,500 per season on climbing Mount McKinley would indirectly restrict growth in air taxi access to Kahiltna Base Camp, and growth in climber demand is not likely to reach the limit within the life of the plan. The 1,500 limit would allow 22% more climbers than in 2002, when a small sample of days showed that noise standards were exceeded in this area. As a result, other access management tools are likely to be applied before restrictions on climber numbers would affect the amount of noise.

Snowmachine access would be restricted parkwide to traditional activities as defined for the Old Park in 2000, but recreational snowmachine access would be provided along winter season corridors in the Tokositna River valley and the Broad Pass/Dunkle Hills area. A High level of noise would be allowed along each of these corridors and that level would likely be reached during late winter months. However, the amount of snowmachine noise in locations other than the corridors in the Dunkle Hills would likely be substantially less than recorded in the small sample described above.

Rivers that support existing use of motorboats (Kantishna, Muddy, Tokositna, Yentna) are designated corridors under this alternative and so have a High standard for natural sound disturbance. For the Kantishna, Muddy, and Yentna Rivers most motorboat noise occurs during the general and/or subsistence hunting seasons and would likely remain under the standard by itself. Along the Yentna, it would be a contributing factor near the river, although most noise in the area would be associated with aircraft.

The Tokositna River is likely to have growth in recreational motorboat traffic particularly accessing private visitor facilities along the lower section of the river. Increased motorboat traffic would result in increased noise; however, during the summer visitor season when motorboat use occurs, motorboat noise would continue to have relatively little impact compared to airplane noise in this area.

In this alternative, the park road would be maintained to mile 7 during winter months for administrative purposes only to remove ice from the park road, although a snow-covered surface would be left for winter recreation. This action would result in heavy road equipment traveling up 4 miles of the park road between October and March. Experimentation has proved that the required maintenance can generally be accomplished before 10am and is required only occasionally. Natural sound disturbance would be minimal and would likely fit within the range allowable for a Low standard of natural sound disturbance.

The National Park Service would designate trails and campsites within Management Area A in Kantishna and improve existing social trails if needed. Trail and campsite construction in the Kantishna could include the use of motorized equipment such as

power wheelbarrows or chainsaws as well as aerial delivery of material if the minimum tool requirement is met, all of which would create noise disturbances. The same might also be required for trail maintenance in future years. The noise disturbances would be localized to the places near where construction or maintenance was occurring, and could temporarily exceed standards for the duration of the project (usually less than a single season in any one location).

The National Park Service would apply the minimum requirement process to the entire backcountry and would develop methodologies for minimizing aircraft use for administrative and research purposes. However, plan implementation would require additional levels of administrative and research presence for monitoring in the backcountry, and some of these plan-related activities would meet the minimum tool requirement for use of aircraft, snowmachines, or other equipment that produces motorized noise.

Cumulative Impacts

Denali National Park and Preserve has become a noisier place since the park expansion in 1980. Aircraft are primarily responsible for increased natural sound disturbance, particularly the expansion of scenic air tours since the late 1980s, which produce much of the existing motorized noise over the eastern portion of the Old Park, around Mount McKinley, and the south side of the Alaska Range between the Kahiltna and Eldridge Glaciers. The National Park Service has contributed by authorizing concessionaire aircraft to land on glaciers, affecting primarily the area between the Kahiltna and Eldridge Glaciers, and through its own gradual expansion of airplane and helicopter use to support research and administrative activities, which has impacts parkwide. Military use of the Susitna Military Operations Area, which has been occurring at present levels since 1995, also has a substantial adverse impact on the southwestern park and preserve extending east to the Ruth Glacier.

Snowmachine access plays a role during winter months, particularly in the Broad Pass/Dunkle Hills region and low-lying areas in and around the Tokositna River valley, which have become popular riding destinations from the Parks Highway as power and range have increased and ownership has become more common. The closure of the Old Park to snowmachine access in 2000 restricted areas that were only lightly used and primarily served to inhibit future expansion of snowmachine access and accompanying noise to new areas.

If one or more lodges in Kantishna began operating in the winter, this alternative would prohibit use of snowmachines for recreational touring, so there would only be additional natural sound-related impacts associated with activities that meet the “traditional activities” definition or potentially with access to or from the private establishments. If a trail were cleared from Nenana to Lake Minchumina and services were offered to support snowmachine access, this alternative would prohibit recreational snowmachine use from this park boundary, so there would be no additional noise-related impacts except by users accessing “traditional activities.”

Collectively, these actions have had (and would have) a major adverse impact on the natural soundscape of Denali because of high intensity, long-term motorized disturbances in the Old Park, around Mount McKinley, in the Dunkle Hills/Broad Pass area, and over the southern glaciers. The actions proposed in this alternative would provide a moderate benefit to the natural sound environment by mitigating some of these adverse impacts, although increases in motorized noise could still occur in many areas of the park. Cumulatively, the natural soundscape resource of the national park and preserve would still have moderate adverse impacts because of noise that approaches the Very High standards for natural sound disturbance in the Ruth Amphitheater, and High standards elsewhere on the Ruth Glacier and along corridors in the Dunkle Hills and Tokositna River areas. Standards for a Medium level of natural sound disturbance would be reached in other locations on the southern glaciers and in the Dunkle Hills/Broad Pass area. However, the actions proposed in this alternative would contribute very little to the adverse impacts that generally already exist.

Conclusion

This alternative would provide a moderate benefit to the natural sound resource at Denali by mitigating the adverse impacts caused by past actions, resulting in low to medium intensity, long-term reductions in noise levels over the Old Park and parts of the southern park additions. However, there would be additional temporary noise associated with construction and maintenance of trails in Kantishna along with increased backcountry monitoring. There would still be moderate adverse cumulative impacts to the natural soundscape of the park and preserve because of high intensity noise on corridors, at Portals, and over the Ruth Glacier and medium intensity noise across much of the rest of the southern additions.

The level of impacts to the natural soundscape anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the natural integrity of the park.

ALTERNATIVE 4 (PREFERRED ALTERNATIVE)

This alternative would have negligible overall impacts on the natural sound environment of the Denali backcountry. Standards that would require improvements in sound conditions in some areas, such as the Old Park, would be offset by increasing noise in other locations in the southern additions. There would still be major cumulative adverse impacts because of the high intensity of airplane and snowmachine noise in large portions of the park additions.

In this alternative, there would be new soundscape standards established for management areas throughout the national park and preserve and a set of tools identified for managing access to achieve the standards. The proportion of the park and preserve that falls within each standard would be as follows:

Natural Sound Disturbance	% of park backcountry
Very High	3%
High	9%
Medium	9%
Low	79%

In addition, there would be year-round corridors designated on the Kantishna, Muddy, and east and west fork of the Yentna Rivers. While other corridor designation in the Dunkle Hills, Kantishna Hills, and Tokositna valley areas would not differ in allowed natural sound disturbance from the surrounding area, these 109 miles of year-round corridors would allow a High level of natural sound disturbance that could have border impacts on the surrounding management areas, where a lesser degree of disturbance would be expected.

As demonstrated by the table below, where standards can be compared to available data there would be a mixture of results. The amount of motorized noise in the Old Park should decline substantially, as should some localized areas such as the Ruth Amphitheater landing area. Access management tools would be applied to bring conditions into standard. However, the amount of motorized noise in areas such as the northern additions or localized areas like Kahiltna Base Camp could remain the same or even accommodate some additional noise.

Location	Natural Sound Disturbance Standard	Comparison of Existing Conditions to Standard
Eastern portion of Old Park	Low	Both the NPS patrol observations and the report from the 2000 backpacker survey demonstrate that the eastern portion of the Old Park receives considerably more airplane noise than the Low standard for natural sound disturbance would permit. The standard would allow only 1 motorized noise per day louder than natural ambient, while the average for one survey is 9.1 per day, for the other 4.9 per day. Some of these airplane noises may not reach the natural ambient threshold, but from the sound level rating system used by the ranger patrols at least 56% of the motorized noise likely reaches that level. In addition, 10.5% may exceed the maximum sound level of 40 dBA.
Stampede Airstrip	Medium	Data from the airstrip at Stampede Mine show that the level of natural sound disturbance generally falls within the range of variation allowed by Medium standards. One exception was the maximum sound level, which for five out of six months exceeded the standard of 40 dBA in between 6% and 18% of motorized noise samples.
Dunkle Hills	High	Data from the Dunkle Hills during winter months demonstrate that the standard for a High level of natural sound disturbance is exceeded at times. Existing samples from the area show that about 21% of hours exceed the standard for time audible during late winter months, which allows motorized noise for 25% of any hour. During summer months, the percentage of hours exceeding the standard was only 8% to 10%.

Ruth Amphitheater landing area	Very High	Data from the Ruth Amphitheater show that the Very High standards for the Ruth Glacier Special Use Area are exceeded between 18% and 24% of measured hours for the percent time motorized noise is audible. Standards are also sometimes exceeded for the number of motorized noises louder than natural ambient heard during the course of the day, up to 57% of days during a July sample period. Conditions at the landing area are likely to be considerably noisier than the surrounding area, however.
Kahiltna Base Camp	Very High	The small data sample at Kahiltna Base Camp shows that the Very High standard is generally met.
Pika Glacier	High	Measurements taken near the airplane landing area on the Pika Glacier – within the Portal area – show that all standards for a High level of natural sound disturbance were met during a July sampling period; however, 11% of both sample hours (for percent time audible) and sample days (for number of motorized noises over natural ambient) exceeded standard in an August sampling period.

General aviation landings would continue to be allowed throughout the park additions and preserve consistent with existing regulations. This method of access is not expected to grow substantially over time, but this alternative would allow infrequent loud noise associated with take-offs and landings at lakes suitable for float plane landings and other scattered off-airport landing locations.

Scenic air tour landings would be restricted to glaciers in Management Area A and to the Pika and Eldridge Glaciers when climbers and mountaineers are not present. Present use levels by climbers and mountaineers on the Pika and Eldridge would allow an increase in scenic tour landings over current numbers. However, as climbing and mountaineering use grows, scenic tour use could be limited. Between 1999 and 2004, only two scenic air tour landings took place outside the allowable area under this alternative, thus, there would be little immediate impact on existing airplane landings or the accompanying noise. Large numbers of scenic air tour overflights could continue to produce high intensity levels of noise between the Kanikula, Buckskin, and upper Ruth and Kahiltna glaciers in the southern additions, with a particular concentration of noise over the Ruth and Tokositna Glaciers. This noise would be the most distinctive part of the sound environment during the summer visitor season.

A limit of 1,500 per season on climbing Mount McKinley would indirectly restrict growth in air taxi access to Kahiltna Base Camp, and growth in climber demand is unlikely to reach the limit within the life of the plan. The 1,500 limit would allow 22% more climbers than in 2002, when a small sample of days showed that noise standards were exceeded in this area. As a result, other access management tools are likely to be applied before restrictions on climber numbers would affect the amount of noise.

Snowmachine access would be managed through the application of access management tools to achieve natural sound disturbance standards set for each management area. Snowmachine noise would likely reach those standards on weekend days in late winter during the course of the plan in the Dunkle Hills/Broad Pass area as well as the lowlands, lower glaciated areas, and foothills around the Ruth, Tokositna, and Kanikula Glaciers, all of which are designated for a High standard of natural sound disturbance. Noise

would also increase during late winter weekdays over the duration of the plan as winter visitation in Alaska increases, although it would not be expected to reach the High standard.

Rivers that support existing use of motorboats (Kantishna, Muddy, Tokositna, Yentna) are designated corridors under this alternative. Noise levels from motorboats are likely to remain below levels allowed under the standard for a High level of natural sound disturbance during the life of the plan. The highest level of noise would be experienced on the lower Tokositna River and on the Kantishna and Muddy Rivers during subsistence and sport hunting seasons.

In this alternative, the Tokositna River also falls into the Ruth Glacier Special Use Area, which allows a Very High standard for natural sound disturbance. This river is likely to have growth in recreational motorboat traffic particularly accessing private visitor facilities along the lower section of the river. During the summer visitor season when motorboat use occurs, motorboat noise would continue to have relatively little impact compared to airplane noise in this area.

Under Alternative 4, the park road would be maintained to mile 7 during winter months for administrative purposes only to remove ice from the park road, although a snow-covered surface would remain for winter recreation. This action would result in heavy road equipment traveling up four miles of the park road between October and March. Experimentation has proved that the required maintenance can generally be accomplished before 10am and is required only occasionally. Natural sound disturbance would be minimal and would likely fit within the range allowable for a Low standard of natural sound disturbance.

Several additional trails would be constructed in Kantishna along with designated campsites and single trails that would be constructed at Wonder Lake, Eielson Visitor Center, and Wildhorse Creek. Trail construction could include the use of motorized equipment such as power wheelbarrows or chainsaws as well as aerial delivery of material if the minimum tool requirement is met, all of which would create noise disturbances. The same might also be required for trail maintenance in future years. The noise disturbances would be localized in impact to the places near where construction or maintenance was occurring, and could temporarily exceed standards.

The National Park Service would apply the minimum requirement process to the entire backcountry and would develop methodologies for minimizing aircraft use for administrative and research purposes. These actions should improve natural soundscape conditions in the backcountry.

Cumulative Impacts

Denali National Park and Preserve has become a noisier place since the park expansion in 1980. Aircraft are primarily responsible for increased natural sound disturbance,

particularly the expansion of scenic air tours since the late 1980s, which produce much of the existing motorized noise over the eastern portion of the Old Park, around Mount McKinley, and the south side of the Alaska Range between the Kahiltna and Eldridge Glaciers. The National Park Service has contributed by authorizing concessioner aircraft to land on glaciers, affecting primarily the area between the Kahiltna and Eldridge Glaciers, and through its own gradual expansion of airplane and helicopter use to support research and administrative activities, which has impacts parkwide. Military use of the Susitna Military Operations Area, which has been occurring at present levels since 1995, also has a substantial adverse impact on the southwestern park and preserve extending east to the Ruth Glacier.

Snowmachine access plays a role during winter months, particularly in the Broad Pass/Dunkle Hills region and low-lying areas in and around the Tokositna River valley, which have become popular riding destinations from the Parks Highway as power and range have increased and ownership has become more common. The closure of the Old Park to snowmachine access in 2000 restricted areas that were only lightly used and primarily served to inhibit future expansion of snowmachine access and accompanying noise to new areas.

If one or more lodges in Kantishna began operating in the winter and supported snowmachine access, this alternative would allow such access to occur. In the southern Kantishna Hills, there would be a High standard for motorized noise. Depending on the scale of service provided by the lodges, this threshold could be reached in some parts of the southern Kantishna Hills within the life of the plan. Much of the noise impact would occur during late winter months. Adjacent areas would have a Low or Medium standard for natural sound disturbance, which would require dispersal of snowmachine access in these areas.

If a trail were cleared from Nenana to Lake Minchumina and services were offered to support snowmachine access, this alternative would allow only a Low standard of natural sound disturbance within the park and preserve. During late winter months, there would likely be some additional natural sound disturbance, although it would be limited by the standard.

Collectively, these actions have had (and would have) a major adverse impact on the natural soundscape of Denali because of high intensity, long-term motorized disturbances in the Old Park, around Mount McKinley, in the Dunkle Hills/Broad Pass area, and over the southern glaciers. The actions in this alternative provide a negligible impact to the overall natural sound environment, mitigating the impacts of some past actions, but allowing motorized noise to increase in other locations. Overall, there would continue to be a major adverse cumulative impact to the natural soundscape of the park and preserve from the actions in this alternative combined with other past and possible future actions, but this alternative contributes only a minor portion of those impacts.

Conclusion

Alternative 4 would have negligible overall impacts on the natural sound environment of the Denali backcountry. Although the amount of motorized noise would substantially decline in the Old Park, this alternative would allow medium to high intensity, long-term increases in motorized noise in other locations, including the portions of the northern additions east of the Kantishna Hills, the Dunkle Hills and Tokositna River areas during winter months at times that use is presently low, and over portions of the southern additions between the Kahiltna and Eldridge Glaciers during summer months. Some temporary noise would be added because of trail and campsite construction. There would still be major cumulative adverse impacts because of the high intensity airplane noise in the Ruth Amphitheater, over the southern glaciers, lowland areas between the Kahiltna and Ruth Glaciers, and in the Dunkle Hills/Broad Pass area.

The level of impacts to the natural soundscape anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the natural integrity of the park.

ALTERNATIVE 5

This alternative would result in moderate adverse impacts to the natural soundscape of the park and preserve because it would allow increasing motorized noise in the southern additions. Because the actions in this alternative would not mitigate the adverse impacts of previous noise intrusions, there would continue to be major adverse cumulative impacts from existing sources of noise, but the standards presented in the plan would establish limits that would prevent impairment of the natural sound resource.

In this alternative, there would be new soundscape standards established for management areas throughout the national park and preserve and a set of tools identified for managing access to achieve the standards. The proportion of the park and preserve that falls within each standard would be as follows:

Natural Sound Disturbance	% of park backcountry
Very High	3%
High	15%
Medium	66%
Low	16%

In addition, there would be year-round corridors designated on the Kantishna, Muddy, and east and west fork of the Yentna Rivers and potentially a winter season corridor from the Sushana River to Kantishna. While other corridor designation in Dunkle Hills/Broad Pass, Kantishna, and Tokositna valley areas would not differ in allowed natural sound disturbance from the surrounding area, these 109 miles of year-round corridors and additional 48 miles of winter season corridor would allow a High level of natural sound

disturbance that could have border impacts on the surrounding management areas, where a lesser degree of disturbance would be expected.

As demonstrated by the table below, where the standards can be compared to available data they would maintain existing conditions or allow some additional noise in the Old Park and Stampede airstrip areas, while requiring some improvement in localized areas such as the Ruth Amphitheater landing area and Kahiltna Base Camp. Late winter use in the Dunkle Hills might require some reduction in noise on weekends.

Location	Natural Sound Disturbance Standard	Comparison of Existing Conditions to Standard
Eastern portion of Old Park	Medium	Both the NPS patrol observations and the report from the 2000 backpacker survey demonstrate on average the eastern portion of the Old Park receives an amount of airplane noise that would meet the Medium standard. The standard would allow 10 motorized noises per day louder than natural ambient, while the average for one survey is 9.1 per day, for the other 4.9 per day. Some of these airplane noises may not reach the natural ambient threshold, but from the sound level rating system used by the ranger patrols, at least 56% of the motorized noise likely reaches that level. The only standard that might be exceeded is maximum sound level, for which 10.5% of motorized noises likely exceed 40 dBA.
Stampede Airstrip	Medium	Data from the airstrip at Stampede Mine show that the level of natural sound disturbance generally falls within the range of variation allowed by Medium standards. One exception was the maximum sound level, which for five out of six months exceeded the standard of 40 dBA in between 6% and 18% of motorized noise samples.
Dunkle Hills	High	Data from the Dunkle Hills during winter months demonstrate that the standard for a High level of natural sound disturbance is exceeded at times. Existing samples from the area show that about 21% of hours exceed the standard for time audible during late winter months, which allows motorized noise for 25% of any hour. During summer months, the percentage of hours exceeding the standard were only 8% to 10%.
Ruth Amphitheater landing area	Very High	Data from the Ruth Amphitheater show that the Very High standards for the Ruth Glacier Special Use Area are exceeded between 18% and 24% of measured hours for the percent time motorized noise is audible. Standards are also sometimes exceeded for the number of motorized noises louder than natural ambient heard during the course of the day, up to 57% of days during a July sample period. Conditions at the landing area are likely to be considerably noisier than the surrounding area, however.
Kahiltna Base Camp	Very High	The small data sample at Kahiltna Base Camp shows that the Very High standard is generally met.
Pika Glacier	High	Measurements taken near the airplane landing area on the Pika Glacier – within the Portal area – show that all standards for a High level of natural sound disturbance were met during a July sampling period; however, 11% of both sample hours (for percent time audible) and sample days (for number of motorized noises over natural ambient) exceeded standards in an August sampling period.

General aviation landings would continue to be allowed throughout the park additions and preserve consistent with existing regulations. This method of access is not expected to grow substantially over time, but this alternative would allow infrequent loud noise

associated with take-offs and landings at lakes suitable for float plane landings and other scattered off-airport landing locations.

Scenic air tour landings would be restricted to glaciers in Management Area A. Between 1999 and 2004, only two scenic air tour landings took place outside of this area, thus there would be little impact on existing airplane landings. As landing areas become crowded and noise thresholds are reached in the Ruth Amphitheater and at Kahiltna Base Camp, scenic tour landings would expand to the Eldridge and Pika Glaciers to a greater degree, and possibly to other locations as well. Scenic air tour overflights would maximize use of glaciated areas that allow a High level of natural sound disturbance. Scenic air tour overflights above the Old Park could continue with as much noise as at present. Much of the area between the Kahiltna and Eldridge Glaciers could have sound levels that reach the High or Very High thresholds allowed in this area.

There would be no limit on the number of climbers on Mount McKinley during the primary climbing season. As a result, air-taxi traffic could increase to accommodate demand, which is likely to increase gradually. However, since noise standards were exceeded in 2002 when only 1,232 climbers attempted the summit, it is likely that other actions would be taken to reduce noise from present levels, and slightly increasing climber numbers would have no affect.

Snowmachine access would be managed through the application of access management tools to achieve natural sound disturbance standards set for each management area. Snowmachine noise would likely reach those standards on weekend days in late winter during the course of the plan in the Dunkle Hills/Broad Pass area as well as the lowlands, lower glaciated areas, and foothills around the Ruth, Tokositna, and Kanikula Glaciers, all of which are designated for a High standard of natural sound disturbance. Noise would also increase during late winter weekdays over the duration of the plan as winter visitation in Alaska increases, although it would not be expected to reach the High standard.

Rivers that support existing use of motorboats (Kantishna, Muddy, Tokositna, Yentna) are designated corridors under this alternative. Noise levels from motorboats are likely to remain below levels allowed under the standard for a High level of natural sound disturbance during the life of the plan. The highest level of noise would be experienced during subsistence and sport hunting seasons along the Kantishna and Muddy Rivers.

Under Alternative 5, the Tokositna River also falls into the Ruth Glacier Special Use Area, which allows a Very High standard for natural sound disturbance. Growth in recreational motorboat traffic is likely, particularly for access to private visitor facilities along lower sections of the river. During the summer visitor season when motorboat use occurs, motorboat noise would continue to have relatively little impact compared to airplane noise in this area.

In this alternative, the park road would be kept open to Savage Campground throughout the winter, the parking lot would be plowed at the campground, and a warming hut would

be provided to serve as a base for winter activities in the eastern portion of the Old Park. This action would result in additional motorized noise from both maintenance vehicles and visitor traffic along 9 miles of park road and through Savage Campground, areas which are now typically undisturbed from October through March. The frequency of maintenance traffic would be predicated on snow and ice conditions. Winter visitors have been increasing and current figures indicate that several hundred visitors could be expected each month (375-1,000 per month based on winter 2003-2004 data). This number is expected to increase during the life of the plan, particularly in late winter months such as February and March.

Several additional trails would be constructed in Kantishna along with designated campsites, two trails at Eielson Visitor Center, and single trails at Wonder Lake and Wildhorse Creek, the latter also having designated campsites. Additional trails could be constructed in Management Area A in the lowland areas surrounding the lower Kahiltna, Tokositna, and Ruth Glaciers. Trail construction could include the use of motorized equipment such as power wheelbarrows or chainsaws as well as aerial delivery of material if the minimum tool requirement is met, all of which would create noise disturbances. The same might also be required for trail maintenance in future years. The noise disturbances would be localized in impact to the places near where construction or maintenance was occurring, and could temporarily exceed standards.

The National Park Service would apply the minimum requirement process to the entire backcountry and would develop methodologies for minimizing aircraft use for administrative and research purposes. These actions should improve natural soundscape conditions in the backcountry.

Cumulative Impacts

Denali National Park and Preserve has become a noisier place since the park expansion in 1980. Aircraft are primarily responsible for increased natural sound disturbance, particularly the expansion of scenic air tours since the late 1980s, which produce much of the existing motorized noise over the eastern portion of the Old Park, around Mount McKinley, and the south side of the Alaska Range between the Kahiltna and Eldridge Glaciers. The National Park Service has contributed by authorizing concessioner aircraft to land on glaciers, affecting primarily the area between the Kahiltna and Eldridge Glaciers, and through its own gradual expansion of airplane and helicopter use to support research and administrative activities, which has impacts parkwide. Military use of the Susitna Military Operations Area, which has been occurring at present levels since 1995, also has a substantial adverse impact on the southwestern park and preserve extending east to the Ruth Glacier.

Snowmachine access plays a role during winter months, particularly in the Broad Pass/Dunkle Hills region and low-lying areas in and around the Tokositna River valley, which have become popular riding destinations from the Parks Highway as power and range have increased and ownership has become more common. The closure of the Old Park to snowmachine access in 2000 restricted areas that were only lightly used and primarily

served to inhibit future expansion of snowmachine access and accompanying noise to new areas.

If one or more lodges in Kantishna began operating in the winter and supported snowmachine access, this alternative would allow such access to occur. Along a corridor from the Sushana River to Kantishna and in the southern Kantishna Hills, there would be a High standard for motorized noise, and depending on the scale of service provided by the lodges this threshold could be reached in some parts of the southern Kantishna Hills during the life of the plan. Much of the noise impact would occur during late winter months. Adjacent areas would have a Medium standard for natural sound disturbance, which would require dispersal of snowmachine access in these areas.

If a trail were cleared from Nenana to Lake Minchumina and services were offered to support snowmachine access, this alternative would allow a Medium standard of natural sound disturbance within the park and preserve. During late winter months, there would likely be some additional natural sound disturbance, although it would be limited by the standard.

Collectively, these actions have had (and would have) a major adverse impact on the natural soundscape of Denali because of high intensity, long-term motorized disturbances in the Old Park, around Mount McKinley, in the Dunkle Hills/Broad Pass area, and over the southern glaciers. Actions in this alternative would result in moderate adverse impacts because of medium intensity, long-term increases in motorized noise particularly in the southern park additions from the Kahiltina Glacier east to Cantwell. This alternative does little to mitigate the adverse impacts of previous actions. All together, there would continue to be a major adverse cumulative impact from the actions in this alternative combined with past and possible future actions. This alternative would be responsible for a substantial portion of the cumulative impacts.

Conclusion

There would be moderate adverse impacts to the natural soundscape of the park and preserve under this alternative because of medium intensity, long-term increases in motorized noise over broad portions of the park and preserve, particularly the southern additions east of and including the Kahiltina Glacier during summer months and the Dunkle Hills/Broad Pass and Tokositna areas during late winter. There would continue to be major adverse cumulative impacts because of high intensity, long-term airplane and snowmachine access in the southern park additions and airplane overflights above the Old Park. The actions in this alternative do little to mitigate the increased motorized noise from previous actions, but do prevent impairment of the natural sound resource by setting standards that would limit the extent to which noise could increase.

As a result of these actions, the level of impacts to the natural soundscape anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the natural integrity of the park.

WILDERNESS RESOURCES

The Alaska National Interest Lands Conservation Act designated most of the Old Park as the Denali Wilderness, to be managed under the provisions of the Wilderness Act. ANILCA also identified the protection of “wilderness resource values” and the provision of associated “wilderness recreational opportunities” to be important purposes of the park additions and preserves. In addition, a wilderness suitability review conducted as part of the 1986 General Management Plan concluded that 3.73 million acres of the park additions were also suitable for wilderness designation, and NPS Management Policies direct the NPS to “take no action that would diminish the wilderness suitability of an area possessing wilderness characteristics until the legislative process of wilderness designation has been completed.” The extent of impact to the wilderness resources of Denali, including both wilderness character and wilderness experience, is therefore a central concern of this analysis.

METHODOLOGY

Working from the definitions given in the Wilderness Act, the clarifications (including ANILCA provisions) under the Wilderness Management section of chapter 2, and the tradition of wilderness preservation at Denali described in chapter 3, the following “wilderness resource values” have been identified for Denali National Park and Preserve.

- Perpetuation of natural ecological relationships and processes and the continued existence of native wildlife populations in largely natural condition
- Absence of permanent human structures, including buildings, roads, trails, dams, and communications facilities
- Opportunities for solitude including:
 - Freedom from the reminders of society
 - Privacy and isolation
 - Absence of distractions such as large groups, mechanization, unnatural noise, signs, and other modern artifacts
- Opportunities for primitive and unconfined recreation, which have the following characteristics:
 - Self-sufficiency, absence of support facilities or motorized transportation
 - Direct experience of weather, terrain, and wildlife with minimal shelter or assistance from devices of modern civilization
 - Lack of restriction on movement; freedom to explore in the way that is desirable given conditions of weather, terrain, and personal ability; ability to be spontaneous
 - Minimal formal regulatory requirements

Impacts on wildlife, soundscapes, and other natural resources are addressed in the Wildlife, Vegetation, Soil and Water, and Natural Soundscapes sections. The analysis in this section will focus on wilderness character and wilderness experience, which are

integrally related because much of wilderness character can only be subjectively determined by the visitor's experience (for example, solitude or freedom of movement).

Impacts on wilderness character and experience are determined by comparing the desired future conditions described by management area standards to current conditions and to likely future conditions given predicted changes in use and varying management area designations among alternatives.

ALTERNATIVE 1 (NO ACTION)

The actions in this alternative would result in major adverse impacts to the wilderness resource of the Denali backcountry because of ongoing increases in motorized access in accessible regions that would compromise wilderness qualities including absence of motorized noise, privacy and isolation, and absence of evidence of modern human use. These adverse impacts could result in the impairment of a park resource specified in legislation.

Absence of Permanent Structures

No additional facilities would be constructed under this alternative. Consequently, there would be no change in wilderness character either in the designated wilderness of the Old Park or areas determined suitable for wilderness designation.

Opportunities for Solitude

In this alternative, there would be no new management areas or standards for such indicators of wilderness solitude as encounters with other people, encounters with large groups, or camping density. While the existing encounter rate standard of two parties per day in the Old Park – implemented in part by overnight camping quotas – help ensure the opportunity for solitude in designated wilderness, the same is not true for areas in the park additions and preserve. In the Old Park, there is also no uniform group size limit or limit on the number of large groups that could be encountered.

As visitation to the park's backcountry increases, opportunities for solitude would decline in some areas of the park additions, particularly in those areas that are easily accessible by air or road, such as the Dunkle Hills in summer along the state right of way, areas near the Petersville Road, and alpine areas between the Kahiltna and Ruth Glaciers.

The amount of motorized equipment used for access and the attendant noise expected under this alternative is described in detail in the Natural Soundscapes section of this chapter. This section concluded that under Alternative 1, there would be major adverse impacts to the natural soundscape because of increasing airplane access over the eastern portions of the Old Park and the southern glaciers (Kahiltna Glacier to Eldridge Glacier) and snowmachine access in the southern additions. Because noise levels are likely at

least to double over the life of the plan, particularly in areas that already have high intensity, long-term changes in the natural sound environment, there is the likelihood of impairment of the natural sound resource. This in turn would constitute a long-term, consistent decline in the wilderness character of those locations in the park and the potential for visitors to have a wilderness experience. This conclusion is true both for the designated wilderness of the Old Park as well as for areas in the southern park additions that have been determined suitable for wilderness designation.

Opportunities for Primitive and Unconfined Recreation

Under this alternative, no additional registration requirements would be immediately imposed. Thus, visitors would have no further restrictions prior to entering the backcountry. While airplanes and motorboats could continue to be used parkwide for access to recreational activities, and snowmachines could continue to be used in the park additions and preserve for undefined “traditional activities,” visitors would still have the opportunity to travel throughout the backcountry without assistance from motorized transportation.

Cumulative Impacts

The establishment of unit quotas in the 1976 Backcountry Management Plan protected wilderness experience in the backcountry of the Old Park by limiting encounters, dispersing visitors and visitor impacts, and insuring that the great majority of visitors could camp out of sight and sound of others. The permit requirement for the Old Park does restrict freedom of movement since visitors must camp in the unit for which they have a permit on any given night. However, day users are not similarly restricted. The 60-day registration requirement for climbing Mount McKinley and Mount Foraker does not restrict freedom of movement once climbers enter the park.

The authorization of commercial air taxi landings for climbers on the Kahiltna glacier at the Denali Wilderness boundary, combined with improvements in climbing equipment and the popularization of the West Buttress as a mostly non-technical route to the summit of Mount McKinley, has led to large increases in the number of climbers in this area, from 124 in 1970 to a peak of 1,305 in 2001. Because each expedition is 17 days on average and the primary climbing season is only 2-3 months long, there is a large concentration of visitors on the West Buttress every year, during which time opportunities for solitude are not available.

The increase in snowmachine access particularly in accessible areas of the park additions in the Broad Pass/Dunkle Hills area and the Tokositna River valley has greatly increased the number of encounters with other parties, the evidence of modern human use, and natural sound disturbance, detracting from the wilderness qualities of these areas. Likewise, the expansion of scenic air tour access in response to changes in visitor demand has increased motorized noise across large areas of the Old Park wilderness and the glaciated area between the Kahiltna and Ruth glaciers. This alteration in wilderness

resources is long-term, occurring every season, and is consistently observable over large portions of the backcountry and therefore a high-intensity change to wilderness resources.

The National Park Service has constructed trails that extend into the Congressionally designated wilderness of the Old Park, and will construct additional trails as specified by the 1997 *Entrance Area and Road Corridor DCP*. These trails are permanent new structures in the wilderness area, but total fewer than 20 miles within the 1.9 million acre Denali Wilderness, and therefore are a low intensity change in wilderness character. The National Park Service has also established seasonal administrative camps at Kahiltna Base Camp and at the 14,000-foot level on Mount McKinley, and generally increased the amount of research and administrative activity in the backcountry, including the use of aircraft and other motorized equipment and some temporary and long-term installations of research equipment. This heightened administrative presence is observable to the visitor but generally is not a consistent change over any particular area of the park except for the administrative camps, and is therefore a medium intensity, long-term alteration in the wilderness resources of the park and preserve.

These past, present, and future actions have had a major adverse impact on the wilderness resources of the park and preserve, largely because of the long-term, high-intensity changes caused by airplane and snowmachine access over a large portion of the park and preserve and the loss of opportunities for solitude on the West Buttress of Mount McKinley during the primary climbing season. The actions under this alternative would also have major adverse impacts on the wilderness resources of the park because of additional long-term, high-intensity increases in motorized access that lead to losses in opportunities for solitude. Therefore, there would be major adverse cumulative impacts to wilderness resources under this alternative, half of which could be attributed to the actions in this alternative.

Conclusion

Under this alternative, major adverse impacts to wilderness resources of the Denali backcountry would occur because of long-term, high-intensity increases in motorized access in accessible regions. These would compromise wilderness qualities including absence of motorized noise, privacy and isolation, and absence of evidence of modern human use. For some areas, such as portions of the southern glaciers between the Kahiltna and Eldridge Glaciers, the level of motorized noise and evidence of modern human use could reach a level during the summer visitor season that the area no longer suitable for wilderness designation. This condition would constitute impairment of a park resource that fulfills a specific purpose identified in legislation.

ALTERNATIVE 2

The actions in this alternative would result in moderate benefits to the wilderness resource of the Denali backcountry because limitations on motorized access would

restore opportunities for solitude. However, there would still be minor adverse cumulative impacts because of ongoing airplane access and the absence of opportunities for solitude on the West Buttress route on Mount McKinley during the primary climbing season.

Absence of Permanent Structures

No additional facilities would be constructed under this alternative, thus there would be no change in wilderness character either in the designated wilderness of the Old Park or areas determined suitable for wilderness designation.

Opportunities for Solitude

This alternative establishes a variety of standards that would protect opportunities for solitude. Important among these are the following standards.

Standards for the number of encounters with other parties in this alternative emphasize high levels of privacy and isolation, as demonstrated in the following table.

Number of Encounters with Other Parties					
Descriptor	Very Low	Low	Medium	High	Very High
Standard	0	3/week	2/day	5/day	10/day
% of Park & Preserve	57%	8%	27%	8%	62 miles summer & winter corridors, West Buttress SUA
At 9 Portals and in the West Buttress Special Use Area there is no standard for the number of encounters with other parties					

Standards for encounters with large groups limit associated impacts on vegetation, wildlife, and the solitude of other visitors, as well as mitigate the impacts of adding group educational and guided activities in areas where allowed.

Possible to Encounter Large Groups?			
Descriptor	No	Yes	Yes - 2/day
Standard	0 groups	1 group per day	2 groups per day
% of Park & Preserve	64%	28%	8%

Standards for camping density assure that visitors throughout almost the entire backcountry would have the opportunity to camp out of sight and sound of other visitors.

Possible to Camp Out of Sight and Sound of Others?			
Descriptor	Low	Medium	High
Standard	Yes, always	Not always at peak season	No, during peak season
% of Park & Preserve	99%	62 miles summer & winter corridors, 5 Portals	3 Portals, West Buttress Special Use Area

Standards for the number of encounters with evidence of modern human use ensure that in most of the backcountry, visitors would continue to be relatively free of reminders of society. Some exceptions occur in the West Buttress Special Use area, corridors, Portals, and backcountry hiker areas.

Number of Encounters with Evidence of Modern Human Use			
Descriptor	Low	Medium	High
Standard	1/backcountry trip	3/day	5/day
% of Park & Preserve	92%	8% + 5 Portals	3 Portals, BC Hiker Areas, West Buttress SUA, 62 miles summer & winter corridors

As visitation to the park increases, these standards protect opportunities for solitude by triggering management action to disperse or limit the density of visitors in locations where problems arise. While hiker areas, corridors, Portals, and the West Buttress Special Use area allow higher-intensity levels of visitor use and landscape impact than is typical of the Denali backcountry, collectively these represent a small area of the park and preserve.

Application of these standards primarily affects the park additions and preserve, since the Denali Wilderness was already managed to achieve similar standards. However, for the Old Park these standards do provide more definition for qualities such as evidence of modern human use, and they do distinguish the western portion of the Old Park (OP2) as an area that should protect current conditions of very low use levels.

The amount of motorized equipment used for access and the attendant noise expected under this alternative is described in detail in the Natural Soundscapes section of this chapter. As documented in that section, 88% of the park and preserve is designated within a management area that only allows Low levels of natural sound disturbance and the other 12% of the park and preserve would allow a Medium level of natural sound disturbance. This alternative also has actions that would exclude airplane landings except from Portals and frontcountry airstrips, and snowmachines and motorboats from the entire park and preserve. Although the level of noise on 62 miles of corridors and at nine Portals could reach the High standard, together, these actions would generally allow very little noise or motorized transport in the park backcountry, which would protect wilderness character and the wilderness experience of visitors.

The 14,000-foot camp on Mount McKinley would be discontinued. This action would reduce signs of human presence, noise associated with helicopter deliveries and retrieval of materials, and the need for Lama helicopter support for rescue operations and resource management activities. Climbers would be forced to be more self-sufficient, since rescue services would not be as available. However, without the camp there would likely be increased signs of human presence in the form of litter and human waste.

Opportunities for Primitive and Unconfined Recreation

There would be a limit of 1,300 climbers per season on Mount McKinley. At present visitation levels, this limit would not exclude any climbers. However, within the 20-year life of the plan demand would grow to an estimated 1,405-1,470 climbers per year, thus between 105 and 170 climbers per year would have their ability to climb Mount McKinley restricted. This is a very small proportion of overall park backcountry visitation, and affects only one destination within the 6 million acre park and preserve.

Mountaineers would be required to carry out human waste from the West Buttress above 14,000 feet and from campsites within one-half mile of air taxi landing locations on glaciers. At present, this action would only require visiting the NPS ranger station at Talkeetna to obtain a Clean Mountain Can, although other options may be available within the life of the plan.

Day-use registration would be required in the Old Park during summer months and in portions of the southern park additions east of and including the Kahiltna Glacier during winter months. All overnight camping in the park and preserve would require registration.

None of these actions would result in restrictions on freedom of movement once the visitor has entered the backcountry. The burden on visitors prior to entering the backcountry is expected to be light if the National Park Service is successful in making registration convenient and simple. These requirements would constitute a long-term, low-to-medium intensity adverse impact.

Cumulative Impacts

The establishment of unit quotas in the 1976 Backcountry Management Plan protected wilderness experience in the backcountry of the Old Park by limiting encounters, dispersing visitors and visitor impacts, and insuring that the great majority of visitors could camp out of sight and sound of others. The permit requirement for the Old Park does restrict freedom of movement since visitors must camp in the unit for which they have a permit on any given night. However, day users are not similarly restricted. The 60-day registration requirement for climbing Mount McKinley and Mount Foraker does not restrict freedom of movement once climbers enter the park.

The authorization of commercial air taxi landings for climbers on the Kahiltna glacier at the Denali Wilderness boundary, combined with improvements in climbing equipment and the popularization of the West Buttress as a mostly non-technical route to the summit of Mount McKinley, has led to large increases in the number of climbers in this area, from 124 in 1970 to a peak of 1,305 in 2001. Because each expedition takes 17 days on average and the primary climbing season is only 2-3 months long, there is a large concentration of visitors on the West Buttress every year, during which time opportunities for solitude are not available.

The increase in snowmachine access particularly in accessible areas of the park additions in the Broad Pass/Dunkle Hills area and the Tokositna River valley has greatly increased the number of encounters with other parties, the evidence of modern human use, and natural sound disturbance, detracting from the wilderness qualities of these areas. Likewise, the expansion of scenic air tour access in response to changes in visitor demand has increased motorized noise across large areas of the Old Park wilderness and the glaciated area between the Kahiltna and Ruth glaciers. This alteration in wilderness resources is long-term, occurring every season, and is consistently observable over large portions of the backcountry and therefore a high-intensity change to wilderness resources.

The National Park Service has constructed trails that extend into the Congressionally designated wilderness of the Old Park, and will construct additional trails as specified by the 1997 *Entrance Area and Road Corridor DCP*. These trails are permanent new structures in the wilderness area, but altogether total fewer than 20 miles within the 1.9-million-acre Denali Wilderness, and therefore are a low intensity change in wilderness character. The National Park Service has also established seasonal administrative camps at Kahiltna Base Camp and at the 14,000 foot level on Mount McKinley, and generally increased the amount of research and administrative activity in the backcountry, including the use of aircraft and other motorized equipment and some temporary and long-term installations of research equipment. This heightened administrative presence is observable to the visitor but generally is not a consistent change over any particular area of the park except for the administrative camps, and is therefore a medium intensity, long-term alteration in the wilderness resources of the park and preserve.

These past, present, and future actions have had a major adverse impact on the wilderness resources of the park and preserve, largely because of the long-term, high-intensity changes caused by airplane and snowmachine access over a large portion of the park and preserve and the loss of opportunities for solitude on the West Buttress of Mount McKinley during the primary climbing season. This alternative would provide a minor benefit to wilderness resources by mitigating the impacts of past actions and future growth. Combined with previous actions protecting the wilderness character of the Old Park, there would be only minor adverse cumulative impacts from the actions in this alternative combined with the past, present, and reasonably foreseeable future actions. The actions in this alternative would be responsible for none of the adverse impacts.

Conclusion

Under this alternative, there would be a moderate benefit to the wilderness resource of the Denali backcountry primarily because of long-term, substantial reductions in motorized access that translates into increased opportunity for solitude. The proposed standards for encounters with other parties, encounters with large groups, ability to camp out of sight and sound, and evidence of modern human use would protect wilderness resource values as visitation grows but would generally still allow increases in visitor use across most of the western portion of the Old Park, park additions, and preserve. There is

a long-term but low-intensity loss of unconfined recreation opportunities because of new registration requirements and climbing limits on Mount McKinley, but these either are minimal or affect a small percentage of backcountry visitors. A cumulative minor adverse impact to the wilderness resource of the Denali backcountry would occur, primarily because of ongoing absence of opportunities for solitude on the West Buttress route of Mount McKinley, and localized high levels of noise and motorized equipment at Kahiltna Base Camp, the Ruth Amphitheater landing area, and to a lesser degree at other Portals.

The level of impacts to wilderness character and experience anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the natural integrity of the park.

ALTERNATIVE 3

The actions in this alternative would result in a moderate benefit to wilderness resource values in the Denali backcountry by increasing opportunities for solitude while only minimally adding new structures or constraining freedom of movement. There would still be moderate adverse impacts to the wilderness resource of the Denali backcountry because of the loss of opportunity for solitude on the West Buttress of Mount McKinley and the noise and equipment associated with aircraft use on and around the Ruth Glacier and in corridors in the southern park additions.

Absence of Permanent Structures

There would be new trails and limited designated campsite development in this alternative, bringing not only permanent facilities – potentially including food storage and sanitation facilities at up to five sites in the Kantishna area – but also the noise and human presence associated with trail construction and maintenance.

However, in the Kantishna Hills area the trails would generally either replace or improve existing social trails or old community and mining access trails. The actions would take place outside areas determined suitable for wilderness designation.

None of these would affect the designated wilderness of the Old Park.

Opportunities for Solitude

This alternative establishes a variety of standards that would protect opportunities for solitude. Important among these are the following standards.

Standards for the number of encounters with other parties in this alternative provide for a balance between areas that emphasize privacy and isolation and areas that allow more use while still protecting wilderness qualities, as the table below demonstrates.

Number of Encounters with Other Parties					
Descriptor	Very Low	Low	Medium	High	Very High
Standard	0	3/week	2/day	5/day	10/day
% of Park & Preserve	44%	13%	32%	11%	128 miles summer corridors , 135 miles winter corridors, West Buttress SUA
At 9 Portals and in the West Buttress Special Use Area no standard exists for the number of encounters with other parties					

Standards for encounters with large groups limit impacts on vegetation, wildlife, and the solitude of other visitors, as well as mitigate the impacts of adding group educational and guided activities in areas where allowed.

Possible to Encounter Large Groups?			
Descriptor	No	Yes	Yes - 2/day
Standard	0 groups	1 group per day	2 groups per day
% of Park & Preserve	58%	32%	10%

Standards for camping density assure that visitors throughout almost the entire backcountry would have the opportunity to camp out of sight and sound of other visitors.

Possible to Camp Out of Sight and Sound of Others?			
Descriptor	Low	Medium	High
Standard	Yes, always	Not always at peak season	No, during peak season
% of Park & Preserve	99%	128 miles summer corridors, 135 miles winter corridors, 5 Portals	3 Portals, West Buttress Special Use Area

Standards for the number of encounters with evidence of modern human use ensure that in most of the backcountry visitors would continue to encounter few or no signs of modern equipment, as demonstrated by the table below. Some exceptions occur in the West Buttress Special Use area, corridors, Portals, and backcountry hiker areas.

Number of Encounters with Evidence of Modern Human Use			
Descriptor	Low	Medium	High
Standard	1/backcountry trip	3/day	5/day
% of Park & Preserve	89%	11% + 5 Portals	3 Portals, BC Hiker Areas, West Buttress SUA, 128 miles summer corridors, 135 miles winter corridors

As visitation to the park increases, these standards protect wilderness character and experience by triggering management action to disperse or limit the density of visitors in locations where problems arise. While backcountry hiker areas, corridors, Portals, and the West Buttress Special Use area allow higher levels of visitor use and landscape impact than is typical of the Denali backcountry, collectively these represent a small area of the park and preserve.

Application of these standards would primarily affect the park additions and preserve, since the Denali Wilderness was already managed to achieve similar standards. However, for the Old Park these standards would provide more definition for qualities such as evidence of modern human use, and they would distinguish the western portion of the Old Park (OP2) as an area that should protect current conditions of very low use levels.

The amount of motorized equipment used for access and the attendant noise expected under this alternative is described in detail in the Natural Soundscapes section of this chapter. As documented in that section, 81% of the park and preserve would be designated within a management area that only allows Low levels of natural sound disturbance, 15% in areas that allow Medium sound disturbance, and only 4% in areas that allow a High level of sound disturbance. In addition, there are 128 miles of corridor in the summer and 135 miles in winter along with 5 Portals that would allow a High level of sound disturbance, and 3 Major Landing Areas plus less than 1% of the park and preserve in the seasonal Ruth Glacier Special Use Area that would allow a Very High level of natural sound disturbance. Overall, there would be a moderate benefit to the natural soundscape in this alternative, primarily because conditions in the southern park additions and the designated wilderness of the Old Park should improve.

The park road would be maintained to mile 7 during winter months for ice removal only. This action would retain noise and signs of heavy equipment to a 4-mile stretch of road for approximately 6 months, but the impact can be mitigated to a degree by short hours of operation. Only a small portion of the park and preserve and no designated wilderness is affected except for cross-boundary noise.

There would be up to 135 miles of corridors in winter, some of which could be marked with route markers. This action would provide more guidance and add more signs of management and human presence than is typical of the wilderness experience at Denali, but they would be used only if the minimum tool requirement is met and other, less intrusive measures (such as providing maps, guidance with natural land features) are ineffective.

Opportunities for Primitive and Unconfined Recreation

There would be a limit of 1,500 climbers per season on Mount McKinley. Within the 20-year life of the plan, demand could grow to an estimated 1,405-1,470 climbers per year, thus the expectation is that the limit would not be reached and the limit would exist primarily to establish a ceiling on visitors if growth is faster than anticipated.

Mountaineers would be required to carry out human waste from the West Buttress above 14,000 feet and from campsites within one-half mile of air taxi landing locations on glaciers. At present, this would require visiting the NPS ranger station at Talkeetna to obtain a Clean Mountain Can and to return it after use, although other options may be available within the life of the plan.

Day-use registration would be required in the Old Park during summer months and in portions of the southern park additions east of and including the Kahiltna Glacier during winter months. All overnight camping in the park and preserve would require registration.

None of these actions would result in restrictions on freedom of movement once the visitor has entered the backcountry. The burden on visitors prior to entering the backcountry is expected to be light if the National Park Service is successful in making registration convenient and simple.

Cumulative Impacts

The establishment of unit quotas in the 1976 Backcountry Management Plan protected wilderness experience in the backcountry of the Old Park by limiting encounters, dispersing visitors and visitor impacts, and insuring that the great majority of visitors could camp out of sight and sound of others. The permit requirement for the Old Park does restrict freedom of movement since visitors must camp in the unit for which they have a permit on any given night. However, day users are not similarly restricted. The 60-day registration requirement for climbing Mount McKinley and Mount Foraker does not restrict freedom of movement once climbers enter the park.

The authorization of commercial air taxi landings for climbers on the Kahiltna glacier at the Denali Wilderness boundary, combined with improvements in climbing equipment and the popularization of the West Buttress as a mostly non-technical route to the summit of Mount McKinley, has led to large increases in the number of climbers in this area, from 124 in 1970 to a peak of 1,305 in 2001. Because each expedition takes an average of 17 days and the primary climbing season is only 2-3 months long, a large amount of visitors concentrate on the West Buttress every year, during which time opportunities for solitude are not available.

The increase in snowmachine access— particularly in accessible areas of the park additions in the Broad Pass/Dunkle Hills area and the Tokositna River valley— has greatly increased the number of encounters with other parties, the evidence of modern human use, and natural sound disturbance, detracting from the wilderness qualities of these areas. Likewise, the expansion of scenic air tour access in response to changes in visitor demand has increased motorized noise across large areas of the Old Park wilderness and the glaciated area between the Kahiltna and Ruth glaciers. This alteration in wilderness resources is long term, occurring every season, and is consistently observable over large portions of the backcountry and therefore a high-intensity change to wilderness resources.

The National Park Service has constructed trails that extend into the Congressionally designated wilderness of the Old Park, and will construct additional trails as specified by the 1997 *Entrance Area and Road Corridor DCP*. These trails are permanent new structures in the wilderness area, but altogether total fewer than 20 miles within the 1.9-million-acre Denali Wilderness, and therefore are a low intensity change in wilderness character. The National Park Service has also established seasonal administrative camps at Kahiltna Base Camp and at the 14,000-foot level on Mount McKinley, and generally increased the amount of research and administrative activity in the backcountry, including the use of aircraft and other motorized equipment and some temporary and long-term installations of research equipment. This heightened administrative presence is observable to the visitor but generally is not a consistent change over any particular area of the park except for the administrative camps, and is therefore a medium intensity, long-term alteration in the wilderness resources of the park and preserve.

These past, present, and future actions have had a major adverse impact on the wilderness resources of the park and preserve, largely because of the long-term, high-intensity changes caused by airplane and snowmachine access over a large portion of the park and preserve and the loss of opportunities for solitude on the West Buttress of Mount McKinley during the primary climbing season. The actions in this alternative mitigate the impacts of cumulative past actions and restrict impacts from further growth in these kinds of uses. There is still a moderate adverse impact to the wilderness resource because the Ruth Glacier and Amphitheater would have a substantial amount of scenic air tours and other aircraft use and some corridors would have a substantial amount of recreational access by snowmachine. The actions in this alternative would not be responsible for any substantial adverse impacts, although they would be responsible for small, isolated impacts such as new structures (trails) and new registration requirements.

Conclusion

Under this alternative, there would be a moderate benefit to the wilderness resource of the Denali backcountry, primarily because of long-term, substantial reductions in motorized access that translate into increased opportunity for solitude. The proposed standards for encounters with other parties, encounters with large groups, ability to camp out of sight and sound of others, and evidence of modern human use would protect wilderness resource values as visitation grows, but would generally still allow increases in visitor use across most of the western portion of the Old Park, park additions, and preserve. There is a long-term but low-intensity loss of unconfined recreation opportunities because of new registration requirements and climbing limits on Mount McKinley, but these either are minimal or would be unlikely to trigger during the life of the plan. There would still be a moderate adverse cumulative impact primarily because of ongoing high levels of motorized noise and equipment associated with aircraft use during summer months and associated with some corridors in the southern additions during winter months.

The level of impacts to wilderness character and experience anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the natural integrity of the park.

ALTERNATIVE 4 (PREFERRED ALTERNATIVE)

The actions in this alternative would have negligible new impacts on wilderness resources in the Denali backcountry, protecting and improving conditions in some areas while allowing the loss of some quality in others. There would still be major adverse cumulative impacts because of ongoing motorized access in parts of the southern additions and the absence of opportunities for solitude on the West Buttress route of Mount McKinley.

Absence of Permanent Structures

There would be new trails and limited designated campsite development in this alternative, bringing not only permanent facilities – potentially including food storage and sanitation facilities at up to five sites in the Kantishna area – but also the noise and human presence associated with trail construction and maintenance.

However, in the Kantishna Hills area the trails would generally either replace or improve existing social trails or old community and mining access trails. The actions would take place outside of areas determined suitable for wilderness designation.

Short sections of trail would be constructed within the Old Park at Wonder Lake, at Eielson Visitor Center, and at the Healy Overlook, but they would replace existing obvious social trails and fall partly within the Backcountry Day Use area, outside the designated wilderness.

Most impacted would be the Wildhorse Creek area, where an area determined suitable for wilderness designation would have new trail construction in an area that presently has no signs of human structures or ongoing human presence. However, the trail would occupy only part of a single creek valley.

Opportunities for Solitude

This alternative establishes a variety of standards that would protect opportunities for solitude. Important among these are the following standards.

Standards for the number of encounters with other parties in this alternative provide a balance between areas that emphasize privacy and isolation and areas that allow more use while still protecting wilderness qualities, as the table below demonstrates.

Number of Encounters with Other Parties					
Descriptor	Very Low	Low	Medium	High	Very High
Standard	0	3/week	2/day	5/day	10/day
% of Park & Preserve	11%	44%	29%	15%	128 miles summer corridors, 135 miles winter corridors, West Buttress SUA
There is no standard for the number of encounters with other parties at 9 Portals and in the West Buttress Special Use Area.					

Standards for encounters with large groups limit impacts on vegetation, wildlife, and the solitude of other visitors, as well as mitigate the impacts of adding group educational and guided activities in areas where allowed.

Possible to Encounter Large Groups?			
Descriptor	No	Yes	Yes - 2/day
Standard	0 groups	1 group per day	2 groups per day
% of Park & Preserve	56%	29%	15%

Standards for camping density assure that visitors throughout almost the entire backcountry would have the opportunity to camp out of sight and sound of other visitors.

Possible to Camp Out of Sight and Sound of Others?			
Descriptor	Low	Medium	High
Standard	Yes, always	Not always at peak season	No, during peak season
% of Park & Preserve	99%	128 miles summer corridors, 135 miles winter corridors, 5 Portals	3 Portals, West Buttress Special Use Area

Standards for the number of encounters with evidence of modern human use ensure that in most of the backcountry visitors would continue to encounter few or no signs of modern equipment, as demonstrated by the table below. Some exceptions occur in the West Buttress Special Use area, corridors, Portals, and backcountry hiker areas.

Number of Encounters with Evidence of Modern Human Use			
Descriptor	Low	Medium	High
Standard	1/backcountry trip	3/day	5/day
% of Park & Preserve	85%	15% + 5 Portals	3 Portals, BC Hiker Areas, West Buttress SUA, 128 miles summer corridors, 135 miles winter corridors

As visitation to the park increases, these standards protect wilderness character and experience by triggering management action to disperse or limit the density of visitors in

locations where problems arise. While backcountry hiker areas, corridors, Portals, and the West Buttress Special Use area allow higher levels of visitor use and landscape impact than is typical of the Denali backcountry, collectively these represent a small area of the park and preserve.

Application of these standards primarily affects the park additions and preserve, since the Denali Wilderness was already managed to achieve similar standards. However, for the Old Park these standards do provide more definition for qualities such as evidence of modern human use, and they do distinguish the western portion of the Old Park (OP2) as an area that should protect current conditions of very low use levels.

The amount of motorized equipment used for access and the attendant noise expected under this alternative is described in detail in the Natural Soundscapes section of this chapter. As documented in that section, 80% of the park and preserve would be designated within a management area that allows Low levels of natural sound disturbance, 9% in areas that allow Medium sound disturbance, and 9% in areas that allow a High level of sound disturbance. In addition, there are 128 miles of corridor in the summer and 135 miles in winter along with 5 Portals that would allow a High level of sound disturbance, and 3 Major Landing Areas plus 2.5% of the park and preserve in the seasonal Ruth Glacier Special Use Area that would allow a Very High level of natural sound disturbance. Overall, under this alternative there would be negligible impacts on the natural soundscape at Denali; although conditions over the designated wilderness of the Old Park should improve, they would likely worsen in other areas that have been determined suitable for wilderness designation, particularly those areas designated as Management Area A.

The park road would be maintained to mile 7 during winter months for ice removal only. This action would retain noise and signs of heavy equipment to a 4-mile stretch of road for approximately 6 months, but the impact can be mitigated to a degree by short hours of operation. Only a small portion of the park and preserve and no designated wilderness is affected except for cross-boundary noise.

There would be up to 135 miles of corridors in winter, some of which could be marked with route markers. This action would provide more guidance and add more signs of management and human presence than is typical of the wilderness experience at Denali, but they would be used only if the minimum tool requirement is met and other, less intrusive measures (such as providing maps, guidance with natural land features) are ineffective.

Opportunities for Primitive and Unconfined Recreation

There would be a limit of 1,500 climbers per season on Mount McKinley. Within the 20-year life of the plan, demand would grow to an estimated 1,405-1,470 climbers per year. Thus the expectation is that the limit would not be reached and it would serve primarily to establish a ceiling on visitors if growth is faster than anticipated.

Mountaineers would be required to carry out human waste from the West Buttress above 14,000 feet and from campsites within one-half mile of air taxi landing locations on glaciers. At present, this would require visiting the NPS ranger station at Talkeetna to obtain a Clean Mountain Can and to return it after use, although other options may be available within the life of the plan.

There would initially be no new registration requirements, but new requirements would be added if certain criteria were met. It is anticipated that these criteria would trigger new requirements on overnight and winter day use activities from the Kahiltna Glacier east to Cantwell in the near future.

None of these actions would result in restrictions on freedom of movement once the visitor has entered the backcountry. The burden on visitors prior to entering the backcountry is expected to be light if the National Park Service is successful in making registration convenient and simple.

Cumulative Impacts

The establishment of unit quotas in the 1976 Backcountry Management Plan protected wilderness experience in the backcountry of the Old Park by limiting encounters, dispersing visitors and visitor impacts, and insuring that the great majority of visitors could camp out of sight and sound of others. The permit requirement for the Old Park does restrict freedom of movement since visitors must camp in the unit for which they have a permit on any given night. However, day users are not similarly restricted. The 60-day registration requirement for climbing Mount McKinley and Mount Foraker does not restrict freedom of movement once climbers enter the park.

The authorization of commercial air taxi landings for climbers on the Kahiltna glacier at the Denali Wilderness boundary, combined with improvements in climbing equipment and the popularization of the West Buttress as a mostly non-technical route to the summit of Mount McKinley, has led to large increases in the number of climbers in this area, from 124 in 1970 to a peak of 1,305 in 2001. Because each expedition takes 17 days on average and the primary climbing season is only 2-3 months long, a large amount of visitors concentrate on the West Buttress every year, during which time opportunities for solitude are not available.

The increase in snowmachine access particularly in accessible areas of the park additions in the Broad Pass/Dunkle Hills area and the Tokositna River valley has greatly increased the number of encounters with other parties, the evidence of modern human use, and natural sound disturbance, detracting from the wilderness qualities of these areas. Likewise, the expansion of scenic air tour access in response to changes in visitor demand has increased motorized noise across large areas of the Old Park wilderness and the glaciated area between the Kahiltna and Ruth glaciers. This alteration in wilderness resources is long-term, occurring every season, and is consistently observable over large portions of the backcountry and therefore a high-intensity change to wilderness resources.

The National Park Service has constructed trails that extend into the Congressionally designated wilderness of the Old Park, and will construct additional trails as specified by the 1997 *Entrance Area and Road Corridor DCP*. These trails are permanent new structures in the wilderness area, but total fewer than 20 miles within the 1.9-million-acre Denali Wilderness, and therefore represent a low intensity change in wilderness character. The National Park Service has also established seasonal administrative camps at Kahiltna Base Camp and at the 14,000-foot level on Mount McKinley, and generally increased the amount of research and administrative activity in the backcountry, including the use of aircraft and other motorized equipment and some temporary and long-term installations of research equipment. This heightened administrative presence is observable to the visitor but generally is not a consistent change over any particular area of the park except for the administrative camps, and is therefore a medium intensity, long-term alteration in the wilderness resources of the park and preserve.

These past, present, and future actions have had a major adverse impact on the wilderness resources of the park and preserve, largely because of the long-term, high-intensity changes caused by airplane and snowmachine access over a large portion of the park and preserve and the loss of opportunities for solitude on the West Buttress of Mount McKinley during the primary climbing season. The actions in this alternative constrain these impacts from spreading and may offer limited improvement in some areas because of the imposition of management area standards. However, there would still be major adverse cumulative impacts. This alternative would be responsible only for only small, isolated adverse impacts such as the few additional structures (trails) and the maintenance of a short section of the park road during winter months.

Conclusion

Under this alternative, there would be negligible new impacts to the wilderness resources of the Denali backcountry. Positive changes would occur in some locations, such as in the designated wilderness of the Old Park, but other areas that have wilderness qualities would likely lose some opportunities for solitude. The proposed standards for encounters with other parties, encounters with large groups, ability to camp out of sight and sound of others, and evidence of modern human use would protect wilderness resource values in much of the park as visitation grows, but would generally still allow increases in visitor use across most of the western portion of the Old Park, park additions, and preserve. There are minor adverse impacts from the construction of new trails and campsites and very limited restrictions on freedom of movement. However, there would still be major adverse cumulative impacts because of the ongoing absence of solitude on the West Buttress route of Mount McKinley during the primary climbing season and high levels of encounters, noise, and motorized transport in areas such as the Kantishna Hills, Dunkle Hills, and between the Kanikula and Ruth Glaciers in the southern park additions.

The level of impacts to wilderness character and experience anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the natural integrity of the park.

ALTERNATIVE 5

The actions in this alternative would result in moderate adverse impacts to the wilderness resource of Denali because the alternative allows ongoing decline in opportunities for solitude in large portions of the park additions and preserve while not mitigating existing impacts on the designated wilderness of the Old Park. There would be a major adverse cumulative impact because of the long-term decline in opportunities for solitude that would continue under this alternative and aggravated by increased motorized access and crowding in some areas, as well as new trails and other low-intensity impacts.

Absence of Structures

There would be new trails and limited designated campsite development in this alternative, bringing not only permanent facilities – potentially including food storage and sanitation facilities at up to five sites in the Kantishna area and three sites in the Wildhorse Creek area – but also the noise and human presence associated with trail construction and maintenance. However, in the Kantishna Hills area the trails would generally either replace or improve existing social trails or old community and mining access trails. The actions would take place outside of areas determined suitable for wilderness designation.

Short sections of trail would be constructed within the Old Park at Wonder Lake, Eielson Visitor Center, and Eielson Bluffs, but they would replace existing obvious social trails and fall partly within the Backcountry Day Use area, outside designated wilderness areas.

Most immediately affected would be the Wildhorse Creek area, where an area determined suitable for wilderness designation would have new trail and campsite construction in an area that presently has no signs of human structures or ongoing human presence. Particularly with the possible addition of sanitation or food storage facilities, the impact would be substantial, but only on a single creek valley.

Additionally, more trails could be established in the lowland areas between the Kahiltna and Ruth glaciers. A trail system in this area would add substantial permanent additional structures that are a reminder of human presence and that mildly reduce the required level of self-sufficiency in this broad area.

Up to five public use cabins could be constructed along the park's southern boundary, but these would not affect the park's wilderness resources.

Opportunities for Solitude

This alternative establishes a variety of standards that would protect opportunities for solitude. Important among these are the following standards.

Standards for the number of encounters with other parties in this alternative emphasize areas that allow a substantial amount of use while still protecting wilderness qualities, as the table below demonstrates.

Number of Encounters with Other Parties					
Descriptor	Very Low	Low	Medium	High	Very High
Standard	0	3/week	2/day	5/day	10/day
% of Park & Preserve	0%	16%	66%	18%	128 miles summer corridors, 183 miles winter corridors
There is no standard for the number of encounters with other parties at 9 Portals and in the West Buttress Special Use Area					

Standards for encounters with large groups limit impacts on vegetation, wildlife, and the solitude of other visitors, as well as mitigating the impacts of adding group educational and guided activities in areas where allowed.

Possible to Encounter Large Groups?			
Descriptor	No	Yes	Yes - 2/day
Standard	0 groups	1 group per day	2 groups per day
% of Park & Preserve	16%	66%	18%

Standards for camping density assure that visitors throughout almost the entire backcountry would have the opportunity to camp out of sight and sound of other visitors.

Possible to Camp Out of Sight and Sound of Others?			
Descriptor	Low	Medium	High
Standard	Yes, always	Not always at peak season	No, during peak season
% of Park & Preserve	99%	128 miles summer corridors, 183 miles winter corridors, 5 Portals	3 Portals, West Buttress Special Use Area

Standards for the number of encounters with evidence of modern human use ensure that in most of the backcountry visitors would continue to encounter few or no signs of modern equipment, as demonstrated by the table below. Some exceptions occur in the West Buttress Special Use area, corridors, Portals, and backcountry hiker areas.

Number of Encounters with Evidence of Modern Human Use			
Descriptor	Low	Medium	High
Standard	1/backcountry trip	3/day	5/day
% of Park & Preserve	82%	18% + 5 Portals	3 Portals, BC Hiker Areas, West Buttress SUA, 128 miles summer corridors, 183 miles winter corridors

As visitation to the park increases, these standards protect wilderness character and experience by triggering management action to disperse or limit the density of visitors in locations where problems arise. While backcountry hiker areas, corridors, Portals, and the West Buttress Special Use area allow higher levels of visitor use and landscape impact than is typical of the Denali backcountry, collectively these represent a small area of the park and preserve.

Application of these standards primarily affects the park additions and preserve, since the Denali Wilderness was already managed to achieve similar standards. However, for the Old Park these standards do provide more definition for qualities such as evidence of modern human use. They also distinguish the western portion of the Old Park as an area that should have less use than the road-accessible areas, although it could still accommodate considerably more use than it has at present.

The amount of motorized equipment used for access and the attendant noise expected under this alternative is described in detail in the Natural Soundscapes section of this chapter. As documented in that section, 16% of the park and preserve would be designated within a management area that allows Low levels of natural sound disturbance, 66% in areas that allow Medium sound disturbance, and 16% in areas that allow a High level of sound disturbance. In addition, there are 128 miles of corridor in the summer and 183 miles in winter, along with 5 Portals that would allow a High level of sound disturbance, and 3 Major Landing Areas plus 2.5% of the park and preserve in the seasonal Ruth Glacier Special Use Area that would allow a Very High level of natural sound disturbance. Overall, there would be major adverse impacts to natural sound at Denali, primarily over the southern additions, that would affect the wilderness character of the park and wilderness experience of visitors. Conditions over the Old Park would not be expected to improve from current conditions.

There would be up to 183 miles of marked corridors in winter, which would provide more guidance and add more signs of management and human presence than is typical of the wilderness experience at Denali. None of these would affect the designated wilderness of the Old Park.

The park road would be plowed to Savage Campground during winter months and a parking area and warming hut provided at the campground. The direct action would not affect designated wilderness; however, indirectly this action would add a substantial amount of activity to the surrounding wilderness area compared to existing conditions, particularly during late winter months. However, management area standards would keep these impacts on wilderness resources at a level no greater than what presently occurs in the same area during summer months.

Opportunities for Primitive and Unconfined Recreation

There would be no restriction on the number of climbers on Mount McKinley during the course of a season, although a limit could be revisited in five years once more information is gathered. As a result, there would be no immediate constraint on climbers.

Mountaineers would be required to carry out human waste from the West Buttress above 14,000 feet and from campsites within one-half mile of air taxi landing locations on glaciers. At present, this would require visiting the NPS ranger station at Talkeetna to obtain a Clean Mountain Can and to return it after use, although other options may be available within the life of the plan.

There would be no additional registration requirements immediately imposed under this alternative, thus visitors would have no further restrictions prior to entering the backcountry. Registration or other restrictions could be required in the future if it is a necessary tool for achieving desired future conditions.

Cumulative Impacts

The establishment of unit quotas in the 1976 Backcountry Management Plan protected wilderness experience in the backcountry of the Old Park by limiting encounters, dispersing visitors and visitor impacts, and insuring that the great majority of visitors could camp out of sight and sound of others. The permit requirement for the Old Park does restrict freedom of movement since visitors must camp in the unit for which they have a permit on any given night. However, day users are not similarly restricted. The 60-day registration requirement for climbing Mount McKinley and Mount Foraker does not restrict freedom of movement once climbers enter the park.

The authorization of commercial air taxi landings for climbers on the Kahiltna glacier at the Denali Wilderness boundary, combined with improvements in climbing equipment and the popularization of the West Buttress as a mostly non-technical route to the summit of Mount McKinley, has led to large increases in the number of climbers in this area, from 124 in 1970 to a peak of 1,305 in 2001. Because each expedition takes 17 days on average and the primary climbing season is only 2-3 months long, there is a large concentration of visitors on the West Buttress every year, during which time opportunities for solitude are not available.

The increase in snowmachine access—particularly in accessible areas of the park additions in the Broad Pass/Dunkle Hills area and the Tokositna River valley—has greatly increased the number of encounters with other parties, the evidence of modern human use, and natural sound disturbance, detracting from the wilderness qualities of these areas. Likewise, the expansion of scenic air tour access in response to changes in visitor demand has increased motorized noise across large areas of the Old Park wilderness and the glaciated area between the Kahiltna and Ruth glaciers. This alteration in wilderness resources is long-term, occurring every season, and is consistently observable over large portions of the backcountry and therefore a high-intensity change to wilderness resources.

The National Park Service has constructed trails that extend into the Congressionally designated wilderness of the Old Park, and will construct additional trails as specified by the 1997 *Entrance Area and Road Corridor DCP*. These trails are permanent new

structures in the wilderness area, but altogether total fewer than 20 miles within the 1.9-million-acre Denali Wilderness, and therefore are a low intensity change in wilderness character. The National Park Service has also established seasonal administrative camps at Kahiltna Base Camp and at the 14,000-foot level on Mount McKinley, and generally increased the amount of research and administrative activity in the backcountry, including the use of aircraft and other motorized equipment and some temporary and long-term installations of research equipment. This heightened administrative presence is observable to the visitor but generally is not a consistent change over any particular area of the park except for the administrative camps, and is therefore a medium intensity, long-term alteration in the wilderness resources of the park and preserve.

These past, present, and future actions have had a major adverse impact on the wilderness resources of the park and preserve, largely because of the long-term, high-intensity changes caused by airplane and snowmachine access over a large portion of the park and preserve and the loss of opportunities for solitude on the West Buttress of Mount McKinley during the primary climbing season. The actions in this alternative would have a moderate adverse impact because they would allow further loss of opportunities for solitude in the southern park additions and to a lesser degree in the northern additions without mitigating existing impacts. As a result, there would continue to be major adverse cumulative impacts to wilderness resources. The actions in this alternative would be responsible for less than a majority of the impacts related to the expansion of motorized access, but would be primarily responsible for numerous, more localized impacts from the plowing of the park road to Savage Campground, construction of several new trails including in some undisturbed areas, and enabling the construction of further trails in the future.

Conclusion

Under Alternative 5 there would be moderate adverse impacts to wilderness resources at Denali. Opportunities for solitude would remain stable in the Old Park but would decline in other locations in the southern park additions and potentially the northern park additions with increases of motorized access, support facilities such as trails, and numbers of visitors. The proposed standards for encounters with other parties, encounters with large groups, ability to camp out of sight and sound of others, and evidence of modern human use would allow higher levels of impacts than presently occur throughout the park additions and preserve. There is, however, no loss of opportunities for unconfined recreation since there would be no new registration requirements or quotas. The existing major cumulative impacts would worsen under this alternative.

The level of impacts to wilderness character and experience anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the natural integrity of the park.

SUBSISTENCE RESOURCES AND OPPORTUNITIES

The 1980 additions to Denali National Park and Preserve are open to subsistence uses in accordance with Section 202 (3)(a) of ANILCA. Lands within the former Mount McKinley National Park are closed to subsistence activities. Congress found and declared in Title VIII, Subsistence Management and Use, Section 801 (3), that the continuation of the opportunity for subsistence uses of resources on public and other lands in Alaska is threatened by the increasing population of Alaska, with resultant pressure on subsistence resources, by sudden decline in the populations of some wildlife species that are crucial subsistence resources, by increased accessibility of remote areas containing subsistence resources, and by the taking of fish and wildlife in a manner inconsistent with recognized principles of fish and wildlife management.

Furthermore, Congress declared it to be the policy in Section 802 (1), that, consistent with sound management principles and the conservation of healthy populations of fish and wildlife, the utilization of the public lands in Alaska is to cause the least adverse impact possible on rural residents who depend upon subsistence uses of resources of such lands; consistent with management of fish and wildlife in accordance with recognized scientific principles and the purposes for each unit established, designated, or expanded by Title II; it is the purpose of Title VIII to provide the opportunity for rural residents engaged in a subsistence way of life to do so.

Guided by the enabling legislation and mandates for Denali National Park and Preserve, and policies and Congressional intent of ANILCA Title VIII, the following section outlines the impact thresholds used to determine the magnitude of effects on subsistence and presents an analysis of the impacts likely to occur under each alternative.

METHODOLOGY

Methodology for assessing impacts to subsistence consisted of literature review and consultation with subject matter experts.

This analysis focuses on the three key subsistence areas of the park: the northwestern park and preserve region near Lake Minchumina; the southeastern park region near Cantwell; and the southern Kantishna Hills region near Kantishna. This analysis assumes that adverse impacts to subsistence resources and opportunities from subsistence users are negligible because subsistence use is very low, especially compared to recreational use of the park.

ALTERNATIVE 1 (NO ACTION)

There could be major adverse impacts to subsistence resources and opportunities from Alternative 1 because of the potential for high levels of widespread recreation that could

create unfavorable conditions for subsistence wildlife populations and could result in the displacement of traditional subsistence activities. Information from the Denali Subsistence Resource Commission suggests that impacts would result from snowmachine use in the Cantwell area; however, no scientific data are currently available to support this conclusion. Impacts on subsistence resources and opportunities in the park and preserve additions would persist beyond the life of this plan. Unless otherwise stated, all impacts would occur throughout the life of this plan.

This alternative would allow for substantial increases in types and levels of use; without management area prescriptions, desired future conditions, and indicators and standards, the park would have no formal process to determine when impact levels become severe enough to warrant management action. More people recreating in the backcountry would create more impacts to subsistence resources and opportunities. Non-subsistence snowmachine use would continue to increase and expand into more locations in both the north and south park and preserve additions. Heavy use would occur at some popular destinations, such as Broad Pass southwest of Cantwell and along the Upper and Lower Tokositna River (heavy use would occur at locations within about 25% of the total park area). Use would expand throughout 64.4% of the park (3,881,906 acres) and the intensity and duration of use would increase.

Cantwell

Several different impacts to subsistence wildlife populations and subsistence use activities could be expected as documented by the Denali Subsistence Resource Commission. For several years, subsistence users have expressed concerns about the impacts and conflicts of increasing recreational use and increasing non-subsistence snowmachine use on subsistence resources and subsistence activities. Members of Denali's Subsistence Resource Commission have specifically expressed concerns regarding the effects of increasing levels of snowmachine use in the Broad Pass/Cantwell area upon moose, furbearers, and ptarmigan populations and their distributions (Denali Subsistence Resource Commission Meeting Minutes, April 30, 2001; April 29, 1996; August 9, 1996; and June 28, 1993). The Denali Subsistence Resource Commission Meeting Minutes (June 1993) document high levels of non-subsistence-related snowmachine use in the Cantwell area. It was noted that riders were primarily using drainages and basins, essentially saturating the area and displacing furbearers, causing local trappers to pull their traps prematurely in December of that year. This trend has persisted in subsequent years (pers comm. Hollis Twitchell 1/13/05). As the range of non-subsistence snowmachine use overlaps with subsistence use areas, the potential for conflict between these user groups increases.

Non-subsistence snowmachine users could interfere with subsistence traplines, displace furbearers, and create paths that encourage animals to travel farther from places where subsistence activities typically occur. Trappers begin trapping as early as November 1. The trapping season closes by the end of February; however, increasing levels of non-subsistence snowmachine use in the Cantwell/Broad Pass area would continue to

displace wildlife, and trappers would continue to pull their traps by December because it would be inefficient to set traps in an area in which furbearers have been displaced. This would constitute a loss of an opportunity for subsistence users in that area.

Increased use of the park, particularly non-subsistence snowmachine use, would likely displace moose and caribou from critical wintering areas on park lands in the Windy and Cantwell Creek drainages. Local moose populations and the Cantwell group of the Nelchina Caribou herd use areas within the former Mount McKinley National Park and the ANILCA park additions of Windy Creek, Cantwell Creek, and the Bull River drainages during winter. These areas along the Alaska Range in the vicinity of Windy Pass provide important winter habitat for moose and caribou because snow depths associated with the pass area are less than in other areas.

Non-subsistence snowmachine use is often concentrated in these high-elevation basins where riders spend many hours at a time. These basins provide critical winter habitat for moose and caribou. Moose and caribou would continue to be displaced from these critical wintering areas as non-subsistence snowmachine use increases. This could significantly increase the stress and nutritional demands upon moose and caribou and result in some moose or caribou mortality, depending on the environmental conditions and the body reserves of moose or caribou in a given year.

Non-subsistence snowmachine use originating in Cantwell begins when adequate snow cover is present, and during early winter, use is relatively low. As snowpack increases so does snowmachine use. In late winter when the days are lighter, warmer, and there is adequate snow cover, non-subsistence snowmachine use is highest. This corresponds with the time of the year when moose and caribou are at their lowest nutritional states. Non-subsistence snowmachine use would continue to induce stress on moose and caribou in the Windy and Cantwell drainages, especially in late winter when the animals are in a nutritional deficit. The magnitude of the impact would depend on snow depth. Die off would be greater as snow depth increases because displaced animals would have a more difficult time moving through the snow to forage and to get away from snowmachine use.

In addition, the State issues a limited number of permits for the Tier II hunt for the Nelchina Caribou herd, and local Cantwell residents must compete with residents statewide for the permits. Local residents rely on federal permits to hunt caribou in the Cantwell area. Under this alternative, non-subsistence snowmachine use would continue to increase and either would displace caribou from the Windy and Cantwell drainages or it would prevent caribou from going there altogether. If caribou do not travel onto these federal lands, subsistence hunters from Cantwell would not have an opportunity to hunt them. This opportunity would be lost for as long as the caribou remain on lands outside the national park.

Kantishna

During the peak summer season there are approximately 300 overnight visitors to the Kantishna area. Increasing numbers of visitors could necessitate an expansion of the

firearms discharge closure in Kantishna. The decision to extend the closure would be evaluated in a separate public process. If the closure were extended, it would have adverse impacts on moose hunters in the Upper and Lower Moose Creek drainages, Eldorado, and Skyline Drive by severely restricting opportunities to hunt moose in those areas because they would not be permitted to use firearms.

Minchumina

Lake Minchumina area residents also mentioned concerns about the impacts of increasing non-subsistence uses during public scoping (see also Letter from Collins, 3/3/01).

Increases in non-subsistence uses through the northwest preserve could increase the risk of theft and vandalism at subsistence cabins. There are at least five usable subsistence cabins along the Muddy and Kantishna Rivers and many others scattered throughout the preserve. This has been an issue of concern raised by the Subsistence Resource Commission because theft and vandalism have been reported on lands adjacent to the park (Hollis Twitchell, pers. comm., 1/13/05).

Cumulative Effects

The following actions increase the potential for adverse impacts to subsistence:

- In the last five years, non-subsistence snowmachine use has expanded dramatically in and adjacent to the southeastern areas of the park, particularly in the area near Cantwell and Broad Pass. Along with increasing popularity for snowmobiling have come dramatic improvements in snowmachine technology. Because of the increased reliability, power and flotation ability of the newer snowmachines, snowmachiners have been accessing more distant areas and operating in significantly steeper and higher terrain than in past years.

Open habitat, mountain slopes, and reasonably good snow deposition in the Broad Pass area have attracted increasing numbers of snowmachiners from areas of the state accessible to the Parks Highway. Typically, non-subsistence snowmachine groups tend to travel in larger numbers and spend more time traveling in basins and drainages.

Increases in types and levels of recreation interfere with subsistence activities. Visitors, especially those who travel via motorized means, may disturb wildlife and interfere with subsistence users who are hunting or scouting for subsistence resources. As popular places become crowded, it is expected that recreational use will disperse into more remote or infrequently used places. Potential restrictions to subsistence may occur if visitors frequent areas used for subsistence. Visitors, especially those who travel via motorized means, may disturb wildlife and interfere with subsistence users who are hunting or scouting for subsistence resources.

- New housing and commercial development has occurred in the Nenana Canyon north of the park entrance, the Yanert Valley east of the park, in the eastern part of the Stampede Road Corridor, around Cantwell, and along Petersville Road. This development has resulted in minor expansion of local road networks or improvements of existing roads. This development is likely to continue, creating increased access to the eastern and southern boundaries of the park. Increases in types and levels of recreation can interfere with subsistence activities.
- While brushing a trail from Nenana to Minchumina for snowmachine use is opposed by locals in Minchumina and Telida, there is a reasonable chance that it would happen in the future. This trail would provide easier access to the northwestern part of the park. Increased access means higher use levels and greater potential for impacts to subsistence resources and opportunities.
- Continued growth in commercial developments in Kantishna would attract more visitors to that area, thereby increasing the potential for conflicts between subsistence and non-subsistence users, or increasing the potential for restrictions or conditions on subsistence use in the Kantishna area.
- Concern for the safety of park visitors prompted the National Park Service to initiate a closure to the discharge of firearms in the Kantishna area. This developed area has a large number of summer visitors using the facilities and surrounding area to engage in outdoor activities that could put them at risk of a firearm-related injury. The restriction on the discharge of firearms applies on federal public lands within one mile of the Kantishna road right-of-way from the former Mount McKinley National Park boundary at mile 87.9 to the north end of the Kantishna airport. The firearm discharge restriction is in effect during summer when the Kantishna lodges are in operation. During the period, subsistence harvests utilizing other methods and means of harvest may still take place according to federal subsistence management regulations.
- Restrictions and conditions associated with travel on the park road affect subsistence access. Subsistence users are required to obtain a permit, adhere to camping requirements and food storage requirements, and other conditions associated with backcountry use in the Old Park. Park road restrictions and backcountry requirements do not prevent subsistence access; however, subsistence users must be cognizant of and adhere to this additional requirement.

The combined impact of these actions would be major in Cantwell where conflicts between recreation and subsistence already exist and are predicted to increase, moderate in Kantishna where a high level of recreation and infrastructure exists, and minor in Minchumina where low levels of visitation are expected due to its remote location. Implementing this alternative alone would have major adverse impacts on subsistence resources and opportunities. The cumulative impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be major.

Conclusion

There could be major adverse impacts to subsistence resources and opportunities from Alternative 1 because of the potential for high levels of widespread use of the park, particularly non-subsistence snowmachine use. Dramatic increases in park use would create unfavorable conditions for subsistence wildlife populations. These impacts on subsistence resources and opportunities in the park and preserve additions would persist beyond the life of this plan. The cumulative impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be major. The level of impacts to subsistence resources anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the integrity of the park.

ALTERNATIVE 2

The impacts to subsistence resources and opportunities under Alternative 2 would be negligible because there would be no observable or measurable reduction of opportunities for subsistence activities or important subsistence fish and wildlife populations or distributions due to human-caused factors, and there would be no observable or measurable increase in angler or hunter competition for subsistence resources by other consumptive users. Unless otherwise stated, all impacts would occur throughout the life of this plan.

Under this alternative, recreational and administrative activities would be reduced from current levels, and recreational users may be subject to additional conditions on use. This alternative would have the least impact on subsistence resources and opportunities of all the alternatives because the levels of some activities, particularly non-subsistence snowmachine use, would be reduced in the park additions and preserve. Reducing use would reduce overlap between non-subsistence use and subsistence use areas to very small areas, thereby reducing user conflicts.

Under this alternative, all areas of the park used for subsistence activities would be zoned as Management Area B or E. These management areas allow for very low to medium encounters with other people, very little evidence of modern human use, and low to medium disturbance of natural sounds. If standards in these categories are approached or exceeded, non-subsistence use would be curtailed or mitigated. If non-subsistence use is curtailed or mitigated, it could have less of an impact on subsistence resources and opportunities. The types of impacts that could be mitigated are described throughout this section.

Cantwell

Snowmobile use under Alternative 2 would be limited to subsistence and other traditional activities in the park and preserve additions. Therefore, there would be an

immediate decrease in recreational snowmachine use at popular destinations such as the Broad Pass area southwest of Cantwell, an area of particular concern to subsistence users. While difficult to quantify, the potential for conflict between these user groups would be expected to decrease. Displacement of furbearers, moose, and caribou from the Broad Pass/Cantwell area that is described in the other alternatives would not occur under this alternative because non-subsistence snowmachine use would decrease.

Kantishna

Under Alternative 2, the Kantishna area would be designated as Management Area B, which would allow for encounters of up to two parties per day and a medium level of natural sound disturbance. This encounter rate is similar to current conditions in the Kantishna Hills in backcountry areas, thus no change to subsistence would be anticipated under this alternative.

Minchumina

Lake Minchumina area residents mentioned concerns about the impacts of increasing non-subsistence uses during public scoping (see also Letter from Collins, 3/3/01).

There are at least five usable subsistence cabins along the Muddy and Kantishna Rivers, which could be impacted by non-subsistence motorboat use on these rivers. Vandalism and theft could occur by non-subsistence users who encounter these cabins. This has been an issue of concern raised by the Subsistence Resource Commission because theft and vandalism have been reported on lands adjacent to the park (pers. comm. Hollis Twitchell, 1/13/05).

Cumulative Effects

The following actions increase the potential for adverse impacts to subsistence:

- In the last five years, non-subsistence snowmachine use has expanded dramatically in and adjacent to the southeastern areas of the park, particularly in the area near Cantwell and Broad Pass. Along with increasing popularity for snowmobiling have come dramatic improvements in snowmachine technology. Because of the increased reliability, power and flotation ability of the newer snowmachines, snowmachiners have been accessing more distant areas and operating in significantly steeper and higher terrain than in past years.

Open habitat, mountain slopes, and reasonably good snow deposition in the Broad Pass area have attracted increasing numbers of snowmachiners from areas of the state accessible to the Parks Highway. Typically, non-subsistence snowmachine groups tend to travel in larger numbers and spend more time traveling in basins and drainages.

Increases in types and levels of recreation interfere with subsistence activities. Visitors, especially those who travel via motorized means, may disturb wildlife and interfere with subsistence users who are hunting or scouting for subsistence resources. As popular places become crowded, it is expected that recreational use will disperse into more remote or infrequently used places. Potential restrictions to subsistence may occur if visitors frequent areas used for subsistence. Visitors, especially those who travel via motorized means, may disturb wildlife and interfere with subsistence users who are hunting or scouting for subsistence resources.

- New housing and commercial development has occurred in the Nenana Canyon north of the park entrance, the Yanert Valley east of the park, in the eastern part of the Stampede Road Corridor, around Cantwell, and along Petersville Road. This development has resulted in minor expansion of local road networks or improvements of existing roads. This development is likely to continue, creating increased access to the eastern and southern boundaries of the park. Increases in types and levels of recreation can interfere with subsistence activities.
- While brushing a trail from Nenana to Minchumina for snowmachine use is opposed by locals in Minchumina and Telida, there is a reasonable chance that it would happen in the future. This trail would provide easier access to the northwestern part of the park. Increased access means higher use levels and greater potential for impacts to subsistence resources and opportunities.
- Continued growth in commercial developments in Kantishna would attract more visitors to that area, thereby increasing the potential for conflicts between subsistence and non-subsistence users, or increasing the potential for restrictions or conditions on subsistence use in the Kantishna area.
- Concern for the safety of park visitors prompted the National Park Service to initiate a closure to the discharge of firearms in the Kantishna area. This developed area has a large number of summer visitors using the facilities and surrounding area to engage in outdoor activities that could put them at risk of a firearm-related injury. The restriction on the discharge of firearms applies on federal public lands within one mile of the Kantishna road right-of-way from the former Mount McKinley National Park boundary at mile 87.9 to the north end of the Kantishna airport. The firearm discharge restriction is in effect during summer when the Kantishna lodges are in operation. During the period, subsistence harvests utilizing other methods and means of harvest may still take place according to federal subsistence management regulations.
- Restrictions and conditions associated with travel on the park road affect subsistence access. Subsistence users are required to obtain a permit, adhere to camping requirements and food storage requirements, and other conditions associated with backcountry use in the Old Park. Park road restrictions and

backcountry requirements do not prevent subsistence access; however, subsistence users must be cognizant of and adhere to this additional requirement.

The combined impact of these actions would be major in Cantwell where conflicts between recreation and subsistence already exist and are predicted to increase, moderate in Kantishna where a high level of recreation and infrastructure exists, and minor in Minchumina where low levels of visitation are expected due to its remote location. Implementing this alternative alone would have negligible adverse impacts on subsistence resources and opportunities. The cumulative impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be major.

Conclusion

The impacts to subsistence resources under Alternative 2 would be negligible because recreational and administrative activities would be reduced from current levels, and recreational users may be subject to additional conditions on use. The cumulative impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be major. The level of impacts to subsistence resources anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the integrity of the park.

ALTERNATIVE 3

While the decrease in non-subsistence snowmachine use would benefit subsistence, Alternative 3 would have minor adverse impacts on subsistence resources and opportunities due to the potential for conflicts along the winter snowmachine corridors and the year-round river corridors, and the increased backcountry use in the Kantishna area. Unless otherwise stated, all impacts would occur throughout the life of the plan.

Under Alternative 3, snowmachine use would be limited to subsistence and other traditional activities in the park and preserve additions, and to established winter corridors for recreational use. Therefore, there would be an immediate decrease in non-subsistence snowmachine use throughout the park and preserve, but the winter corridors would result in areas of more concentrated snowmachine use.

Establishing corridors would channel snowmachine use along the West Fork, Bull River, and Cantwell Creek; to the toes of the Ruth, Tokositna, and Kanikula glaciers from the Tokositna River; and along the Yentna, Tokositna, and Kantishna/Muddy Rivers (135 linear miles of winter corridors). Many of these higher use areas overlap areas currently or traditionally used for subsistence activities. Encounters with wildlife along these corridors could cause behavioral disturbance, increase stress levels, and temporarily displace wildlife. In some cases, wildlife mortality or injury to species could occur from wildlife-snowmachine collisions.

Cantwell

The Cantwell subsistence area would be zoned as Management Area B. This management area allows for medium encounters with other people, very little evidence of modern human use, and medium disturbance of natural sounds. If standards in these categories are approached or exceeded, non-subsistence use would be curtailed or mitigated. If non-subsistence use is curtailed or mitigated, it could have less of an impact on subsistence resources and opportunities. The types of impacts that could be mitigated are described throughout this section.

Several different impacts to subsistence wildlife populations and subsistence use activities could be expected as documented by the Denali Subsistence Resource Commission. For several years, subsistence users have expressed concerns about the impacts and conflicts of increasing recreational use and increasing non-subsistence snowmachine use on subsistence resources and subsistence activities. Members of Denali's Subsistence Resource Commission have specifically expressed concerns regarding the effects of increasing levels of snowmachine use in the Broad Pass/Cantwell area upon moose, furbearers, and ptarmigan populations and their distributions (Denali Subsistence Resource Commission Meeting Minutes, April 30, 2001; April 29, 1996; August 9, 1996; and June 28, 1993). The Denali Subsistence Resource Commission Meeting Minutes (June 1993) document high levels of non-subsistence related snowmachine use in the Cantwell area. It was noted that riders were primarily using drainages and basins, essentially saturating the area and displacing furbearers, causing local trappers to pull their traps prematurely in December of that year. This trend has persisted in subsequent years (pers comm. Hollis Twitchell 1/13/05).

Non-subsistence snowmachine users would interfere with subsistence traplines along Cantwell Creek, displace furbearers, and create paths that encourage animals to travel farther from places where subsistence activities typically occur. Trappers begin trapping as early as November 1. The trapping season closes by the end of February; however, increasing levels of non-subsistence snowmachine use in the Cantwell Creek corridor would continue to displace wildlife, and trappers would continue to pull their traps by December because it would be inefficient to set traps in an area in which furbearers have been displaced. This would constitute a loss of an opportunity for subsistence users in that area.

Non-subsistence snowmachine use could displace moose and caribou from critical wintering areas on park lands in the Cantwell Creek and Bull River drainages. Local moose populations and the Cantwell group of the Nelchina Caribou herd use areas within the former Mount McKinley National Park and the ANILCA park additions of Windy Creek, Cantwell Creek, and the Bull River drainages during winter. These areas provide important winter habitat for moose and caribou because snow depths associated with the pass area are less than in other areas.

Non-subsistence snowmachine use is often concentrated in these high-elevation basins where riders spend many hours at a time. These basins provide critical winter habitat for moose and caribou. Moose and caribou would continue to be displaced from these critical wintering areas as non-subsistence snowmachine use increases. This could significantly increase the stress and nutritional demands upon moose and caribou and result in some moose or caribou mortality, depending on the environmental conditions and the body reserves of moose or caribou in a given year.

Non-subsistence snowmachine use originating in Cantwell begins when adequate snow cover is present, and during early winter, use is relatively low. As snowpack increases so does snowmachine use. In late winter when the days are lighter, warmer, and there is adequate snow cover, non-subsistence snowmachine use is highest. This corresponds with the time of the year when moose and caribou are at their lowest nutritional states. Non-subsistence snowmachine use would induce stress on moose and caribou in the Cantwell Creek and Bull River drainages, especially in late winter when the animals are in a nutritional deficit. The magnitude of the impact would depend on snow depth. Die-off would be greater as snow depth increases because displaced animals would have a more difficult time moving through the snow to forage and to get away from snowmachine use.

In addition, the State issues a limited number of permits for the Tier II hunt for the Nelchina Caribou herd, and local Cantwell residents must compete with residents statewide for the permits. Local residents rely on federal permits to hunt caribou in the Cantwell area. Under this alternative, non-subsistence snowmachine use either could displace caribou from the Cantwell Creek and Bull River drainages or it would prevent caribou from going there altogether. If caribou do not travel onto these federal lands, subsistence hunters from Cantwell would not have an opportunity to hunt them. This opportunity would be lost for as long as the caribou remain on lands outside the national park.

Kantishna

Under Alternative 3, the Kantishna area would be designated as Management Area A, allowing for high disturbance to natural sounds and an encounter rate of up to five parties per day, including two parties of six people. Up to five designated campsites would be created in conjunction with the summer corridor areas in the Kantishna Hills. Increased recreational use in the Kantishna Hills could negatively affect subsistence hunters who rely on this area for subsistence purposes.

During the peak summer season there are approximately 300 overnight visitors to the Kantishna area. Increasing numbers of visitors and increased recreational opportunities could necessitate an expansion of the firearms discharge closure in Kantishna. The decision to extend the closure would be evaluated in a separate public process. If the closure were extended, it would have adverse impacts on moose hunters in the Upper and Lower Moose Creek drainages, Eldorado, and Skyline Drive by severely restricting

opportunities to hunt moose in those areas because they would not be permitted to use firearms.

Minchumina

Year-round recreational corridors would be designated in the northwest part of the park (Muddy/Kantishna Rivers), inviting more use along these corridors and potentially increasing user conflicts and the risk of theft and vandalism at subsistence cabins along these corridors. There are at least five usable subsistence cabins along the corridor on the Muddy and Kantishna Rivers. Lake Minchumina area residents mentioned concerns about the impacts of increasing non-subsistence uses during public scoping (see also Letter from Collins, 3/3/01). This has been an issue of concern raised by the Subsistence Resource Commission because theft and vandalism have been reported on lands adjacent to the park (Hollis Twitchell, pers. comm. 1/13/05).

The Minchumina subsistence area would be zoned as Management Area D and E. These management areas allow for very low to low encounters with other people, very little evidence of modern human use, and little disturbance of natural sounds. If standards in these categories are approached or exceeded, non-subsistence use would be curtailed or mitigated. If non-subsistence use is curtailed or mitigated, it could have less of an impact on subsistence resources and opportunities. The types of impacts that could be mitigated are described throughout this section.

Cumulative Effects

The following actions increase the potential for adverse impacts to subsistence:

- In the last five years, non-subsistence snowmachine use has expanded dramatically in and adjacent to the southeastern areas of the park, particularly in the area near Cantwell and Broad Pass. Along with increasing popularity for snowmobiling have come dramatic improvements in snowmachine technology. Because of the increased reliability, power and flotation ability of the newer snowmachines, snowmachiners have been accessing more distant areas and operating in significantly steeper and higher terrain than in past years.

Open habitat, mountain slopes, and reasonably good snow deposition in the Broad Pass area have attracted increasing numbers of snowmachiners from areas of the state accessible to the Parks Highway. Typically, non-subsistence snowmachine groups tend to travel in larger numbers and spend more time traveling in basins and drainages.

Increases in types and levels of recreation interfere with subsistence activities. Visitors, especially those who travel via motorized means, may disturb wildlife and interfere with subsistence users who are hunting or scouting for subsistence resources. As popular places become crowded, it is expected that recreational use

will disperse into more remote or infrequently used places. Potential restrictions to subsistence may occur if visitors frequent areas used for subsistence. Visitors, especially those who travel via motorized means, may disturb wildlife and interfere with subsistence users who are hunting or scouting for subsistence resources.

- New housing and commercial development has occurred in the Nenana Canyon north of the park entrance, the Yanert Valley east of the park, in the eastern part of the Stampede Road Corridor, around Cantwell, and along Petersville Road. This development has resulted in minor expansion of local road networks or improvements of existing roads. This development is likely to continue, creating increased access to the eastern and southern boundaries of the park. Increases in types and levels of recreation can interfere with subsistence activities.
- While brushing a trail from Nenana to Minchumina for snowmachine use is opposed by locals in Minchumina and Telida, there is a reasonable chance that it would happen in the future. This trail would provide easier access to the northwestern part of the park. Increased access means higher use levels and greater potential for impacts to subsistence resources and opportunities.
- Continued growth in commercial developments in Kantishna would attract more visitors to that area, thereby increasing the potential for conflicts between subsistence and non-subsistence users, or increasing the potential for restrictions or conditions on subsistence use in the Kantishna area.
- Concern for the safety of park visitors prompted the National Park Service to initiate a closure to the discharge of firearms in the Kantishna area. This developed area has a large number of summer visitors using the facilities and surrounding area to engage in outdoor activities that could put them at risk of a firearm-related injury. The restriction on the discharge of firearms applies on federal public lands within one mile of the Kantishna road right-of-way from the former Mount McKinley National Park boundary at mile 87.9 to the north end of the Kantishna airport. The firearm discharge restriction is in effect during summer when the Kantishna lodges are in operation. During the period, subsistence harvests utilizing other methods and means of harvest may still take place according to federal subsistence management regulations.
- Restrictions and conditions associated with travel on the park road affect subsistence access. Subsistence users are required to obtain a permit, adhere to camping requirements and food storage requirements, and other conditions associated with backcountry use in the Old Park. Park road restrictions and backcountry requirements do not prevent subsistence access; however, subsistence users must be cognizant of and adhere to this additional requirement.

The combined impact of these actions would be major in Cantwell where conflicts between recreation and subsistence already exist and are predicted to increase, moderate in Kantishna where a high level of recreation and infrastructure exists, and minor in Minchumina where low levels of visitation are expected due to its remote location. Implementing this alternative alone would have minor adverse impacts on subsistence resources and opportunities. The cumulative impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be major.

Conclusion

There would be minor adverse impacts to subsistence resources and opportunities under Alternative 3 because of the potential for conflicts along the winter snowmachine corridors and the year-round river corridors, and the increased visitation in the Kantishna area. The cumulative impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be major. The level of impacts to subsistence resources anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or are essential to the integrity of the park.

ALTERNATIVE 4 (PREFERRED ALTERNATIVE)

Alternative 4 would have moderate adverse impacts on subsistence resources and opportunities because it would result in increases in non-subsistence snowmachine use and generally higher levels of recreation use in subsistence areas, both of which would create unfavorable conditions for subsistence wildlife populations and increase conflicts between recreational and subsistence users.

Under this alternative, access by snowmachine to the park and preserve additions would continue to grow. Designating corridors for winter use would focus use in the following places: from the southern park boundary to the Old Park boundary near the West Fork Chulitna, Cantwell Creek, and Bull River; to the toes of the Ruth, Tokositna, and Kanikula glaciers from the Tokositna River; along the Yentna, Tokositna, and Kantishna/Muddy Rivers. In a future wilderness proposal, accommodation would be made as necessary for recreational snowmachine access along winter corridors and throughout those areas designated as Management Area A (11% of the total park area and along 135 linear miles of winter corridors). Winter corridors would result in areas of more concentrated snowmachine use and areas designated as Management Area A would allow for an encounter rate of up to five parties per day, including two parties of up to six people. Nearly all of the winter corridors overlap with areas currently or traditionally used for subsistence activities.

Except for the Kantishna area and the Broad Pass area between Cantwell Creek and the West Fork of the Chulitna River (which are zoned as Management Area A), all other subsistence use areas would be zoned as Management Area B or D. These management

areas allow for low to medium encounters with other people, very little evidence of modern human use, and low to medium disturbance of natural sounds. If standards in these categories are approached or exceeded, non-subsistence use would be curtailed or mitigated. If non-subsistence use is curtailed or mitigated, it could have less of an impact on subsistence resources and opportunities. The types of impacts that could be mitigated are described throughout this section.

Cantwell

Under Alternative 4, the Broad Pass area between Cantwell Creek and the West Fork of the Chulitna River would be designated as Management Area A, allowing for high disturbance to natural sounds and an encounter rate of up to five parties per day, including two parties of six people. Increased recreational use in the Broad Pass area could negatively affect subsistence hunters who rely on this area for subsistence purposes.

Several different impacts to subsistence wildlife populations and subsistence use activities could be expected as documented by the Denali Subsistence Resource Commission. For several years, subsistence users have expressed concerns about the impacts and conflicts of increasing recreational use and increasing non-subsistence snowmachine use on subsistence resources and subsistence activities. Members of Denali's Subsistence Resource Commission have specifically expressed concerns regarding the effects of increasing levels of snowmachine use in the Broad Pass/Cantwell area upon moose, furbearers, and ptarmigan populations and their distributions (Denali Subsistence Resource Commission Meeting Minutes, April 30, 2001; April 29, 1996; August 9, 1996; and June 28, 1993). The Denali Subsistence Resource Commission Meeting Minutes (June 1993) document high levels of non-subsistence related snowmachine use in the Cantwell area. It was noted that riders were primarily using drainages and basins, essentially saturating the area and displacing furbearers, causing local trappers to pull their traps prematurely in December of that year. This trend has persisted in subsequent years (pers comm. Hollis Twitchell 1/13/05). As the range of non-subsistence snowmachine use overlaps with subsistence use areas, the potential for conflict between these user groups increases.

Non-subsistence snowmachine users would interfere with subsistence traplines, displace furbearers, and create paths that encourage animals to travel farther from places where subsistence activities typically occur. Trappers begin trapping as early as November 1. The trapping season closes by the end of February; however, increasing levels of non-subsistence snowmachine use in the Cantwell/Broad Pass area would continue to displace wildlife, and trappers would continue to pull their traps by December because it would be inefficient to set traps in an area in which furbearers have been displaced. This would constitute a loss of an opportunity for subsistence users in that area.

Increased use of the park, particularly non-subsistence snowmachine use, would likely displace moose and caribou from critical wintering areas on park lands in the Windy

Creek, Bull River and Cantwell Creek drainages. Local moose populations and the Cantwell group of the Nelchina Caribou herd use areas within the former Mount McKinley National Park and the ANILCA park additions of Windy Creek, Cantwell Creek, and the Bull River drainages during winter. These areas provide important winter habitat for moose and caribou because snow depths associated with the pass area are less than in other areas.

Non-subsistence snowmachine use is often concentrated in these high-elevation basins where riders spend many hours at a time. These basins provide critical winter habitat for moose and caribou. Moose and caribou would continue to be displaced from these critical wintering areas as non-subsistence snowmachine use increases. This could significantly increase the stress and nutritional demands upon moose and caribou and result in some moose or caribou mortality, depending on the environmental conditions and the body reserves of moose or caribou in a given year.

Non-subsistence snowmachine use originating in Cantwell begins when adequate snow cover is present, and during early winter, use is relatively low. As snowpack increases so does snowmachine use. In late winter when the days are lighter, warmer, and there is adequate snow cover, non-subsistence snowmachine use is highest. This corresponds with the time of the year when moose and caribou are at their lowest nutritional states. Non-subsistence snowmachine use would continue to induce stress on moose and caribou in the Windy Creek, Bull River, and Cantwell drainages, especially in late winter when the animals are in a nutritional deficit. The magnitude of the impact would depend on snow depth. Die off would be greater as snow depth increases because displaced animals would have a more difficult time moving through the snow to forage and to get away from snowmachine use.

In addition, the State issues a limited number of permits for the Tier II hunt for the Nelchina Caribou herd, and local Cantwell residents must compete with residents statewide for the permits. Local residents rely on federal permits to hunt caribou in the Cantwell area. Under this alternative, non-subsistence snowmachine use would continue to increase and would either displace caribou from the Windy Creek, Bull River, and Cantwell Creek drainages or it would prevent caribou from going there altogether. If caribou do not travel onto these federal lands, subsistence hunters from Cantwell would not have an opportunity to hunt them. This opportunity would be lost for as long as the caribou remain on lands outside the national park.

Kantishna

Under Alternative 4, the Kantishna area would be designated as Management Area A, allowing for high disturbance to natural sounds and an encounter rate of up to five parties per day, including two parties of six people. Up to five designated campsites would be created in conjunction with the summer corridor areas in the Kantishna Hills. Increased recreational use in the Kantishna area could negatively affect subsistence hunters who rely on this area for subsistence purposes. During the peak summer season there are

approximately 300 overnight visitors to the Kantishna area. Increasing numbers of visitors could necessitate an expansion of the firearms discharge closure in Kantishna. The decision to extend the closure would be evaluated in a separate public process. If the closure were extended, it would have adverse impacts on moose hunters in the Upper and Lower Moose Creek drainages, Eldorado, and Skyline Drive by severely restricting opportunities to hunt moose in those areas because they would not be permitted to use firearms.

Minchumina

Year-round recreational corridors would be designated in the northwest part of the park (Muddy/Kantishna Rivers), inviting more use along these corridors and potentially increasing user conflicts and the risk of theft and vandalism at subsistence cabins along these corridors. Lake Minchumina area residents mentioned concerns about the impacts of increasing non-subsistence uses during public scoping (see also Letter from Collins, 3/3/01).

There are at least five usable subsistence cabins along the Muddy and Kantishna Rivers and many others scattered throughout the preserve. This has been an issue of concern raised by the Subsistence Resource Commission because theft and vandalism have been reported on lands adjacent to the park (Hollis Twitchell, pers. comm. 1/13/05).

Cumulative Effects

The following actions increase the potential for adverse impacts to subsistence:

- In the last five years, non-subsistence snowmachine use has expanded dramatically in and adjacent to the southeastern areas of the park, particularly in the area near Cantwell and Broad Pass. Along with increasing popularity for snowmobiling have come dramatic improvements in snowmachine technology. Because of the increased reliability, power and flotation ability of the newer snowmachines, snowmachiners have been accessing more distant areas and operating in significantly steeper and higher terrain than in past years.

Open habitat, mountain slopes, and reasonably good snow deposition in the Broad Pass area have attracted increasing numbers of snowmachiners from areas of the state accessible to the Parks Highway. Typically, non-subsistence snowmachine groups tend to travel in larger numbers and spend more time traveling in basins and drainages.

Increases in types and levels of recreation interfere with subsistence activities. Visitors, especially those who travel via motorized means, may disturb wildlife and interfere with subsistence users who are hunting or scouting for subsistence resources. As popular places become crowded, it is expected that recreational use will disperse into more remote or infrequently used places. Potential restrictions

to subsistence may occur if visitors frequent areas used for subsistence. Visitors, especially those who travel via motorized means, may disturb wildlife and interfere with subsistence users who are hunting or scouting for subsistence resources.

- New housing and commercial development has occurred in the Nenana Canyon north of the park entrance, the Yanert Valley east of the park, in the eastern part of the Stampede Road Corridor, around Cantwell, and along Petersville Road. This development has resulted in minor expansion of local road networks or improvements of existing roads. This development is likely to continue, creating increased access to the eastern and southern boundaries of the park. Increases in types and levels of recreation can interfere with subsistence activities.
- While brushing a trail from Nenana to Minchumina for snowmachine use is opposed by locals in Minchumina and Telida, there is a reasonable chance that it would happen in the future. This trail would provide easier access to the northwestern part of the park. Increased access means higher use levels and greater potential for impacts to subsistence resources and opportunities.
- Continued growth in commercial developments in Kantishna would attract more visitors to that area, thereby increasing the potential for conflicts between subsistence and non-subsistence users, or increasing the potential for restrictions or conditions on subsistence use in the Kantishna area.
- Concern for the safety of park visitors prompted the National Park Service to initiate a closure to the discharge of firearms in the Kantishna area. This developed area has a large number of summer visitors using the facilities and surrounding area to engage in outdoor activities that could put them at risk of a firearm-related injury. The restriction on the discharge of firearms applies on federal public lands within one mile of the Kantishna road right-of-way from the former Mount McKinley National Park boundary at mile 87.9 to the north end of the Kantishna airport. The firearm discharge restriction is in effect during summer when the Kantishna lodges are in operation. During the period, subsistence harvests utilizing other methods and means of harvest may still take place according to federal subsistence management regulations.
- Restrictions and conditions associated with travel on the park road affect subsistence access. Subsistence users are required to obtain a permit, adhere to camping requirements and food storage requirements, and other conditions associated with backcountry use in the Old Park. Park road restrictions and backcountry requirements do not prevent subsistence access; however, subsistence users must be cognizant of and adhere to this additional requirement.

The combined impact of these actions would be major in Cantwell where conflicts between recreation and subsistence already exist and are predicted to increase, moderate

in Kantishna where a high level of recreation and infrastructure exists, and minor in Minchumina where low levels of visitation are expected due to its remote location. Implementing this alternative alone would have moderate adverse impacts on subsistence resources and opportunities. The cumulative impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be major.

Conclusion

Alternative 4 would have moderate adverse impacts on subsistence resources and opportunities because it would result in increases in non-subsistence snowmachine use, especially in the Cantwell area, and generally higher levels of recreation use in subsistence areas, both of which would create unfavorable conditions for subsistence wildlife populations and increase conflicts between recreational and subsistence users. The cumulative impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be major. The level of impacts to subsistence resources anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the integrity of the park.

ALTERNATIVE 5

Alternative 5 could have major impacts on subsistence resources and opportunities because of substantial increases in recreational activities – including non-subsistence snowmachine access – in both the Kantishna and Cantwell areas, which could create conflicts between recreational and subsistence users and unfavorable conditions for subsistence wildlife populations.

Under this alternative, access by snowmachine to the park additions and preserves would continue and grow. Designating corridors for winter use would focus snowmachine use in the following places: from the southern park boundary to the Old Park boundary near the West Fork Chulitna, Bull River, and Cantwell Creek; to the toes of the Ruth, Tokositna, and Kanikula glaciers from the Tokositna River; to Kantishna from the Sushana River; along the Yentna, Tokositna, and Kantishna/Muddy Rivers. In a future wilderness proposal, accommodation would be made as necessary for recreational snowmachine access along corridors and throughout those areas designated as Management Area A (18% of the total park area plus 183 linear miles of winter corridors). Winter corridors would result in areas of more concentrated snowmachine use and areas designated as Management Area A would allow for an encounter rate of up to five parties per day, including two parties of up to six people. Nearly all of the winter corridors overlap with areas currently or traditionally used for subsistence activities. If standards in these categories were approached or exceeded, non-subsistence use would be curtailed or mitigated. If non-subsistence use is curtailed or mitigated, it could have less of an impact on subsistence resources and opportunities. The types of impacts that could be mitigated are described throughout this section.

Cantwell

Under Alternative 5, the Cantwell/Broad Pass area would be designated as Management Area A, allowing for high disturbance to natural sounds and an encounter rate of up to five parties per day, including two parties of six people. Increased recreational use in the Broad Pass area could negatively affect subsistence hunters and trappers who rely on this area for subsistence purposes.

Several different impacts to subsistence wildlife populations and subsistence use activities could be expected as documented by the Denali Subsistence Resource Commission. For several years, subsistence users have expressed concerns about the impacts and conflicts of increasing recreational use and increasing non-subsistence snowmachine use on subsistence resources and subsistence activities. Members of Denali's Subsistence Resource Commission have specifically expressed concerns regarding the effects of increasing levels of snowmachine use in the Broad Pass/Cantwell area upon moose, furbearers, and ptarmigan populations and their distributions (Denali Subsistence Resource Commission Meeting Minutes, April 30, 2001; April 29, 1996; August 9, 1996; and June 28, 1993). The Denali Subsistence Resource Commission Meeting Minutes (June 1993) document high levels of non-subsistence related snowmachine use in the Cantwell area. It was noted that riders were primarily using drainages and basins, essentially saturating the area and displacing furbearers, causing local trappers to pull their traps prematurely in December of that year. This trend has persisted in subsequent years (pers comm. Hollis Twitchell 1/13/05). As the range of non-subsistence snowmachine use overlaps with subsistence use areas, the potential for conflict between these user groups increases.

Non-subsistence snowmachine users would interfere with subsistence traplines, displace furbearers, and create paths that encourage animals to travel farther from places where subsistence activities typically occur. Trappers begin trapping as early as November 1. The trapping season closes by the end of February; however, increasing levels of non-subsistence snowmachine use in the Cantwell/Broad Pass area would continue to displace wildlife, and trappers would continue to pull their traps by December because it would be inefficient to set traps in an area in which furbearers have been displaced. This would constitute a loss of an opportunity for subsistence users in that area.

Increased use of the park, particularly non-subsistence snowmachine use, would likely displace moose and caribou from critical wintering areas on park lands in the Windy and Cantwell Creek drainages. Local moose populations and the Cantwell group of the Nelchina Caribou herd use areas within the former Mount McKinley National Park and the ANILCA park additions of Windy Creek, Cantwell Creek, and the Bull River drainages during winter. These areas along the Alaska Range in the vicinity of Windy Pass provide important winter habitat for moose and caribou because snow depths associated with the pass area are less than in other areas.

Non-subsistence snowmachine use is often concentrated in these high-elevation basins where riders spend many hours at a time. These basins provide critical winter habitat for moose and caribou. Moose and caribou would continue to be displaced from these critical wintering areas as non-subsistence snowmachine use increases. This could significantly increase the stress and nutritional demands upon moose and caribou and result in some moose or caribou mortality, depending on the environmental conditions and the body reserves of moose or caribou in a given year.

Non-subsistence snowmachine use originating in Cantwell begins when adequate snow cover is present, and during early winter, use is relatively low. As snowpack increases so does snowmachine use. In late winter when the days are lighter, warmer, and there is adequate snow cover, non-subsistence snowmachine use is highest. This corresponds with the time of the year when moose and caribou are at their lowest nutritional states. Non-subsistence snowmachine use would continue to induce stress on moose and caribou in the Windy and Cantwell drainages, especially in late winter when the animals are in a nutritional deficit. The magnitude of the impact would depend on snow depth. Die-off would be greater as snow depth increases because displaced animals would have a more difficult time moving through the snow to forage and to get away from snowmachine use.

In addition, the State issues a limited number of permits for the Tier II hunt for the Nelchina Caribou herd, and local Cantwell residents must compete with residents statewide for the permits. Local residents rely on federal permits to hunt caribou in the Cantwell area. Under this alternative, non-subsistence snowmachine use would continue to increase and would either displace caribou from the Windy and Cantwell drainages or it would prevent caribou from going there altogether. If caribou do not travel onto these federal lands, subsistence hunters from Cantwell would not have an opportunity to hunt them. This opportunity would be lost for as long as the caribou remain on lands outside the national park.

Kantishna

Under Alternative 5, the Kantishna area would be designated as Management Area A, allowing for high disturbance to natural sounds and an encounter rate of up to five parties per day, including two parties of six people. Up to five designated campsites would be created in conjunction with the summer corridor areas in the Kantishna Hills. Increased recreational use in the Kantishna area could negatively affect subsistence hunters who rely on this area for subsistence purposes. In this alternative, snowmachine access via the Sushana-Kantishna corridor combined with high allowable levels of natural sound disturbance and high encounter rates could mean extensive snowmachine disruption to subsistence resources, although not during a time of year when subsistence users are currently present.

During the peak summer season there are approximately 300 overnight visitors to the Kantishna area. Increasing numbers of visitors could necessitate an expansion of the firearms discharge closure in Kantishna. The decision to extend the closure would be

evaluated in a separate public process. If the closure were extended, it would have adverse impacts on moose hunters in the Upper and Lower Moose Creek drainages, Eldorado, and Skyline Drive by severely restricting opportunities to hunt moose in those areas because they would not be permitted to use firearms.

Minchumina

Year-round recreational corridors would be designated in the northwest part of the park (Muddy/Kantishna Rivers), inviting more use along these corridors and potentially increasing user conflicts and the risk of theft and vandalism at subsistence cabins along these corridors. Lake Minchumina area residents mentioned concerns about the impacts of increasing non-subsistence uses during public scoping (see also Letter from Collins, 3/3/01). There are at least five usable subsistence cabins along the Muddy and Kantishna Rivers and many others scattered throughout the preserve. This has been an issue of concern raised by the Subsistence Resource Commission because theft and vandalism have been reported on lands adjacent to the park (Hollis Twitchell, pers. comm. 1/13/05).

Guided sport hunting would increase under Alternative 5, allowing three guides to cover the entire southwest preserve and one guide in the southern portion of the northwest preserve. The increase in guided hunting would increase competition with subsistence users, particularly in the northwest preserve where guided hunting would be a new activity. However, the main subsistence use in the southern portion of the northwest preserve is trapping, which occurs in winter. Therefore, commercial hunting in fall is not likely to conflict with trapping in winter.

Cumulative Effects

The following actions increase the potential for adverse impacts to subsistence:

- In the last five years, non-subsistence snowmachine use has expanded dramatically in and adjacent to the southeastern areas of the park, particularly in the area near Cantwell and Broad Pass. Along with increasing popularity for snowmobiling have come dramatic improvements in snowmachine technology. Because of the increased reliability, power and flotation ability of the newer snowmachines, snowmachiners have been accessing more distant areas and operating in significantly steeper and higher terrain than in past years.

Open habitat, mountain slopes, and reasonably good snow deposition in the Broad Pass area have attracted increasing numbers of snowmachiners from areas of the state accessible to the Parks Highway. Typically, non-subsistence snowmachine groups tend to travel in larger numbers and spend more time traveling in basins and drainages.

Increases in types and levels of recreation interfere with subsistence activities. Visitors, especially those who travel via motorized means, may disturb wildlife

and interfere with subsistence users who are hunting or scouting for subsistence resources. As popular places become crowded, it is expected that recreational use will disperse into more remote or infrequently used places. Potential restrictions to subsistence may occur if visitors frequent areas used for subsistence. Visitors, especially those who travel via motorized means, may disturb wildlife and interfere with subsistence users who are hunting or scouting for subsistence resources.

- New housing and commercial development has occurred in the Nenana Canyon north of the park entrance, the Yanert Valley east of the park, in the eastern part of the Stampede Road Corridor, around Cantwell, and along Petersville Road. This development has resulted in minor expansion of local road networks or improvements of existing roads. This development is likely to continue, creating increased access to the eastern and southern boundaries of the park. Increases in types and levels of recreation can interfere with subsistence activities.
- While brushing a trail from Nenana to Minchumina for snowmachine use is opposed by locals in Minchumina and Telida, there is a reasonable chance that it would happen in the future. This trail would provide easier access to the northwestern part of the park. Increased access means higher use levels and greater potential for impacts to subsistence resources and opportunities.
- Continued growth in commercial developments in Kantishna would attract more visitors to that area, thereby increasing the potential for conflicts between subsistence and non-subsistence users, or increasing the potential for restrictions or conditions on subsistence use in the Kantishna area.
- Concern for the safety of park visitors prompted the National Park Service to initiate a closure to the discharge of firearms in the Kantishna area. This developed area has a large number of summer visitors using the facilities and surrounding area to engage in outdoor activities that could put them at risk of a firearm-related injury. The restriction on the discharge of firearms applies on federal public lands within one mile of the Kantishna road right-of-way from the former Mount McKinley National Park boundary at mile 87.9 to the north end of the Kantishna airport. The firearm discharge restriction is in effect during summer when the Kantishna lodges are in operation. During the period, subsistence harvests utilizing other methods and means of harvest may still take place according to federal subsistence management regulations.
- Restrictions and conditions associated with travel on the park road affect subsistence access. Subsistence users are required to obtain a permit, adhere to camping requirements and food storage requirements, and other conditions associated with backcountry use in the Old Park. Park road restrictions and backcountry requirements do not prevent subsistence access; however, subsistence users must be cognizant of and adhere to this additional requirement.

The combined impact of these actions would be major in Cantwell where conflicts between recreation and subsistence already exist and are predicted to increase, moderate in Kantishna where a high level of recreation and infrastructure exists, and minor in Minchumina where low levels of visitation are expected due to its remote location. Implementing this alternative alone would have major adverse impacts on subsistence resources and opportunities. The cumulative impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be major.

Conclusion

Alternative 5 could have major impacts on subsistence resources and opportunities because of substantial increases in recreational activities – including non-subsistence snowmachine access – in both the Kantishna and Cantwell areas, which could create conflicts between recreational and subsistence users and unfavorable conditions for subsistence wildlife populations. The cumulative impact of this alternative plus the aforementioned past, present, and reasonably foreseeable actions would be major. The level of impacts to subsistence resources anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the integrity of the park.

CULTURAL RESOURCES

Cultural resources at Denali include archaeological resources, ethnographic resources, cultural landscapes, and historic structures. While there is some potential for impacts to any of these resources from plan actions, the archaeological resources and historic structures are most at risk while impacts to the other categories are anticipated to be negligible in all alternatives and were dismissed from further analysis (see chapter 1).

METHODOLOGY

The potential for increased pressure on cultural sites increases as the number of visitors increases. Impacts from visitor use can include modification, defacement, displacement, or removal of objects from cultural sites. Management actions to manage visitor use could also result in adverse impacts (for example, disturbing sites during trail construction). However, without site-specific information it is difficult to determine impacts. When specific actions are taken within any alternative further analysis will be required to comply with the requirements of Section 106 of the National Historic Preservation Act (NHPA) in accordance with the Advisory Council on Historic Preservation's regulations implementing Section 106 (36 CFR Part 800, "Protection of Historic Properties").

ALTERNATIVE 1 (NO ACTION)

As recreational use continues to increase under Alternative 1, visitors are more likely to encounter cultural resource sites and investigate them. As popular areas get crowded (such as the day-use areas around Wonder Lake and Kantishna), use would disperse into places with lower levels of use, such as the Kantishna Hills. Increasing numbers of visitors without concomitant management action have the potential for increased pressure on cultural resources and the types of adverse impacts described under the Methodology section.

Cumulative Effects

Adverse impacts to cultural resources could be expected from land development in the Kantishna Hills and increases in regional recreational activities. These impacts would occur mainly because of increasing numbers of visitors without concomitant management actions. Impacts from activities addressed in the no-action alternative of the backcountry management plan would not appreciably add to effects from other past, present, and reasonably foreseeable future actions.

Conclusion

Under Alternative 1, there is the potential for minor to major adverse impacts on cultural resources because of unmanaged increases in the number of visitors in areas where cultural resources exist.

The level of impacts to cultural resources anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are key to the integrity of the park.

ALTERNATIVE 2

Impacts to cultural resources under this alternative would be negligible because actions are not proposed that would facilitate or encourage more people to visit areas where cultural resources exist.

Under Alternative 2, the backcountry would be managed for low visitor density throughout most of the park and preserve. Although a year-round recreational corridor would be designated in the northwest part of the park (Muddy/Kantishna Rivers), because snowmobile and motorboat use would be limited to subsistence and other traditional activities in the park and preserve the amount of visitor use on this corridor would likely remain small. The Kantishna area would be designated as Management Area B, allowing for an encounter rate of generally no more than two parties per day. Management Area E designation, encompassing 46% of the backcountry, would allow for an encounter rate of zero parties per day, including at the Stampede Mine site which is one of very few antimony mines to have operated in the state. Cultural resources at this site are therefore unique, and any damage or loss would be significant. For these reasons, impacts to cultural resources under this alternative would be negligible because actions are not proposed that would facilitate or encourage more people to visit areas where cultural resources exist, particularly in the backcountry. Instances of damage to cultural resources by visitors, such as vandalism and theft, would continue to be rare. Overall impacts on cultural resources from this alternative would be negligible for the entire time in which the plan is in effect.

Cumulative Effects

As described under Alternative 1, adverse impacts to cultural resources could be expected from land development in the Kantishna Hills and increases in regional recreational activities. As described in the analysis for Alternative 2, impacts to cultural resources under Alternative 2 would be negligible and therefore would not add to overall effects from other past, present, and reasonably foreseeable future actions.

Conclusion

Impacts to cultural resources under this alternative would be negligible because actions are not proposed that would facilitate or encourage more people to visit areas where cultural resources exist. This would continue as long as the plan is in effect.

The level of impacts to cultural resources anticipated from this alternative would not impair park resources that fulfill specific purposes identified in the establishing legislation or that are key to the integrity of the park.

ALTERNATIVE 3

Actions proposed under Alternative 3 have the potential to increase pressure on cultural resources because of the expected increase in use in some areas where cultural sites are found.

Under Alternative 3, the Kantishna area would be designated as Management Area A, allowing for an encounter rate of up to five parties per day, including two parties of six people. Several historic sites in the Kantishna Hills could experience an increase in visitation, potentially increasing the pressure on these sites because of increased recreational use. The Stampede Mine site is one of very few antimony mines to have operated in the state. Cultural resources at this site are therefore unique, and any damage or loss would be significant. The area around the Stampede Mine would be designated Management Area D, allowing a low amount of visitor use with an encounter rate limitation of 3 parties per week. Year-round recreational corridors would be designated in the northwest part of the park (Muddy/Kantishna Rivers) and the southwest (Yentna and Tokositna Rivers), inviting more use along these corridors and potentially increasing the pressure on cultural resources along these rivers. Potential adverse impacts are those described in the Methodology section.

The increased recreation use would facilitate or encourage more people to visit areas where cultural resources exist, particularly in the backcountry, potentially increasing the pressure on those resources. Overall impacts on cultural resources from this alternative would be minor for the entire time in which the plan is in effect.

Cumulative Effects

As described under Alternative 1, adverse impacts to cultural resources could be expected from land development in the Kantishna Hills and increases in regional recreational activities. As outlined in the above analysis, Alternative 3 would result in increased pressure on cultural resources. This would not add to overall effects from other past, present, and reasonably foreseeable future actions.

Conclusion

Actions proposed under Alternative 3 could result in minor to major adverse impacts on cultural resources because of the expected increase in use in some areas where cultural sites are found, although determining specific impacts would require site-specific information. This would be the case throughout the life of the plan.

The level of impacts to cultural resources anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are key to the integrity of the park.

ALTERNATIVE 4 (PREFERRED ALTERNATIVE)

Actions proposed under Alternative 4 would result in increased pressure on cultural resources because of the likelihood of increased visitation to cultural resource sites in the backcountry.

Snowmobile use under Alternative 4 would allow dispersed use throughout the park additions and preserve and on established winter corridors. Snowmobile use would continue to increase and cultural sites would be more prone to increased visitation throughout the winter months. Under Alternative 4, the Kantishna area would be designated as Management Area A, allowing for an encounter rate of up to five parties per day, including two parties of six people. A portion of the Kantishna Hills, including the Stampede Mine (a site determined to be eligible for the National Register of Historic Places), would be designated Management Area B, allowing for an encounter rate of up to two parties per day. The Stampede Mine site is one of very few antimony mines to have operated in the state. Cultural resources at this site are therefore unique, and any damage or loss would be significant. Several historic sites in the Kantishna Hills could experience an increase in visitation because of increased recreational use. Year-round recreational corridors would be designated in the northwest part of the park (Muddy/Kantishna Rivers) and the southwest (Yentna and Tokositna Rivers), inviting more use along these corridors and potentially increasing the pressure on cultural resources along these rivers. Potential adverse impacts are those described in the Methodology section.

Because the increased recreation use would facilitate or encourage more people to visit areas where cultural resources exist, the potential exists for increased pressure on those resources, particularly in the backcountry.

Cumulative Effects

As described under Alternative 1, adverse impacts on cultural resources could be expected from land development in the Kantishna Hills and increases in regional recreational activities. As outlined in the analysis, Alternative 4 would result in increased pressure on cultural resources. This would not add to overall effects from other past, present, and reasonably foreseeable future actions.

Conclusion

Actions proposed under Alternative 4 could result in minor to major adverse impacts on cultural resources because of the likelihood of increased visitation to cultural resource sites in the backcountry, although determining specific impacts would require site-specific information. This would be the case throughout the life of the plan.

The level of impacts to cultural resources anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are key to the integrity of the park.

ALTERNATIVE 5

Actions proposed under Alternative 5 would result in the potential to increase pressure on cultural resources because of the likelihood of increased visitation to cultural resource sites in the backcountry.

Snowmobile use under Alternative 5 would allow dispersed use throughout the park additions and preserve and on established winter corridors. Snowmobile use would continue to increase and cultural sites would be more prone to increased visitation throughout the winter months. Under Alternative 5, the Kantishna area would be designated as Management Area A, allowing for an encounter rate of up to five parties per day, including two parties of six people. A large portion of the park and preserve (66%), including the Stampede Mine (a site determined to be eligible for the National Register of Historic Places), would be designated Management Area B, allowing for an encounter rate of up to two parties per day. A high use Corridor zone between Sushana River and Kantishna could pass near the mine, allowing a very high level of use particularly during winter months. The Stampede Mine site is one of very few antimony mines to have operated in the state. Cultural resources at this site are therefore unique, and any damage or loss would be significant. Several historic sites in the Kantishna Hills and throughout the backcountry could experience an increase in visitation as a result of increased recreational use. Year-round recreational corridors would be designated in the northwest part of the park (Muddy/Kantishna Rivers) and the southwest (Yentna and Tokositna Rivers), inviting more use along these corridors and potentially increasing the risk of impacts to cultural resources along these rivers. Potential adverse impacts are those described in the Methodology section.

Because the increased recreation use would facilitate or encourage more people to visit areas where cultural resources exist, the potential exists for increased pressure on those resources, particularly in the backcountry.

Cumulative Effects

As described under Alternative 1, adverse impacts on cultural resources could be expected from land development in the Kantishna Hills and increases in regional

recreational activities. As outlined in the analysis, Alternative 5 would result in increased pressure on cultural resources. This would not add to overall effects from other past, present, and reasonably foreseeable future actions.

Conclusion

Actions proposed under Alternative 5 could result in minor adverse impacts on cultural resources because of the likelihood of increased visitation to cultural resource sites in the backcountry, although determining specific impacts would require site-specific information. This would be the case throughout the life of the plan.

The level of impacts to cultural resources anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are key to the integrity of the park.

SOCIOECONOMICS

The first part of this section provides a literature review of the types of impacts that can result from the various visitor and administrative activities that could occur in the park and preserve. The second part is an analysis of the impacts likely to occur under each alternative.

GENERAL IMPACTS BASED ON LITERATURE REVIEW

The impacts of each alternative can be analyzed in terms of direct and indirect effects on social and economic values. Values of the social environment mainly include quality of life in the Denali region, which usually includes factors such as the ability to lead a rural lifestyle, availability of schools, libraries, and other basic community amenities, and personal safety (particularly a low incidence of crime). Economic values include direct and indirect economic benefits or losses to local communities, business and employment opportunities, ecosystem services, and less tangible values such as existence value. These values are defined and further explained in the following sections.

Economic Values of Denali National Park and Preserve

Visitor use in Denali National Park and Preserve represents one part of the economic value of the park. Businesses in gateway communities near the park benefit from visitors' requiring food, lodging, and other services. Studies conducted in Alaska provide an indication of the economic value of these services. For example, Fletcher et al. (2000) estimated that current residents with snowmachines spent about \$297 per machine for gas for tow vehicles and machines and \$286 per household for lodging, meals, snacks, and beverages in 1999. Non-residents were estimated to have spent about \$154 per day for tow vehicle and snowmachine rental, and \$149 per person per day for lodging, food, and beverages—assuming a 5-day trip—in 1999.

The large expanse of protected land in Denali National Park and Preserve also provides other types of direct and indirect economic benefits. Costanza et al. (1997) and others have recently attempted calculating the economic value of ecosystem services performed by natural systems. Economic values have been assigned to ecosystem services such as nutrient cycling, water supply, climate regulation, erosion control and sediment retention, and many others in addition to commonly recognized values such as recreation. While no specific economic values have been assigned to Denali National Park and Preserve, such a measurement may be possible in the future as its value as a natural, intact, functioning sub-arctic ecosystem is fully assessed and quantified.

Another economic value of Denali National Park and Preserve that has not yet been measured is its value in amenities to the local communities. In analyzing counties in the western U.S. that are close to wilderness areas, Lorah (2000) found that the presence of

wilderness is correlated with income, employment, and population growth. According to Power (1995), natural landscapes “often may generate more new jobs and income by providing the natural resource amenities—water and air quality, recreational opportunities, scenic beauty and the fish and wildlife—that make the...[area] an attractive place to live, work, and do business.” In addition, Fausold and Lilieholm (1996) found that real estate prices increase around open space.

Existence and Use Values of Denali National Park and Preserve and the Wilderness Recreational Experience

The existence value of a park or protected area is often phrased as “just knowing it is there.” Colt (2001) estimated the economic importance of Alaska’s ecosystems and concluded that “the ‘existence value’ of Alaska’s undisturbed lands and waters is likely to become increasingly important in the future, as world population, education, and income continue to grow and ecosystems in other places continue to be degraded.”

A number of contingent valuation studies have been conducted over the last 20 years. The purpose of such studies is to determine and compare the socioeconomic values of active and passive use. Active use involves having a wilderness recreational experience by going to the place and setting foot within the boundaries. Passive use involves knowing that such a potential experience exists even if one elects not to participate in wilderness recreational activities (or plans to do so sometime in the future). The results of some of these studies provide a basis for understanding the socioeconomic values affected by different types of wilderness experiences.

Contingent valuation studies have shown that the average household would be willing to invest in passive, non-use of wilderness areas (Gilbert, Glass and More 1991; Barrick and Beazley 1990; Pope and Jones 1990; Walsh, Loomis, and Gillman 1984; Diamond et al. 1993, Kahneman and Knetsch 1992; Vincent et al. 1995; Bjornstad and Kahn 1996). This research indicates that U.S. citizens not only value the existence of wilderness areas because of their importance as a national resource, but also because of the value in having them available in the event that those citizens would like to participate in wilderness recreational activities in the future. In many cases, the passive use value makes up a substantial proportion of the total value (combined use and non-use values) that is placed on wilderness areas.

Impact Thresholds

The following thresholds were used to determine the magnitude of effects on the socioeconomic environment.

Negligible: Little or no noticeable change in economic activity, employment and income levels, or population migration or immigration.

Minor: Local (limited to one community and vicinity) changes in economic

activity, employment and income levels, or population migration or immigration.

Moderate: Regional (involves two or more communities in an area) changes in overall economic activity, employment and income levels, or population migration or immigration.

Major: Widespread (may involve a substantial region of the State, such as Interior Alaska) changes in overall economic activity, employment and income levels, or population migration or immigration.

ALTERNATIVE 1 (NO ACTION)

Economic Impacts

Summer Season

The lack of restrictions on airplane landings and overflights in the Old Park under Alternative 1 would result in continued increases in business opportunities for air taxi and scenic air tour operators in the short term. These increases would likely result in increased employment opportunities to operate and maintain additional airplanes and increases in purchases of aviation fuel, parts, and other materials for operation. This would result in continued gradually increasing income to communities in which air taxi and scenic air tour operations are based, such as Talkeetna and the Healy-McKinley Village area, in the next several years. The level of benefit would be attributed to the fact that air taxi and scenic air tour operations are a major part of the overall business climate in these communities, especially Talkeetna. Over the 20 years in which the plan is to be in effect, however, there could be some reduction of economic benefits from one year to the next. This could result from the possibility that higher levels of activity would begin to compromise the overall visitor experience and keep some customers away.

Economic benefits from other summer backcountry activities such as hiking, camping, and mountaineering, would continue under Alternative 1 with steady increases over the next 20 years. These benefits would include increased retail sales and services with related growth in employment and income for the providers of these services. The lack of limits on these activities in the park additions and preserve would not likely cause a reduction in economic benefits to providers, since the natural trend would be toward dispersed use patterns and the demand for the services would continue to grow. Because current levels of use are generally low outside the Old Park, there is considerable opportunity for such growth. Economic benefits, especially business income, would continue to be realized in area communities, with a higher level of benefit in Talkeetna, a primary staging area for mountaineering activities. This would continue to be the case throughout the next 20 years.

Winter Season

Snowmachine use would likely continue to increase in portions of the north and south additions of the park and in the preserve areas under Alternative 1. This increased use would increase employment opportunities and income levels in the winter, when economic activity is lower in the vicinity of the park, because of the demand for services such as fuel, food, lodging, and some retail sales. Businesses in the park area, especially Healy, Cantwell, and Trapper Creek, would continue to benefit directly, since providers of these services would be located there. Economic benefits such as employment and income would continue to increase steadily for lodges, hotels, restaurants, gas stations, and retail businesses. Communities along the highway and near the park would benefit from at least a portion of the up to \$583 spent in Alaska annually by current residents and \$303 spent per day in Alaska by nonresidents estimated by Fletcher, et al. (2000). In addition, the state economy, particularly those elements related directly to providing snowmachine goods and services, could benefit from the sale of additional snowmachines, accessories, insurance, and other sales if increased access to the park encourages residents to purchase more machines to take advantage of this opportunity. Benefits could be expected to increase during the next several years, after which some use could be directed toward other lands in the region in search of less heavily used areas.

The benefits to local retail sales and service providers, including employment opportunities and income, would likely be less from other winter uses, such as skiing and dog mushing. These visitors would tend to be fewer in number than snowmachine users and would generally spend less in the immediate areas visited. This would be the case throughout the next 20 years.

Population and Housing Impacts

Summer Season

Increased backcountry recreational use and associated employment would likely lead to at least some seasonal influx of people to provide the needed retail services, such as lodging, restaurants, gas stations, and retail stores. Potential increases in backcountry recreational use levels and local seasonal population would likely result in the need for additional community public support services and facilities over the next several years. However, increases would be somewhat gradual, and backcountry use would still be a small percentage of total park visitor use throughout the next 20 years. Most impacts to population and housing during the summer season would result from actions described under the cumulative impacts section.

Winter Season

Although there would be increased recreational uses during the winter, which might provide additional employment opportunities and result in more permanent residents in the areas near the park, it would likely be small and would not result in measurable increases in winter population levels. The increasing levels of visitor use during winter would result in corresponding increases in the demand for emergency services, such as

responses to incidents involving injuries and the need for search and rescue. This would affect emergency service providers in area communities over the next several years by requiring slight increases in their capacity.

Other Economic Values

Changes to the wilderness character of Denali National Park and Preserve over the next several years, especially the increased impacts of human use in new places not currently affected, could result in a reduction of other economic values such as the value of ecosystem services provided by the park. Ecosystem services values accrue from an undisturbed, expansive subarctic ecosystem, so the park and preserve would have higher value with managed recreational types and use levels that prevent or minimize human impacts on the landscape. Ecosystem services for which values have not yet been determined could be compromised by allowing current recreational use patterns to continue to develop, since these use patterns include concentrated use at popular destinations with resource degradation at those locations. Essentially, any detrimental effect on nutrient cycling, water supply, climate regulation, erosion control or sediment retention could affect the value of ecosystem services. The level of impact would increase with the amount of area affected, and this would continue to be the case throughout the next 20 years.

Based on the above descriptions of impacts to the area economy, population and housing, and other economic values, overall impacts to economic values of the park and preserve would be minor over the next several years. Effects would likely increase to moderate levels over the next 20 years.

Quality of Life

Summer Season

Increasing numbers of recreational users in the backcountry of Denali over the next several years would likely result in corresponding increases in traffic, demands for parking, and the general level of human activity in gateway communities. Long-term effects could include increased population levels from the influx of people from elsewhere in Alaska and the United States, employment of non-local residents, and development of new businesses by non-local residents. This could reduce the overall rural quality of life for some area residents.

Winter Season

Minor changes are likely to occur in the quality of life for permanent residents near the park. Increased use of snowmachines in the area and the presence of increasing numbers of visitors from other areas could result in increased noise levels for local residents and current users, as well as signs of greater human presence from snowmachine tracks. This would likely result in a minor reduction in the rural and wilderness quality of life currently experienced by area residents over the next several years. It would also result in a slight decrease in the overall quality of the remote lifestyle valued by owners of second homes and recreational properties.

Another impact of expanding winter use would be increasing traffic in local communities, especially along the George Parks Highway and the Petersville Road. Residents of Cantwell, for example, have reported safety concerns with the increasing traffic along the Parks Highway through their community.

Existence and Use Values

Existence value could be expected to increase eventually as the commodity—a large, undisturbed ecosystem—becomes more rare in the world. Alternative 1 would result in an emphasis of recreational opportunities over and above ecosystem protection because of the lack of limits or visitor capacity determination in the park additions and preserve. This would reduce existence value eventually since this value is determined in large part by the pristine condition of the park and the level of resource protection. Increased impacts of human use in new places not currently affected would result in measurable impacts to existence value over the next several years. Measurement of such reduction would depend upon communicating information on level of impact and desired conditions to the public and determining preferences. A before and after comparison of a specific location, with changes from rarely visited to visibly affected, would likely decrease the amount of existence value placed on the site. This is a likely outcome for several different areas within the park and preserve under Alternative 1.

By contrast, use values would tend to increase in the next several years, exacerbating an existing trend in which some visitors have been seeking other destinations because of crowding at popular use areas in Denali. An increase in this trend could be expected during the next 20 years, since there is already increasing avoidance of popular south side destinations such as the Ruth Amphitheater because of rapidly growing levels of use.

Cumulative Impacts

As stated in the Assumptions section at the beginning of the Environmental Consequences chapter, the NPS expects an average annual increase of about 2% in overall visitation, including backcountry use, to Denali National Park and Preserve in the reasonably foreseeable future. This growth would lead to minor to moderate development of additional lodging, campgrounds, and supporting retail businesses, such as recreational tours and equipment rentals, restaurants, clothing and souvenir stores, and gas stations. This increase in economic activity would provide increased employment opportunities, resulting in an increase in seasonal and permanent population levels and the need for additional housing and public services.

At least a part of these services would support the increased backcountry recreational activities anticipated under Alternative 1, which could increase at a faster rate than overall visitation because of the lack of limits or capacity determinations. Still, most additional services would be directly related to frontcountry recreational uses, because of the much larger numbers of visitors, and uses outside of the park. Therefore, Alternative 1 for backcountry management would account for only a part of overall cumulative impacts.

Increased development along the Petersville Road, Trapper Creek, Talkeetna, in the Healy area, and on private inholdings and Native allotments would result in an increased need for housing and public services, as well as a loss in the current rural to wilderness quality of life in these areas. Overall, there would be moderate increased tourism and economic activity, employment, and population levels in communities and private lands near Denali National Park and Preserve and along the George Parks Highway.

Conclusion

While summer backcountry use is expected to increase at about the same rate as general park visitor use, the fastest growing sectors are in air tours and winter use, which are counted as part of overall backcountry use. This would result in parallel growth in income for existing businesses geared toward these particular user groups over the next several years under Alternative 1. There would also be more opportunities for new businesses to be initiated as a result of anticipated minor to moderate increases in recreational use levels. Alternative 1 would contribute to increased employment opportunities and income levels, commensurate with the levels of increases of recreational use, for concessioners and other recreation-oriented businesses near Denali National Park and Preserve. Increasing backcountry use under Alternative 1 would also contribute to the overall increase in economic activity, a slight increase in population and the need for additional housing and public services. Overall impacts to economic values of the park and preserve would be minor over the next several years. Effects would likely increase to moderate levels over the next 20 years.

There would be a moderate reduction in the current rural quality of life in communities near the park and preserve. Impacts to existence values would increase eventually, while use values would tend to increase over the next several years with some reduction likely in the long term. Impacts to the value of Denali National Park and Preserve for ecosystem services would be minor initially and increase to moderate over the next several years as higher levels of use occur at popular destinations. Overall impacts on social and economic values from the management actions under Alternative 1 would be moderate.

ALTERNATIVE 2

Economic Impacts

Summer Season

Changes in air traffic patterns to reduce aircraft noise, especially over the Old Park, would be voluntary under Alternative 2; therefore, businesses would retain control over the degree to which these measures affect their enterprise. At the same time, agreements by the Aircraft Overflights Working Group and the adoption of technology resulting in fewer resource impacts by commercial scenic tour operators would set new standards for how these types of businesses are operated. The potential of increased trip length required by rerouting scenic air tours to reduce aircraft noise over extensive areas of the

park and preserve could result in a loss of visitors and income for those businesses and increased fuel and labor costs. Operators would have to either decrease their profit goals or increase fees to make up for the loss in net revenues. Increased costs for each trip could further reduce the number of visitors taking scenic air tours because of their resistance to paying the higher fees. To meet the standards for desired conditions under Alternative 2, air tour operators would most likely make changes to operations such as adopting new technology (for example, quieter aircraft). A temporary (five years or less) increase in operating costs would result.

Limiting the numbers of commercial airplane landings in the park and preserve to current levels would not negatively affect air taxi and scenic air tour operations in the next several years since such operations would be able to continue to operate as in recent years. However, over the long term they would not realize the economic benefits of increased visitor use of the backcountry unless they invested in larger airplanes capable of meeting desired conditions for the natural soundscape. Rates of business growth could be reduced throughout the life of the plan if air taxi and scenic air tour operators landing in the park served about the same number of visitors from one year to the next.

Alternative 2 includes several management actions to protect the overall quality of the wilderness experience while providing for lower use levels than would occur under other alternatives, including the no action alternative. This would particularly benefit visitors seeking wilderness recreation characterized by high levels of solitude, especially in the more remote areas of the park and preserve. Growth in overall use would gradually occur at a steady and sustainable rate.

This steady, sustainable growth would mean that economic benefits—specifically for business operators serving backcountry users with goods and services—from other summer backcountry activities such as hiking, camping, and mountaineering, would continue. Steady increases in business could be expected over the next 20 years commensurate with increased numbers of visitors.

Providers of services to these users would benefit from steadily increasing business throughout the life of the plan. Economic benefits, especially business income, would continue to be realized in area communities, particularly in Talkeetna, a primary staging area for mountaineering activities.

Winter Season

Snowmachine use in the park additions and preserve would be limited to subsistence uses and other traditional activities under Alternative 2, with substantial reductions in use levels in some areas such as the Bull River Unit southwest of Cantwell. Lower use levels in the park would result in snowmachine users going to other destinations in the immediate vicinity, the region, and the state, and there could be a slight reduction in overall numbers passing through Denali area communities. If this were to occur, there would be a slight reduction in profits to businesses currently serving these users (lodges, hotels, restaurants, gas stations, and retail businesses), and the economic benefits

possible under other alternatives (employment opportunities and increased income) would not be realized.

The benefits to retail activity and profits, employment, and income from other winter uses, such as skiing and dog mushing, would gradually increase because of park management to protect the quality of these experiences and the growing numbers of users. There would be a gradual but steadily increasing business income.

Population and Housing Impacts

Summer Season

The overall slightly increasing recreational use and associated employment over the next several years in which the plan would be in effect would likely lead to at least some seasonal influx of people to provide the needed retail services, such as lodging, restaurants, gas stations, and retail stores. Potential increases in the recreational use levels and local seasonal population would likely result in the need for additional community public support services and facilities over the next several years. However, increases would be gradual and most visitor use would be related to activities in the frontcountry of the park throughout the life of the plan. Most impacts to population and housing during the summer season would result from actions described under the cumulative impacts section.

Winter Season

The mix of slight increases in winter recreational uses in some parts of the park and preserve (mainly non-motorized destinations such as the Old Park) and the noticeable decreases in other areas, such as the Broad Pass area, would result in little detectable change in employment opportunities, income, and population in nearby communities. There would be little change in demand for emergency services, such as responses to incidents involving injuries and the need for search and rescue. This would not affect emergency service providers in area communities for the next several years.

Other Economic Values

Alternative 2 emphasizes protecting the wilderness character of Denali National Park and Preserve over the long term. There would be similar protection of other economic values such as the value of ecosystem services provided by the park. Ecosystem services values accrue from an undisturbed, expansive subarctic ecosystem, so the park and preserve would have higher value with the managed recreational types and use levels under Alternative 2 that prevent or minimize human impacts on the landscape.

Based on the above descriptions of impacts to the area economy, population and housing, and other economic values, overall impacts to economic values of the park and preserve would be minor over the life of the plan.

Quality of Life

The quality of life in the Denali region would continue to be similar to existing conditions in terms of the opportunity to lead a rural lifestyle, the availability of schools, libraries, and other basic community amenities, and personal safety (particularly a low incidence of crime). This would occur because summer and winter backcountry recreational uses would increase slowly, with little change in population and community structure. Area residents would continue to enjoy the rural and wilderness nature of their lifestyles.

Existence and Use Values

Alternative 2 would emphasize existence values and the types of recreational use values sought by visitors who desire extended experiences in remote locations. This would correspond with a high level of resource protection because of visitor capacity limits in the park additions and preserve. Existence values would be protected and could increase eventually if the pristine condition of the park became a more rare and highly valued commodity. Use values for wilderness recreation in a remote setting would tend to increase throughout the life of the plan. Because most backcountry users value opportunities for travel into remote areas, use values for most recreational activities in the park and preserve would continue to increase throughout the life of the plan.

Cumulative Impacts

The gradual increase in backcountry recreational uses up to visitor capacity limits under Alternative 2 would be a negligible to minor contributor to increases in overall economic activity, development, and employment in the Denali region. As stated in the Assumptions section at the beginning of the Environmental Consequences chapter, the NPS expects an average annual increase of about 2% in overall visitation, including backcountry use, to Denali National Park and Preserve in the reasonably foreseeable future. Regional recreational uses would continue to increase, and at popular destinations outside the park boundary the increasing levels of use could be significant. This would result in some increased economic activity and employment. Development would likely continue along the Petersville Road, in Trapper Creek and Talkeetna, in the Healy area, and on private inholdings and Native allotments resulting in an increased need for housing and public services as well as an increased loss in the current rural to wilderness quality of life in these areas. As a result, there would be moderate cumulative impacts from increased tourism and economic activity, employment, and population levels in communities and private lands near Denali National Park and Preserve and along the George Parks Highway, with backcountry uses under Alternative 2 only a minor contributor.

Conclusion

Despite some potential reductions in recreational use at some locations within the park, Alternative 2 would contribute slightly to increases in income for most existing businesses throughout the life of the plan. The overall number of backcountry users would increase, although it would be a smaller percentage of total park visitation. There would be some potential opportunities for new businesses to be initiated because of anticipated minor increases in recreational use levels in the park. These changes would also lead to increased employment opportunities and income levels, commensurate with the levels of increases of backcountry recreational use, for concessioners and other recreation-oriented businesses near Denali National Park and Preserve. The contributions of Alternative 2 to increased economic activity in the park vicinity would result in negligible increases in population and the need for additional housing and public services. Overall impacts to economic values of the park and preserve would be minor over the life of the plan.

The existing rural quality of life in communities near the park and preserve could be expected to continue. Existence values would be protected and could increase eventually, as would use values for most activities. A moderate increase in the value of ecosystem services possibly contributed by Denali National Park and Preserve could be expected throughout the life of the plan. Overall impacts on social and economic values from the management actions under Alternative 2 would be minor.

ALTERNATIVE 3

Economic Impacts

Summer Season

Changes in air traffic patterns to reduce aircraft noise, especially over the Old Park, would be voluntary under Alternative 3; therefore, businesses would retain control over the degree to which these measures affect their enterprise. At the same time, agreements by the Aircraft Overflights Working Group and the adoption of technology resulting in less resource impacts by commercial scenic tour operators would set new standards for how these types of businesses are operated. The potential of increased trip length required to reroute scenic air tours to reduce aircraft noise over the Old Park could result in a loss of visitors and income for those businesses and increased fuel and labor costs. Operators would have to either decrease their profit goals or increase fees to make up for the loss in net revenues. Increased costs for each trip could further reduce the number of visitors taking scenic air tours because of their resistance to paying the higher fees. To meet the standards for desired conditions under Alternative 3, air tour operators would most likely make changes to operations such as adopting new technology (for example, quieter aircraft). A temporary (five years or less) increase in operating costs would result.

Management actions proposed as part of Alternative 3 would limit the locations for scenic tour airplane landings in the park and preserve to the Kahiltna and Ruth Glaciers, and landings would be restricted to the hours of 9 am to 9 pm. However, based on data from 1999 through 2004, only 10% of all scenic tour airplane landings would have been affected by these restrictions, and much of this percentage could have been accommodated on the Kahiltna and Ruth Glaciers. Therefore, there would generally not be any overall impacts in the near future to businesses providing scenic flights. Toward the latter part of the time in which the plan is to be in effect, 20 years in the future, these business operations would tend to reach full capacity for park use and would have limited opportunities for growth.

Economic benefits—specifically for business operators serving backcountry users—from other summer backcountry activities such as hiking, camping, and mountaineering, would continue under Alternative 3. Steady increases in business could be expected over the next 20 years commensurate with increased numbers of visitors. Visitor capacity determinations and management actions to protect the overall quality of the wilderness experience would benefit visitors participating in all activities; therefore, continued growth would be likely. Providers of services to these users would benefit from steadily increasing business throughout the life of the plan. Economic benefits to area communities from these types of park uses would tend to increase eventually because of the quality of the experience and increasing numbers of users. A higher level of benefit would be likely in Talkeetna, a primary staging area for mountaineering activities.

Minor increases in employment in Talkeetna (between two to five seasonal jobs) would be likely as the National Park Service registered and managed overnight use for backcountry hiking, mountaineering, and camping.

Winter Season

Snowmachine use in the park additions and preserve would likely change in character and possibly decline slightly or substantially under Alternative 3, depending on how the corridor-based opportunities for access are received and utilized. Some types of existing snowmachine users would go to other destinations in the immediate vicinity, the region, and the state, and there could be a slight reduction in overall numbers passing through Denali area communities. This could result in a slight reduction in profits to businesses currently serving these users (lodges, hotels, restaurants, gas stations, and retail businesses), which also could be substituted for different types of park users.

The benefits to retail activity and profits, employment, and income from other winter uses, such as skiing and dog mushing, would gradually increase because of park management to protect the quality of these experiences and provide for the growing numbers of users. There would be gradually but steadily increasing income in area communities throughout the life of the plan. These benefits would be attributable to the increasing numbers of winter visitors and the likelihood of visitors spending more time in the park area, both of which can be expected if the variety and quality of recreational opportunities increase.

Population and Housing Impacts

Summer Season

The overall increasing recreational use and associated employment over the next several years in which the plan would be in effect would likely lead to some level of seasonal influx of people to provide the needed retail services, such as lodging, restaurants, gas stations, and retail stores. Potential increases in the recreational use levels and local seasonal population would likely result in the need for additional community public support services and facilities over the next several years. However, increases would be gradual and most visitor use would be related to activities in the frontcountry of the park throughout the life of the plan. Most impacts to population and housing during the summer season would result from actions described under the cumulative impacts section.

Winter Season

The steady increases in winter recreational uses in the park and preserve would result in steady increases in employment opportunities, income, and population in communities near the park throughout the life of the plan. There would be a continued steady increase in demand for emergency services, such as responses to incidents involving injuries and the need for search and rescue. This would affect emergency service providers in area communities for the next several years by requiring slight increases in their capacity.

Other Economic Values

While providing for expanded opportunities for wilderness recreation, Alternative 3 also emphasizes protecting the wilderness character of Denali National Park and Preserve over the long term. There would be similar protection of other economic values such as the value of ecosystem services provided by the park. Ecosystem services values accrue from an undisturbed, expansive subarctic ecosystem, so the park and preserve would have higher value with the managed recreational types and use levels under Alternative 3 that prevent or minimize human impacts on the landscape.

Based on the above descriptions of impacts to the area economy, population and housing, and other economic values, overall impacts to economic values of the park and preserve would be minor over the life of the plan.

Quality of Life

The quality of life in the Denali region would continue to be similar to existing conditions in terms of the opportunity to lead a rural lifestyle, availability of schools, libraries, and other basic community amenities, and personal safety (particularly a low incidence of crime). This would occur because summer and winter backcountry recreational uses would increase slowly, with little change in population and community structure. Area residents would continue to enjoy the rural and wilderness nature of their lifestyles.

Existence and Use Values

Actions proposed under Alternative 3 would protect both existence values and the types of recreational use values sought by visitors who desire extended experiences in remote locations. This would correspond with a high level of resource protection because of visitor capacity limits in the park additions and preserve. Existence values would increase eventually if the pristine condition of the park became a more rare and highly valued commodity. Use values for wilderness recreation in a remote setting, including motorized uses, would increase throughout the life of the plan.

Cumulative Impacts

The steady increase in recreational uses up to visitor capacity limits under Alternative 3 would be a minor contributor to increases in overall economic activity, development, and employment in the Denali region. As stated in the Assumptions section at the beginning of the Environmental Consequences chapter, the NPS expects an average annual increase of about 2% in overall visitation, including backcountry use, to Denali National Park and Preserve in the reasonably foreseeable future. Regional recreational uses would continue to increase, and at popular destinations outside the park boundary, the increasing levels of use could be significant. This would result in increased economic activity and employment. Development would likely continue along the Petersville Road, in Trapper Creek and Talkeetna, in the Healy area, and on private inholdings and Native allotments resulting in an increased need for housing and public services, as well as an increased loss in the current rural to wilderness quality of life in these areas. As a result, there would be moderate cumulative impacts from increased tourism and economic activity, employment, and population levels in communities and private lands near Denali National Park and Preserve and along the George Parks Highway, with backcountry uses under Alternative 3 a minor contributor.

Conclusion

Because of steady increases in a wide variety of recreational uses throughout the park and preserve, Alternative 3 would result in minor increases in income for many existing businesses over the next several years. There would be potential opportunities for new businesses to be initiated because of anticipated increases in recreational use levels in the park. These changes would also lead to increased employment opportunities and income levels, commensurate with the levels of increases of recreational use, for concessioners and other recreation-oriented businesses near Denali National Park and Preserve. The contributions of Alternative 3 to increased economic activity in the park vicinity would result in minor increases in population and the need for additional housing and public services. Overall impacts to economic values of the park and preserve would be minor over the life of the plan.

The existing rural quality of life in communities near the park and preserve could be expected to continue. Existence values would be protected and could increase eventually, as would use values for most activities. A moderate increase in the value of ecosystem

services possibly contributed by Denali National Park and Preserve could be expected throughout the life of the plan. Overall impacts on social and economic values from the management actions under Alternative 3 would be minor.

ALTERNATIVE 4 (PREFERRED ALTERNATIVE)

Economic Impacts

Summer Season

Under Alternative 4 scenic air tour and air taxi operators would have a variety of options for reducing aircraft noise, only one of which would be rerouting tours to avoid sensitive areas in the park and preserve. Air tour companies could expect continued increases in visitor demand and continued growth in business income throughout the life of the plan.

Management actions proposed as part of Alternative 4 would allow for scenic tour airplane landings throughout much of the south additions between the Kahiltna and Eldridge Glaciers (including the Eldridge and Pika Glaciers when climbers are not present). Based on data from 1999 through 2004, only two scenic air tour landings took place outside of this area. Businesses providing scenic flights could therefore be expected to experience steady growth in income from this activity during the near future and throughout the 20-year life of the plan. The high quality of the scenic air tour experience would result in high demand for the activity throughout the life of the plan. Examples of benefits to scenic air tour operators include decreasing advertising costs as “word of mouth” becomes adequate to market the activity and the competitive advantages realized by providers of quality scenic air tours over Denali as compared to operators elsewhere in the region.

Economic benefits—specifically for business operators serving backcountry users—from other summer backcountry activities such as hiking, camping, and mountaineering, would continue under Alternative 4. Steady increases in business could be expected over the next 20 years commensurate with increased numbers of visitors. Visitor capacity determinations and management action to protect the overall quality of the wilderness experience would benefit visitors participating in all activities; therefore, continued growth would be likely. Providers of services to these users would benefit from steadily increasing business for the life of the plan. Economic benefits to area communities from these types of park uses would tend to increase eventually because of the quality of the experience and the increasing numbers of users. A higher level of benefit would be likely in Talkeetna, a primary staging area for mountaineering activities.

Winter Season

Snowmachine use in the park additions and preserve would increase moderately under Alternative 4, especially in the Bull River Unit southwest of Cantwell and along the upper and lower Tokositna River. There would be a steady increase in overall numbers passing through Denali area communities. Businesses serving these users (lodges, hotels,

restaurants, gas stations, and retail businesses) in the Denali area, especially at popular destinations such as Cantwell and Trapper Creek, would benefit from increased income throughout the life of the plan.

The benefits to retail activity and profits, employment, and income from other winter uses, such as skiing and dog mushing, would steadily increase throughout the life of the plan. Alternative 4 includes provisions to protect the quality of these experiences for growing numbers of users in the entrance area and for operating a visitor contact center south of Cantwell that could help in encouraging and directing this type of use. Benefits would be attributable to the increasing numbers of winter visitors and the likelihood of visitors spending more time in the park area, both of which can be expected if the variety and quality of recreational opportunities increase.

Population and Housing Impacts

Summer Season

The overall increasing recreational use and associated employment over the next several years in which the plan would be in effect would likely lead to some level of seasonal influx of people to provide the needed retail services, such as lodging, restaurants, gas stations, and retail stores. Increases in the recreational use levels and local seasonal population would likely result in the need for additional community public support services and facilities over the next several years. These impacts would increase eventually and would be attributable to increasing backcountry visitor use, as well as growth in overall park visitation.

Winter Season

The steady increases in winter recreational uses in the park and preserve would result in similar increases in employment opportunities, income, and population in communities near the park throughout the life of the plan. There would be a continued steady increase in demand for emergency services, such as responses to incidents involving injuries and the need for search and rescue. This would affect emergency service providers in area communities for the next several years by requiring continued increases in their capacity.

Other Economic Values

While providing for expanded opportunities for wilderness recreation, Alternative 4 also emphasizes protecting the wilderness character of Denali National Park and Preserve over the long term. There would be similar protection of other economic values such as the value of ecosystem services provided by the park. Ecosystem services values accrue from an undisturbed, expansive subarctic ecosystem, so the park and preserve would have higher value with the managed recreational types and use levels under Alternative 4 that prevent or minimize human impacts on the landscape.

Based on the above descriptions of impacts to the area economy, population and housing, and other economic values, overall impacts to economic values of the park and preserve

would be minor in the short term (next several years), but moderate over the life of the plan.

Quality of Life

Summer Season

Increasing numbers of recreational users in the backcountry of Denali over the next several years would likely result in corresponding increases in traffic, demands for parking, and the generally higher level of human activity in gateway communities. Long-term effects could include increased population levels from the influx of people from elsewhere in Alaska and the United States, employment of non-local residents, and development of new businesses by non-local residents. This could reduce the overall rural quality of life for some area residents.

Winter Season

Minor changes are likely to occur in the quality of life for permanent residents near the park. Increased use of snowmachines in the area and the presence of increasing numbers of visitors from other areas could result in increased noise levels for local residents and current users, as well as signs of greater human presence from snowmachine tracks. This would likely result in a minor reduction in the rural and wilderness quality of life currently experienced by area residents over the life of the plan. It would also result in a slight decrease in the overall quality of the remote lifestyle valued by owners of second homes and recreational properties.

Another impact of expanding winter use would be increasing traffic in local communities, especially along the George Parks Highway and the Petersville Road. Residents of Cantwell, for example, have reported safety concerns with the increasing traffic along the Parks Highway through their community.

Existence and Use Values

Actions proposed under Alternative 4 would protect both existence values and the types of recreational use values sought by visitors who desire extended experiences in remote locations. This would correspond with a high level of resource protection because of visitor capacity limits in the park additions and preserve. Existence values could increase eventually if the pristine condition of the park became a more rare and highly valued commodity. Use values for wilderness recreation in a remote setting, including motorized uses such as snowmachine touring, would increase throughout the life of the plan.

Cumulative Impacts

The steady increase in recreational uses up to visitor capacity limits under Alternative 4 would be a moderate contributor to increases in overall economic activity, development, and employment in the Denali region. As stated in the Assumptions section at the beginning of the Environmental Consequences chapter, the NPS expects an average

annual increase of about 2% in overall visitation, including backcountry use, to Denali National Park and Preserve in the reasonably foreseeable future. Regional recreational uses would continue to increase, possibly at a faster rate than park visitor use; and at popular destinations outside the park boundary, the increasing levels of use could be significant. This would result in increased economic activity and employment. Development would likely continue along the Petersville Road, in Trapper Creek and Talkeetna, in the Healy area and on private inholdings and Native allotments, resulting in an increased need for housing and public services, as well as a greater loss in the current rural to wilderness quality of life in these areas. As a result, with backcountry uses under Alternative 4 a moderate contributor, there would be moderate cumulative impacts from increased tourism and economic activity, employment, and population levels in communities and private lands near Denali National Park and Preserve and along the George Parks Highway.

Conclusion

Because of steady increases in a wide variety of recreational uses throughout the park and preserve, Alternative 4 would result in moderate increases in income for many existing businesses throughout the life of the plan. There would be increasing opportunities for new businesses to be initiated as a result of anticipated growth in recreational use levels in the park. These changes would also lead to increased employment opportunities and income levels, commensurate with the levels of increases of recreational use, for concessioners and other recreation-oriented businesses near Denali National Park and Preserve. The increase in economic activity would result in minor increases in population and the need for additional housing and public services.

Minor impacts to the rural quality of life in communities near the park and preserve could be expected over the life span of the plan. Existence values would be protected and could increase eventually, as would use values for most activities. A moderate increase in the value of ecosystem services possibly contributed by Denali National Park and Preserve could be expected throughout the life of the plan. Overall impacts on social and economic values from the management actions under Alternative 4 would be minor over the short term (next several years) and moderate over the life of the plan.

ALTERNATIVE 5

Economic Impacts

Summer Season

Application of management areas under Alternative 5 allows for considerable growth in levels of use and access to much of the park and preserve, so there would be limited restrictions on airplane landings and overflights. This would result in continued increases in business opportunities for air taxi and scenic air tour operators in the short term. Those increases would likely result in increased employment opportunities to operate and

maintain additional airplanes and increases in purchases of aviation fuel, parts, and other materials for operation. This would result in continued growth in business income in communities in which air taxi and scenic air tour operations are based, such as Talkeetna and the Healy-McKinley Village area, over the next several years. Air taxi and scenic air tour operations would continue to be a major part of the overall business climate in those communities, especially Talkeetna.

In the long term, managing the growth in numbers of commercial airplane landings in the park and preserve to protect desired conditions, including natural soundscapes, would allow for the beneficial impacts to air taxi and scenic air tour operators described above to continue, since it would allow for growth in the businesses and would also guarantee the quality of the visitor experience. The high quality of the scenic air tour experience would result in high demand for the activity throughout the life of the plan.

Economic benefits—specifically for business operators serving backcountry users—from other summer backcountry activities such as hiking, camping, and mountaineering, would continue under Alternative 5. Steady increases in business could be expected over the next 20 years commensurate with increased numbers of visitors. Plan provisions to manage the growth of these activities in the park additions and preserve would allow for continued economic benefits to providers, since the quality of the experience would be protected as numbers of users increased. Economic benefits to area communities from these types of park uses would continue to increase, especially in Talkeetna, a primary staging area for mountaineering activities.

Winter Season

Snowmachine use would increase significantly in portions of the north additions closest to Healy and Kantishna and in much of the south additions, especially in the lower elevations such as along major rivers, under Alternative 5. The combination of the management zoning under Alternative 5 and proposed facilities such as a visitor contact station south of Cantwell would likely bring more users to the areas mentioned above. This increased use would create employment opportunities and contribute to higher income levels in the winter, when tourism-related economic activity is otherwise low near the park. Businesses in the park area, especially Healy, Cantwell, and Trapper Creek, would continue to benefit directly since providers of these services would continue to be located there. Economic benefits such as employment and income would continue to increase steadily for lodges, hotels, restaurants, gas stations, and retail businesses. Communities along the highway and near the park would benefit from at least a portion of the up to \$583 spent in Alaska annually by current residents and \$303 spent per day in Alaska by nonresidents estimated by Fletcher, et al. (2000). In addition, the state economy, particularly those elements related directly to providing snowmachine goods and services, could benefit from the sale of additional snowmachines, accessories, insurance, and other sales if increased access to the park encourages residents to purchase more machines to take advantage of this opportunity. Benefits could be expected to increase during the first several years of plan implementation, after which capacity levels would be reached and additional use would tend to spread out to other lands in the region.

The benefits to retail activity and profits, employment, and income from other winter uses, such as skiing and dog mushing, would steadily increase. Alternative 5 includes provisions to protect the quality of these experiences as well as specific actions to provide for winter use, such as plowing the park road to Savage all year long and operating a visitor contact center south of Cantwell. Because of the variety of provisions in the plan to increase these visitor uses, economic benefits would be likely in nearby communities such as Healy, Cantwell, Trapper Creek, and Talkeetna throughout the life of the plan, resulting in overall moderate economic benefits.

Population and Housing Impacts

Summer Season

The overall increasing recreational use and associated employment for the next several years in the life of the plan would likely lead to a moderate seasonal influx of people to provide the needed retail services, such as lodging, restaurants, gas stations, and retail stores. Moderate to major increases in recreational use levels and the local seasonal population would likely result in the need for additional community public support services and facilities over the next several years. These impacts would increase eventually and would be attributable to growing backcountry use, in addition to frontcountry use. Overall impacts from backcountry use would be most noticeable in the later years in which the plan is in effect, as new backcountry destinations develop throughout the park additions and preserve, in turn affecting other communities in the region beyond existing “gateway” communities. For example, small settlements near the western parts of the park and preserve could develop into staging areas for backcountry recreation.

Winter Season

The steady increases in winter recreational uses in the park and preserve would result in increases in employment opportunities, income, and population in communities near the park throughout the life of the plan. There would be a related increase in demand for emergency services, such as responses to incidents involving injuries and the need for search and rescue. This would affect emergency service providers in area communities as they would have to substantially increase winter response capability over the next 20 years.

Other Economic Values

Alternative 5 emphasizes providing for expanded opportunities for wilderness recreation in Denali National Park and Preserve over the long term, with management tools set up to protect resources. These mitigation measures would generally protect other economic values such as the value of ecosystem services provided by the park. Ecosystem services values accrue from an undisturbed, expansive subarctic ecosystem, so the park and preserve would have higher value provided management tools are affected under Alternative 5 to prevent or minimize human impacts on the landscape.

Based on the above descriptions of impacts to the area economy, population and housing, and other economic values, overall impacts to economic values of the park and preserve would be moderate over the life of the plan.

Quality of Life

Summer Season

Increasing numbers of recreational users in the backcountry of Denali for the next several years would likely result in corresponding increases in traffic, demands for parking, and general level of human activity in gateway communities. Long-term effects could include increased population levels from the influx of people from elsewhere in Alaska and the United States, employment of non-local residents, and development of new businesses by non-local residents. This could reduce the overall rural quality of life for some area residents.

Winter Season

Moderate changes are likely to occur in the quality of life for permanent residents near the park, and the impacts could be substantial in some communities, such as Cantwell and Trapper Creek, where growth to date has been slower than in other communities, such as Healy and Talkeetna. Increased use of snowmachines in the area and the increasing numbers of visitors from other areas would result in greater noise levels for local residents and current users, as well as signs of greater human presence overall. In the communities most affected, such as Cantwell and Trapper Creek, this would likely result in noticeable changes to the rural and wilderness quality of life currently experienced by residents, with similar effects in other communities throughout the life of the plan. It would also result in a noticeable decrease in the overall quality of the remote lifestyle valued by owners of second homes or recreational properties.

Another impact of expanding winter use would be increasing traffic in local communities, especially along the George Parks Highway and the Petersville Road. Residents of Cantwell, for example, have reported safety concerns with the increasing traffic along the Parks Highway through their community.

Existence and Use Values

Actions proposed under Alternative 5 would result in increased recreational use values over the short term with some decrease in the long term because of relatively heavy use at popular destinations. Existence values could decrease slightly over the long term because of higher levels of use in major portions of the park additions and preserve, such as those areas designated as Management Area A, (18% of the total area) where encounter rates would be higher and impacts more likely to be noticed.

Cumulative Impacts

The steady increase in recreational uses up to visitor capacity limits under Alternative 5 would be a moderate contributor to increases in overall economic activity, development,

and employment in the Denali region. As stated in the Assumptions section at the beginning of the Environmental Consequences chapter, the NPS expects an average annual increase of about 2% in overall visitation, including backcountry use, to Denali National Park and Preserve in the reasonably foreseeable future. Regional recreational uses would continue to increase, most likely at a similar rate as backcountry use inside the park and preserve. At popular destinations outside the park boundary, the increasing levels of use could be significant, resulting in greater economic activity and employment. Development would likely continue along the Petersville Road, in Trapper Creek and Talkeetna, in the Healy area, and on private inholdings and Native allotments, resulting in an increased need for housing and public services, as well as a noticeable loss in the current rural to wilderness quality of life in those areas. As a result, there would be moderate cumulative impacts from increased tourism and economic activity, employment, and population levels in communities and private lands near Denali National Park and Preserve and along the George Parks Highway, with backcountry uses under Alternative 5 a significant contributor.

Conclusion

Because of continued increases in a wide variety of recreational uses throughout the park and preserve, Alternative 5 would result in moderate increases in income for many existing businesses throughout the life of the plan and major increases in some cases. There would be numerous opportunities for starting new businesses as a result of anticipated growth in recreational use levels in the park. These changes would also lead to increased employment opportunities and income levels, commensurate with the levels of increased recreational use, for concessioners and other recreation-oriented businesses near Denali National Park and Preserve. The increase in economic activity would result in moderate increases in population and the need for additional housing and public services.

Moderate impacts to the rural quality of life in communities near the park and preserve could be expected over the life of the plan. There would be a mix of minor positive and negative effects on existence values over the life of the plan, with a slight increase in the Old Park and a slight decrease in the park additions and preserve areas. Use values would tend to increase in the short term and decrease slightly over the next 20 years. A minor increase in the value of ecosystem services possibly contributed by Denali National Park and Preserve could be expected throughout the life of the plan. Overall impacts on social and economic values from the management actions under Alternative 5 would be moderate over the life of the plan.

RECREATIONAL OPPORTUNITY & VISITOR SAFETY

The actions presented in the alternatives could affect the type, amount, and diversity of recreational opportunities in the Denali backcountry and the Denali region, and could also affect visitor safety. “Recreational opportunities” include all the potential types of recreation that visitors might engage in while within the boundaries of Denali National Park and Preserve, but do not include subsistence activities.

METHODOLOGY

Recreational Opportunity

Recreational opportunities are defined by examining the management prescriptions under each alternative, including the following:

- The type of experience provided for through the allocation of management areas and accompanying standards;
- The type of access that is possible;
- The extent of facilities and services provided.

The opportunities are considered in light of the park’s legislative purposes. For the entire park and preserve, the relevant purposes include “preserve wilderness resource values and related recreational opportunities such as hiking, canoeing, fishing, and sport hunting.” For the park additions and preserve, ANILCA 202(3)(a) specifies as a purpose to “provide continued opportunities, including reasonable access, for mountain climbing, mountaineering, and other wilderness recreational activities.” The Old Park is a legislatively designated wilderness area, so its recreational purposes include those indicated by the Wilderness Act as discussed in Chapter 1.

A useful framework for examining recreational opportunities at Denali is provided by the authors of *Wilderness Management* (Hendee and Dawson, 2002). They characterize various activities in wilderness areas by the degree to which the activities are “wilderness dependent,” identifying three categories that apply to recreational activities. They are presented here in increasing order of wilderness dependence:

- 1) Recreational activities that take place outdoors but that do not require wilderness conditions (for example, naturalness and solitude), such as playing catch or a competitive track meet.
- 2) Recreational activities that are enhanced by a wilderness setting but do not require it, such as fishing or observing wildlife.
- 3) Recreational activities that depend on wilderness conditions, such as experiencing solitude and isolation, observing natural ecological processes, or challenging oneself with wilderness travel

In the Denali backcountry, activities that do not require wilderness conditions include such activities as racing or high-marking with snowmachines, which would fall under the first category of wilderness dependence; that is, not dependent at all and not appropriate at Denali given the park's statutory guidance. Sightseeing for the purpose primarily of witnessing scenic vistas or wildlife falls in the second category; scenic air tours are an example. These activities are appropriate in Denali's backcountry because the wilderness setting enhances them, but they do not require wilderness. The third category comprises those activities that are most consistent with Denali's statutory guidance, and are the most wilderness-dependent.

Visitor Safety

Visitor safety is also a concern for the recreational experience at Denali. Chapter 3 provides details of past successes the National Park Service has had in addressing visitor safety issues, although additional ones are possible as visitor use increases. For example, in some locations, particularly on glaciers where there are high levels of visitation, drinking water quality could be affected primarily through biological hazards associated with human waste, and unburned vehicle fuel. The severity and causes of recreation-related water pollution problems are poorly known, although health hazards due to fecal contamination have been identified as a potential concern (Temple et al. 1982; Herman and Williams 1987; Cole et al. 1987). Inadequate disposal of human waste has been implicated in the spread of water-borne intestinal parasites (*Giardia* spp.), even in watersheds that receive little recreational use (Suk et al. 1987).

Impact Thresholds

- Negligible:** There would be little or no change in recreational opportunities or visitor safety.
- Minor:** There would be a change in recreational opportunities or visitor safety, however it would affect relatively few visitors, or would not affect any wilderness-dependent recreational activities.
- Moderate:** There would be substantial changes in recreational opportunities or visitor safety, however these changes would not affect the majority of visitors in a wilderness-dependent user group.
- Major:** There would be substantial changes in wilderness-dependent recreational activities or visitor safety that would affect opportunities for the majority of one or more user groups.
- Impairment:** Unique opportunities for wilderness-dependent recreational activities would cease to be available at Denali. Uniqueness refers only to uniqueness within Denali National Park and Preserve, and is determined

by such characteristics as the type of activity, landscape setting, and ease of access.

ALTERNATIVE 1 (NO ACTION)

Recreational Opportunity

This alternative would have a major adverse impact on recreational opportunities because opportunities for wilderness-dependent recreation would decline. There would be no impact on visitor safety.

Under this alternative, there would be no new management areas or accompanying standards, so no way of sorting out user conflicts or protecting wilderness-dependent activities. There would be no part of the park and preserve backcountry specifically designated to accommodate visitors who require facilities or services, although these might evolve in an *ad hoc*, unplanned fashion much as scenic air tours have evolved to the present. Access modes such as horses and bicycles that could potentially damage park resources would be addressed on an *ad hoc* basis. The Old Park, about 35% of the park and preserve backcountry, would preserve an experience similar to that presently available along the park road with opportunities for dispersed exploration and few encounters with other parties, but noise from scenic air tour overflights would continue to increase. There would be no area of the park that would preserve the experience of visitors who do not wish to encounter any other people during their exploration, although some areas in the northwest part of the park and preserve might incidentally retain that characteristic.

Summer recreational access in the Old Park would continue to require travel by foot from the park road, roads outside of park boundaries, or personal (non-commercial) airplane. Summer access in the remainder of the park and preserve would be facilitated by ongoing opportunities to use motorboats and airplanes, including commercial air taxis, to reach remote areas at established landing areas, glaciers, or lakes. No area would preserve places that would require lengthy overland travel to reach.

Winter recreational access would be facilitated by ongoing opportunities to use ski-equipped airplanes parkwide and commercial air taxis in the park additions and preserve to reach remote areas. The use of snowmachines for “traditional activities” would continue to be authorized and would continue to grow. However, if in the future the term “traditional activities” were defined to exclude recreational use, such recreational use would be prohibited by existing NPS regulations.

Ongoing, unrestricted motorized access would reduce opportunities for non-motorized, wilderness-dependent visitors. This would be particularly true in accessible areas of the park additions on the south side of the Alaska Range. During climbing season (April to July), the popular, accessible climbing and mountaineering areas are becoming less

desirable because of aircraft noise primarily from scenic air tours. During winter months, the most accessible areas with abundant snow are in the Broad Pass and Tokositna River areas, which are the most popular areas for snowmachine access. Anecdotal evidence from public comment indicates that skiers and other non-motorized winter recreationists have already been displaced from these areas by heavy snowmachine use. There would be no new opportunities created for those users to return to these areas of the park, while the accessible parts of the Old Park north of the Alaska Range – where snowmachine use is not allowed – often has poor snow conditions. Areas that are closed to snowmachines in the Old Park south of the range are relatively inaccessible except at Windy Creek.

The variety of guided backcountry activities would remain the same as at present as described in chapter 3 in the Visitor Use section. Incidental business permits could continue to be awarded in the park additions and preserve (excluding the area between the Toklat and McKinley Rivers) for air taxi operator, mountaineering, guided day-hiking, guided backpacking, and winter backcountry trips. Additional guided activities could be allowed on an *ad hoc* basis if they meet the “necessary and appropriate” criteria. Guided sport hunting opportunities would continue to be rare because the hunting guide areas are insufficiently large to accommodate regular activity.

There would be no new facilities under this alternative, so the backcountry of the park and preserve would remain suitable primarily for those comfortable with cross-country backcountry travel.

Lack of access access to the 17(b) easement connecting Cantwell and the park boundary in the Windy Creek area would result in the loss of opportunities for winter and summer visitors to access this very scenic corner of the park if private landowners stop allowing the public to cross their properties. Although informal arrangements have allowed some access to continue, the community is sensitive to the number of non-local visitors parking on and crossing private property. It is assumed that at some point access to the public would be severely limited. Because this is one of the few parts of the park and preserve that can be easily reached from the road system without traveling the park road, the loss of this entry point is important for future park visitors, including all categories of recreational users.

Visitor Safety

There would be no limit established for the number of climbers on Mount McKinley. As a result, numbers could increase to more than 1,500, which would exceed the educational and rescue capabilities of park mountaineering staff as currently configured. However, it is not expected that climber numbers would reach this level during the life of the plan.

There would be no new registration requirements under this alternative. As a result, there would be no associated opportunity to provide education to visitors related to common backcountry hazards such as bears, rivers, glaciers, avalanches, and potentially hazardous conflicts with other visitors (e.g., people camping too close to landing areas on glaciers).

This particularly impacts day-hikers in the Old Park, overnight users on glaciers on the south side of the Alaska Range other than McKinley and Foraker, and winter day-users on the south side of the Alaska Range because these are the visitors who missed by present systems. The numbers of visitors affected are generally unknown, but there are about 500 mountaineers who presently register voluntarily.

Continued increases in climbers attempting Mount McKinley and neighboring peaks would lead to an increase in unconfined human waste on the West Buttress of Mount McKinley, Kahiltna Base Camp, Pika, Ruth, and Eldridge Glaciers. Although most human waste deposition typically is on ice, snow, or rocky soils well away from surface or groundwater movement, the long-term impacts of this practice are unknown. Contamination of water resources could cause severe health problems for climbers and other visitors in areas drained by these glaciers and could persist for the duration of the plan.

Cumulative Impacts

The National Park Service has generally allowed the growth of backcountry recreational activities and encouraged it by authorizing guided activities such as dog sled tours, scenic air tour landings and air taxi services, guided day-hiking, and guided mountaineering. Some activities have been constrained to protect park resources by prohibiting snowmachine access to the Old Park in 2000 and imposing quotas on overnight backcountry use in 1976, however these actions have served to preserve the diversity of recreational opportunity at Denali, particularly for wilderness-dependent activities. Meanwhile, increasing snowmachine access to the southern park additions and the expansion of aircraft overflights on the south side of the Alaska Range and the eastern portion of the Old Park associated with increasing scenic air tour traffic have had an adverse impact on wilderness-dependent activities.

The actions in this alternative combined with these other actions would have major adverse impacts on recreational opportunities at Denali. The actions under this alternative would fail to stop the erosion of wilderness-dependent opportunities, but are not as important a contributor as the expansion of scenic air tours and snowmachine access.

Conclusion

Although the amount of visitor use would increase under this alternative, the types of recreational opportunities would shrink, particularly for wilderness-dependent recreational activities sought by non-motorized users in accessible areas. This would cause major adverse impacts to recreational opportunities. There would be moderate adverse impacts to visitor safety from declining drinking water quality in some glaciated areas.

The level of impacts on recreational opportunities anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the integrity of the park.

ALTERNATIVE 2

Recreational Opportunity

This alternative would have a moderate adverse impact on recreational opportunities because it would severely constrain opportunities for visitors seeking appropriate activities that might not be wilderness-dependent, but would also constrain options for some users seeking wilderness-dependent activities. There would be an improvement in visitor safety because of better backcountry education associated with registration for some common activities.

The application of management areas and accompanying standards throughout the park and preserve would emphasize wilderness-dependent activities and provide little opportunity for those whose activities are not wilderness-dependent.

There would be few opportunities in the Denali backcountry to accommodate those visitors that need additional facilities or assistance with access to wilderness recreational activities, although some limited commercial services would still be available and a level of scenic air tour landings provided at two Portals. About 28% of the park and preserve backcountry would be available for those visitors seeking an experience similar to what is presently available along the Old Park Road corridor in terms of the amount of crowding and signs of human presence; another 8% would preserve an opportunity to have a remote experience at Denali. About 57% would seek to preserve the experience of visitors who do not wish to encounter any other people during their exploration. In the area between the Kahiltna and Eldridge Glaciers, management area designations would protect all of it – about 8% of the park and preserve – as high use but medium noise, providing an area primarily for the climbing and mountaineering experience.

The standards proposed in the plan may reduce some future opportunities for recreation involving some forms of access. For example, standards that limit social trail development would make it difficult for the National Park Service to allow significant backcountry access by bicycle or pack animal, because either would quickly damage vegetation and lead to social trail development in most parts of the national park and preserve, excepting harder surfaces such as gravel river bars. The standard could lead to prohibiting those activities in the future if such damage becomes likely.

Options for recreational access in summer and winter would be limited under this alternative. No ground-based motorized access by boat or snowmachine would be allowed, and airplane landings would only be allowed at eight designated landing areas (Portals), so most of the park could only be reached by lengthy travel by foot. This action

would limit recreational opportunities in areas of the park remote from Portals, the park road, or the Parks Highway to those individuals capable of mounting extended overland expeditions.

The reduction of motorized access in this alternative would restore and protect opportunities for wilderness-dependent, non-motorized recreation in areas that are accessible from Portals or roads, such as the mountaineering areas between the Kahiltna and Eldridge Glaciers during the climbing season (April to July) the Broad Pass/Dunkle Hills area and the Tokositna River valley during winter months.

The opportunities for guided backcountry activities would be limited to current conditions or reduced under this alternative. There would be an extensive area where guiding is not allowed that includes the Old Park unit OP2 and all of the park additions and preserve west of the Toklat River and north of the Alaska Range, providing a large area that requires visitors to be entirely self-reliant. This prescription would not affect existing opportunities except to eliminate the guided dog tours from Lake Minchumina. The only guided activities that could take place in the Old Park management area OP1 would be dog mushing and guided mountaineering. The amount of guided day-hiking in the Kantishna Hills would be frozen at existing levels. Guided sport hunting opportunities would continue to be rare because the hunting guide areas are insufficiently large to accommodate regular, wilderness-enhanced activity.

Scenic air tour landings would be constrained to only two locations and limited to the number of landings in 2001 (1,900 in the Ruth Amphitheater and 200 at Kahiltna Base Camp), so landings at other locations that sometimes have a hundreds of landings a season (such as the Pika and Eldridge Glaciers) would no longer be allowed, eliminating a small portion of existing appropriate, but not wilderness-dependent, recreational activities.

In addition, educational programs would be phased out of the Old Park, although opportunities for such programs would continue to be available throughout the park additions and preserve.

There would be no new facilities under this alternative, so the backcountry of the park and preserve would remain suitable primarily for those comfortable with cross-country backcountry travel.

Gaining public access to the 17(b) easement between Cantwell and the park boundary at Windy Creek would benefit recreational opportunities by providing an additional point of access that is road accessible.

Visitor Safety

Experience has demonstrated that the park's mountaineering program can safely accommodate the present number of climbers attempting to climb Mount McKinley, and this alternative would limit climbers to that level.

New registration requirements for overnight camping and day-use would enable better visitor education, enhancing visitor safety through better knowledge of common backcountry hazards such as bears, rivers, glaciers, avalanches, and potentially hazardous conflicts with other visitors (e.g., people camping too close to landing areas on glaciers). Requirements in this alternative would apply to the majority of park backcountry users who do not already register, with the exception of those landing briefly during scenic air tours.

Although most human waste deposition typically is on ice, snow, or rocky soils well away from surface or groundwater movement, the long-term impacts of this practice are unknown. However, limitations on scenic air tour landings and limiting the number of climbers on Mount McKinley to 1,300 per season would keep use levels near current levels. Removal of human waste from the park would be required on the West Buttress Route on Mount McKinley at and above the 14,000 foot camp, and at campsites within one-half mile of air taxi landing locations on glaciers. Registration requirements would allow NPS staff to further educate visitors about proper disposal of human waste. These actions would decrease from current levels the amount of unconfined human waste and the potential for degrading drinking water quality on the West Buttress, Kahiltna Base Camp, Pika, Ruth, and Eldridge Glaciers. Remaining water quality impacts would be negligible.

Cumulative Impacts

The National Park Service has generally allowed the growth of backcountry recreational activities and encouraged it by authorizing guided activities such as dog sled tours, scenic air tour landings and air taxi services, guided day-hiking, and guided mountaineering. Some activities have been constrained to protect park resources by prohibiting snowmachine access to the Old Park in 2000 and imposing quotas on overnight backcountry use in 1976; however, these actions have served to preserve the diversity of recreational opportunity at Denali, particularly for wilderness-dependent activities. Meanwhile, increasing snowmachine access to the southern park additions and the expansion of aircraft overflights on the south side of the Alaska Range and the eastern portion of the Old Park associated with increasing scenic air tour traffic have had an adverse impact on wilderness-dependent activities.

The actions in this alternative would mitigate the adverse impacts of previous actions, but would introduce new adverse impacts by limiting the types of recreational opportunities available. Overall, the actions in this alternative combined with these other actions would have a moderate adverse impact on the recreational opportunities in the Denali backcountry. The actions proposed would be responsible for most of the adverse impact.

Conclusion

This alternative would have a moderate adverse impact on recreational opportunities at Denali. Although it would protect the wilderness-dependent activities that Denali is

legislatively mandated to provide, it would exclude many opportunities for individuals who require assistance with access, facilities, and services over most of the park and preserve and constrain some opportunities even for those seeking wilderness-dependent activities, particularly those not able to mount extended expeditions. Those visitors seeking appropriate but not wilderness-dependent sightseeing activities would have limited options. There would be a moderate benefit to visitor safety because of education associated with required registration for some common activities.

The level of impacts to recreational opportunities anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the integrity of the park.

ALTERNATIVE 3

Recreational Opportunity

This alternative would have a moderate beneficial impact on the recreational opportunities and visitor experience available in the Denali backcountry and the region. The actions proposed would maintain the existing diversity of appropriate and wilderness-dependent activities but would emphasize protection of the wilderness dependent activities, which would have room to grow. There would be an improvement in visitor safety because of better backcountry education associated with registration for some common activities.

The application of management areas and accompanying standards throughout the park and preserve would assure the continuation of a spectrum of recreational opportunity at Denali that would emphasize wilderness-dependent activities.

Approximately 4% of the park and preserve plus areas near the park road would accommodate those visitors that need additional facilities or assistance with access to wilderness recreational activities. About 33% would serve those visitors seeking an experience similar to what is presently available in the Denali Wilderness in terms of the amount of crowding and signs of human presence; another 13% would preserve an opportunity to have a remote experience at Denali. About 44% would seek to preserve the experience of visitors who do not wish to encounter any other people during their exploration.

In the busy, accessible area between the Kahiltna and Eldridge Glaciers, management area designations would protect 11% as high use but low noise, providing an area where the climbing and mountaineering experience could avoid conflicts with other uses, such as scenic air tour traffic. However, the Ruth Amphitheater and Ruth Glacier would continue to have multiple use and opportunities for climbers to have an undisturbed experience would diminish.

The standards proposed in the plan may reduce some future opportunities for recreation involving some forms of access. For example, standards that limit social trail development would make it difficult for the National Park Service to allow significant backcountry access by bicycle or pack animal, because either would quickly damage vegetation and lead to social trail development in most parts of the national park and preserve, excepting harder surfaces such as gravel river bars. The standard could lead to prohibiting those activities in the future if such damage were to become likely.

Summer recreational access in the Old Park would be limited to travel by foot from the park road, roads, or airstrips outside of park boundaries, preserving some areas that require sometimes-lengthy overland travel to reach (about 11% of the park and preserve). Summer access in the remainder of the park and preserve would be facilitated by ongoing opportunities to use motorboats and airplanes, including commercial air taxis, to reach remote areas at established landing areas, glaciers, or lakes.

Winter recreational access would be facilitated by ongoing opportunities to use ski-equipped airplanes, including commercial air taxis, to reach remote areas in the park additions and preserve. Recreational visitors would also have the opportunity to use snowmachines on 135 miles of Corridors to reach remote areas in the park additions and preserve and the Old Park boundary in the Dunkle Hills between Cantwell Creek and the West Fork of the Chulitna.

The level of motorized access could be limited in the future if necessary to achieve management area standards.

The management of motorized access in this alternative would restore and protect opportunities for wilderness-dependent, non-motorized recreation particularly in accessible mountaineering areas between the Kahiltina and Eldridge Glaciers – excluding the Ruth Amphitheater and Glacier – during the climbing season (April to July) and in accessible south side areas such as Broad Pass/Dunkle Hills.

Opportunities for guided backcountry activities would be similar to what is presently available. Some additional limitations would constrain future expansion. Guided day-hiking in the Old Park would be restricted to existing levels and locations. Scenic air tour landings – an appropriate but not wilderness-dependent activity – could continue to expand in volume, but would be limited to locations in the Ruth Amphitheater, Ruth Gorge, and Kahiltina Base Camp. Guided sport hunting opportunities would be enhanced by extending the two current guide areas across the entire southwest preserve, thereby creating larger guide areas that have a more viable opportunity for regular hunts.

There would also be the opportunity to offer additional types of guided activities, but these would be restricted only to the Kantishna Hills and Ruth Glacier areas designated as Management Area A, about 4% of the park and preserve backcountry. In addition to the guided activities, there would be additional opportunities for new and expanded educational programs throughout the park and preserve.

The addition of a formalized trail system in the Kantishna Hills would add the opportunity for visitors to hike in a more traditional format, providing an option for those uncomfortable with cross-country travel. However, the opportunity would be largely limited to those who have the ability to stay overnight at the western end of the park in the backcountry, at a campground, in a private lodge, or in the hostel provided for in the 1997 *Entrance Area and Road Corridor Development Concept Plan*.

Gaining public access to the 17(b) easement between Cantwell and the park boundary at Windy Creek would benefit recreational opportunities by providing an additional point of access that is road accessible.

Visitor Safety

Experience has demonstrated that the park's mountaineering program can safely accommodate the present number of climbers attempting to climb Mount McKinley. NPS mountaineering rangers believe that current levels of education and rescue services could safely accommodate up to 1,500 visitors.

New registration requirements for overnight camping and day-use would enable better visitor education, enhancing visitor safety through better knowledge of common backcountry hazards such as bears, rivers, glaciers, avalanches, and potentially hazardous conflicts with other visitors (e.g., people camping too close to landing areas on glaciers). Requirements in this alternative would apply to the majority of park backcountry users who do not already register with the exception of those landing briefly on scenic air tours.

Continued increases in climbers attempting Mount McKinley and neighboring peaks would lead to an increase in unconfined human waste and the potential for degrading water quality as ice melts on the Kahiltna, Pika, Ruth, and Eldridge Glaciers. Although most human waste deposition typically is on ice, snow, or rocky soils well away from surface or groundwater movement, the long-term impacts of this practice are unknown. Contamination of water resources could cause health problems for climbers and other visitors in areas drained by these glaciers.

In this management scenario, all of the park's popular climbing areas (West Buttress, Kahiltna Base Camp, and the Ruth Glacier) are zoned as Management Area A, C, Portals or Special Use Areas, which allow for higher levels of encounters with people and with evidence of modern human use; however, evidence of human waste should still be low in these areas because NPS staff would continue to educate climbers about waste disposal, conduct regular patrols on the West Buttress, and encourage climbers to use Clean Mountain Cans to dispose of their human waste, which have been shown in the past to reduce waste problems on the West Buttress.

Under this alternative, limiting the number of climbers on Mount McKinley to 1,500 per season would allow use levels to increase by over 15%. Removal of human waste from

the park would be required on the West Buttress Route on Mount McKinley at and above the 14,000 foot camp, and at campsites within one-half mile of air taxi landing locations on glaciers. Registration requirements would allow NPS staff to further educate visitors about proper disposal of human waste in other glaciated areas that receive considerable use. These actions would be expected to mitigate most of the potential negative impacts that increased use, and subsequently increased human waste, could have on drinking water quality and human health in these high use areas. Realistically, not all impacts would be mitigated, and impacts to water quality could persist for several years.

Cumulative Impacts

The National Park Service has generally allowed the growth of backcountry recreational activities and encouraged it by authorizing guided activities such as dog sled tours, scenic air tour landings and air taxi services, guided day-hiking, and guided mountaineering. Some activities have been constrained to protect park resources by prohibiting snowmachine access to the Old Park in 2000 and imposing quotas on overnight backcountry use in 1976, however these actions have served to preserve the diversity of recreational opportunity at Denali, particularly for wilderness-dependent activities. Meanwhile, the increasing snowmachine access to the southern park additions and expansion of aircraft overflights on the south side of the Alaska Range and eastern portion of the Old Park associated with increasing scenic air tour traffic and have had an adverse impact on wilderness-dependent activities.

The actions in this alternative would mitigate the adverse impacts of actions originating outside of NPS control and preserve the diversity of recreational opportunity in the face of further changes in recreation demand. Overall, the actions in this alternative combined with these other actions would have a moderate beneficial impact on the recreational opportunities in the Denali backcountry. The actions proposed would be responsible a substantial portion of the benefit, although the previous efforts to limit overnight use and restrict snowmachine access also play an important role.

Conclusion

This alternative would have a moderate beneficial impact on recreational opportunities at Denali because it would allow for a carefully managed set of appropriate backcountry activities to serve individuals who need more assistance with access, facilities, and services, while still protecting the recreational activities that are dependent upon Denali's wilderness resources and which the NPS is legislatively obligated to provide. There would be opportunity for wilderness-dependent activities to expand in accessible areas. Visitor safety would have a minor benefit from education associated with required registration for some common activities, while adverse impacts to drinking water quality would be minimized.

The level of impacts to recreational opportunities anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the integrity of the park.

ALTERNATIVE 4 (PREFERRED ALTERNATIVE)

Recreational Opportunity

This alternative would have a minor beneficial impact on recreational opportunities at Denali because it would allow for growth in a carefully managed set of appropriate backcountry activities to serve individuals who need more assistance with access, facilities, and services, while still protecting the recreational activities that are dependent upon Denali's wilderness resources and which the NPS is legislatively obligated to provide. Visitor safety would be improved by education associated with required registration for some common activities.

The application of management areas and accompanying standards throughout the park and preserve would assure the continuation of a spectrum of recreational opportunity at Denali, with an emphasis on providing continued opportunities for growth in all kinds of appropriate recreational activities.

Approximately 11% of the park and preserve plus areas along the park road would accommodate those visitors that need additional facilities or assistance with access to wilderness recreational activities. About 29% would serve those visitors seeking an experience similar to what is presently available along in the Denali Wilderness in terms of the amount of crowding and signs of human presence; another 44% would preserve an opportunity to have a remote experience at Denali. About 11% would seek to preserve the experience of visitors who do not wish to encounter any other people during their exploration.

In the busy, accessible area between the Kahiltna and Eldridge Glaciers, management area designations would protect 4% as high use but low noise, providing an area where the climbing and mountaineering experience could avoid conflicts with other uses, such as scenic air tour traffic. However, there would be many popular climbing areas in the Ruth Amphitheater, Kahiltna Glacier, and Tokositna Glacier that would continue to have multiple uses; opportunities for climbers to have an undisturbed experience would diminish.

The standards proposed in the plan may reduce some future opportunities for recreation involving some forms of access. For example, standards that limit social trail development would make it difficult for the National Park Service to allow significant backcountry access by bicycle or pack animal, because either would quickly damage vegetation and lead to social trail development in most parts of the national park and preserve, excepting harder surfaces such as gravel river bars. The standard could lead to prohibiting those activities in the future if such damage were to become likely.

Summer recreational access in the Old Park would require travel by foot from the park road, roads outside of park boundaries, or personal (non-commercial) airplane. Summer access in the remainder of the park and preserve would be facilitated by ongoing

opportunities to use motorboats and airplanes, including commercial air taxis, to reach remote areas at established landing areas, glaciers, or lakes. No area would preserve places that would require lengthy overland travel to reach.

Winter recreational access would be facilitated by ongoing opportunities to use ski-equipped airplanes parkwide and commercial air taxis in the park additions and preserve to reach remote areas. There would be an ongoing opportunity to use snowmachines for traditional activities in the park additions and preserve. If in the future the term “traditional activities” were defined to exclude recreational use, such recreational use would be prohibited by existing NPS regulation. The level of motorized access could be limited in the future if necessary to achieve management area standards.

The management of motorized access in this alternative would protect wilderness-dependent opportunities on the Eldridge Glacier and in Little Switzerland and the Rampart Mountains. To a lesser degree, some opportunities for non-motorized winter use would be protected in the accessible park additions on the south side of the Alaska Range where snow conditions are more reliable, but only in limited areas east of Cantwell Creek.

This alternative would allow the development of more guided opportunities than are presently available at Denali and expansion of some existing activities, although the constraints on these activities would be more carefully defined than at present. Guided day-hiking in the Old Park would be restricted to existing levels and locations; however, more than 20 miles of entrance area trails (some still to be constructed) would be opened to guided hiking. Scenic air tour landings – an appropriate but not wilderness-dependent activity – would be restricted to Management Area A and constrained by natural sound disturbance standards, which would allow some growth but limit some locations where landings presently occur. Guided sport hunting opportunities would be enhanced by extending the two current guide areas across the entire southwest preserve, thereby creating larger guide areas that have a more viable opportunity for regular hunts.

There would also be the opportunity to offer additional types of guided activities, but these would be restricted only to the Kantishna Hills, Dunkle Hills, and southern glaciers area designated as Management Area A, about 11% of the park and preserve backcountry. In addition to the guided activities, there would be additional opportunities for new and expanded educational programs throughout the park and preserve.

The addition of a formalized trail system in the Kantishna Hills would add the opportunity for visitors to hike in a more traditional format, providing an option for those uncomfortable with cross-country travel. However, the opportunity would be largely limited to those who have the ability to stay overnight at the western end of the park in the backcountry, at a campground, in a private lodge, or in the hostel provided for in the 1997 *Entrance Area and Road Corridor Development Concept Plan*. Designated campsites in the Kantishna Hills would also offer a different experience than is presently available which would appeal to some visitors who prefer to reduce uncertainty and difficulty in selecting a backcountry campsite.

The Wildhorse Creek trail would provide an additional trail-hiking opportunity and access option on the south side of the park. The other trails provided for in this alternative largely address resource damage and add little opportunity for backcountry travel.

Gaining public access to the 17(b) easement between Cantwell and the park boundary at Windy Creek would benefit recreational opportunities by providing an additional point of access that is road accessible.

Visitor Safety

Experience has demonstrated that the park's mountaineering program can safely accommodate the present number of climbers attempting to climb Mount McKinley. NPS mountaineering rangers believe that current levels of education and rescue services could safely accommodate up to 1,500 visitors.

It is likely that some overnight camping and winter day-use in the southern park additions would trigger registration requirements in the near future. These requirements would enable better visitor education, enhancing visitor safety through better knowledge of common backcountry hazards such as bears, rivers, glaciers, avalanches, and potentially hazardous conflicts with other visitors (e.g., people camping too close to landing areas on glaciers). These new requirements, if implemented, would apply to a substantial but unknown number of visitors who presently do not register. There are presently about 500 overnight mountaineering users on south side glaciers that voluntarily register.

Continued increases in climbers attempting Mount McKinley and neighboring peaks would lead to an increase in unconfined human waste and the potential for degrading water quality as ice melts on the Kahiltna, Pika, Ruth, and Eldridge Glaciers. Although most human waste deposition typically is on ice, snow, or rocky soils well away from surface or groundwater movement, the long-term impacts of this practice are unknown. Contamination of water resources could cause health problems for climbers and other visitors in areas drained by these glaciers.

In this management scenario, all of the park's popular climbing areas (West Buttress, Kahiltna Base Camp, and the Ruth Glacier) are zoned as Management Area A, C, Portals or Special Use Areas, which allow for higher levels of encounters with people and with evidence of modern human use; however, evidence of human waste should still be low in these areas because NPS staff would continue to educate climbers about waste disposal, conduct regular patrols on the West Buttress, and encourage climbers to use Clean Mountain Cans to dispose of their human waste, which have been shown in the past to reduce waste problems on the West Buttress.

Under this alternative, limiting the number of climbers on Mount McKinley to 1,500 per season would allow use levels to increase by over 15%. Removal of human waste from the park would be required on the West Buttress Route on Mount McKinley at and above

the 14,000 foot camp, and at campsites within one-half mile of air taxi landing locations on glaciers. If new registration requirements are imposed in the popular mountaineering areas, they would allow NPS staff to further educate visitors about proper disposal of human waste in other glaciated areas that receive considerable use. These actions would be expected to mitigate most of the potential negative impacts that increased use, and subsequently increased human waste, could have on drinking water quality and human health in these high use areas. Realistically, not all impacts would be mitigated, and impacts to water quality could persist for several years.

Cumulative Impacts

The National Park Service has generally allowed the growth of backcountry recreational activities and encouraged it by authorizing guided activities such as dog sled tours, scenic air tour landings and air taxi services, guided day-hiking, and guided mountaineering. Some activities have been constrained to protect park resources by prohibiting snowmachine access to the Old Park in 2000 and imposing quotas on overnight backcountry use in 1976. However, these actions have served to preserve the diversity of recreational opportunity at Denali, particularly for wilderness-dependent activities. Meanwhile, increasing snowmachine access to the southern park additions and the expansion of aircraft overflights on the south side of the Alaska Range and the eastern portion of the Old Park associated with increasing scenic air tour traffic have had an adverse impact on wilderness-dependent activities.

The actions in this alternative would mitigate the adverse impacts of actions originating outside of NPS control and preserve the diversity of recreational opportunity in the face of further changes in recreation demand. Overall, the actions in this alternative combined with these other actions would have a minor beneficial impact on the recreational opportunities in the Denali backcountry. The actions proposed would be responsible for a substantial portion of the benefit, although the previous efforts to limit overnight use and restrict snowmachine access also play an important role.

Conclusion

This alternative would have a minor beneficial impact on recreational opportunities at Denali because it would allow for a carefully managed set of appropriate backcountry activities to serve individuals who need more assistance with access, facilities, and services, while still protecting the recreational activities that are dependent upon Denali's wilderness resources and which the NPS is legislatively obligated to provide. However, there would be limited opportunities for some wilderness-dependent activities to expand in accessible areas. Visitor safety would be improved by education associated with required registration for some common activities, while adverse impacts to water quality would be minimized.

The level of impacts to recreational opportunities anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the integrity of the park.

ALTERNATIVE 5

Recreational Opportunity

This alternative would have a moderate adverse impact on recreational opportunities because some wilderness-dependent users groups would be displaced, although not from the entire park and preserve. There would be no impact on visitor safety.

The application of management areas and accompanying standards throughout the park and preserve would lead to a reduction in opportunities to participate in some wilderness recreational activities, particularly extended expeditions in remote locations, but also accessible climbing and mountaineering opportunities that are not adversely affected by scenic air tour traffic.

Approximately 18% of the park and preserve plus areas along the park road would accommodate those visitors that need additional facilities or assistance with access to wilderness recreational activities. About 66% would serve those visitors seeking an experience similar to what is presently available in the Denali Wilderness in terms of the amount of crowding and signs of human presence; another 16% would preserve an opportunity to have a remote experience at Denali. There would be no area of the park that would preserve the experience of visitors who do not wish to encounter any other people during their exploration, although some areas in the northwest part of the park and preserve might incidentally retain that characteristic.

In the busy area between the Kahiltna and Eldridge Glacier, the opportunities for climbing and mountaineering in a wilderness setting would diminish with ongoing increases in scenic air tour traffic. This area is the most important climbing and mountaineering area in the park and preserve because of its accessibility and terrain.

The standards proposed in the plan may reduce some future opportunities for recreation involving some forms of access. For example, standards that limit social trail development would make it difficult for the National Park Service to allow significant backcountry access by bicycle or pack animal, because either would quickly damage vegetation and lead to social trail development in most parts of the national park and preserve, excepting harder surfaces such as gravel river bars. The standard could lead to those activities being prohibited in the future if such damage becomes likely.

Summer recreational access in the Old Park would require travel by foot from the park road, roads outside of park boundaries, or personal (non-commercial) airplane. Summer access in the remainder of the park and preserve would be facilitated by ongoing opportunities to use motorboats and airplanes, including commercial air taxis, to reach remote areas at established landing areas, glaciers, or lakes. No area would preserve areas that would require lengthy overland travel to reach.

Winter recreational access would be facilitated by ongoing opportunities to use ski-equipped airplanes parkwide and commercial air taxis in the park additions and preserve to reach remote areas. There would be the opportunity to use snowmachines for traditional activities in the park additions and preserve. If in the future the term “traditional activities” were defined to exclude recreational use, such recreational use would be prohibited by existing NPS regulation. The level of motorized access could be limited in the future if necessary to achieve management area standards.

The management of motorized access in this alternative would generally not protect opportunities for wilderness-dependent, non-motorized recreation on the south side of the Alaska Range during mountaineering season or during the winter recreation season.

This alternative would allow the development of a greater variety of guided opportunities than are presently available at Denali. Guided day-hiking could expand throughout the Old Park including entrance area trails. Guided overnight backpacking in the Old Park would be an additional opportunity not presently available. Scenic air tour landings could occur on glaciers anywhere east of the Lacuna Glacier in the park additions. Guided sport hunting opportunities would be added in the southern portion of the northwest preserve; however, these opportunities could remain static in the southwest preserve because the division into three guide areas would likely mean that none of them would be large enough to support regular guided hunts.

There would also be the opportunity to offer additional types of guided activities in the Kantishna Hills and in the park additions south of the Alaska Range in the area designated as Management Area A, about 18% of the park and preserve backcountry. In addition to the guided activities, there would be additional opportunities for new and expanded educational programs throughout the park and preserve.

Although this alternative would allow for a greater variety of guided opportunities, it is possible that some existing operators, particularly guided mountaineering concessions utilizing areas other than Mount McKinley, would move their operations to less accessible areas or other Alaska locations because of incompatible uses in the area between the Kahiltna and Eldridge Glaciers.

The addition of a formalized trail system in the Kantishna Hills would add the opportunity for visitors to hike in a more traditional format, providing an option for those uncomfortable with cross-country travel. However, the opportunity would be largely limited to those who have the ability to stay overnight at the western end of the park in the backcountry, at a campground, in a private lodge, or in the hostel provided for in the 1997 *Entrance Area and Road Corridor Development Concept Plan*.

The Wildhorse Creek trail would provide an additional trail-hiking opportunity and access option on the south side of the park. The other trails provided for in this alternative largely address resource damage and add little opportunity for backcountry travel.

Designated campsites in the Kantishna Hills and along the Wildhorse Creek trail would also offer a different experience than is presently available which would appeal to some visitors who prefer to reduce uncertainty and difficulty in selecting a backcountry campsite.

Gaining public access to the 17(b) easement between Cantwell and the park boundary at Windy Creek would benefit recreational opportunities by providing an additional point of access that is road accessible.

Visitor Safety

There would be no limit established for the number of climbers on Mount McKinley, although there would be the possibility of establishing such a limit after five years depending on the results of resource and social carrying capacity studies. As a result, numbers could increase to more than 1,500, which would exceed the educational and rescue capabilities of park mountaineering staff as currently configured. However, it is not expected that climber numbers would reach this level during the life of the plan.

There would be no new registration requirements under this alternative, although they could be imposed in the future if necessary to achieving desired conditions in particular areas of the park or for particular activities. As a result, there would be no associated opportunity to provide education to visitors related to common backcountry hazards such as bears, rivers, glaciers, avalanches, and potentially hazardous conflicts with other visitors (e.g., people camping too close to landing areas on glaciers). This particularly affects day-hikers in the Old Park, overnight users on glaciers on the south side of the Alaska Range, and winter day-users on the south side of the Alaska Range. The numbers of visitors affected are generally unknown, but about 500 mountaineers presently register voluntarily.

Continued increases in climbers attempting Mount McKinley and neighboring peaks would lead to an increase in unconfined human waste and the potential for degrading water quality as ice melts on the Kahiltna, Pika, Ruth, and Eldridge Glaciers. Although most human waste deposition typically is on ice, snow, or rocky soils well away from surface or groundwater movement, the long-term impacts of this practice are unknown. Contamination of water resources could cause health problems for climbers and other visitors in areas drained by these glaciers. Adverse impacts to water quality would persist for several years.

In this management scenario, all of the park's popular climbing areas (West Buttress, Kahiltna Base Camp, Pika, Ruth, and Eldridge Glaciers) are zoned as Management Area A, Portals, or Special Use Areas which allow for higher levels of encounters with people and with evidence of modern human use. There would be no limit on the number of visitors attempting to climb Mount McKinley. There would also be no registration requirements for overnight use. Without those registration requirements, it would be more difficult for NPS staff to educate visitors.

However, management action would be taken if standards in these areas are approached or exceeded. NPS staff would continue to educate climbers as they contact them in the field and at the Talkeetna Ranger Station about waste disposal, conduct regular patrols on the West Buttress, and encourage climbers to use Clean Mountain Cans to dispose of their human waste, which have been shown in the past to reduce waste problems on the West Buttress.

Removal of human waste from the park would be required on the West Buttress Route on Mount McKinley at and above the 14,000 foot camp, and at campsites within one-half mile of air taxi landing locations on glaciers. These actions would be expected to mitigate some of the potential negative impacts that increased use, and subsequently, increased human waste, could have on water quality in these high use areas.

Cumulative Impacts

The National Park Service has generally allowed the growth of backcountry recreational activities and encouraged it by authorizing guided activities such as dog sled tours, scenic air tour landings and air taxi services, guided day-hiking, and guided mountaineering. Some activities have been constrained to protect park resources by prohibiting snowmachine access to the Old Park in 2000 and imposing quotas on overnight backcountry use in 1976; however, these actions have served to preserve the diversity of recreational opportunity at Denali, particularly for wilderness-dependent activities. Meanwhile, increasing snowmachine access to the southern park additions and the expansion of aircraft overflights on the south side of the Alaska Range and the eastern portion of the Old Park associated with increasing scenic air tour traffic have had an adverse impact on wilderness-dependent activities.

The actions in this alternative would allow increases in appropriate recreational activities and would inhibit the erosion of wilderness-dependent opportunities in some locations. Overall, the actions in this alternative combined with past, present, and future actions would have a moderate adverse impact on the recreational opportunities in the Denali backcountry, primarily because of the lack of protection for accessible mountaineering opportunities. The actions proposed would be responsible for a substantial portion of the adverse impact, although the independent actions by scenic air tour operators are the most important contributor.

Conclusion

This alternative would have moderate adverse impacts on recreational opportunities because some wilderness-dependent opportunities would become difficult to find. In particular, non-motorized mountaineering and wilderness recreational activities in accessible areas of the park additions on the south side of the Alaska Range would become areas used more for visitors seeking motorized access opportunities. There would be no area of the backcountry that would preserve opportunities to encounter no other people, although some of these opportunities might incidentally remain over time

in inaccessible areas. There would be minimal adverse impacts on visitor safety from declining drinking water quality.

The level of impacts to recreational opportunities anticipated from this alternative would not result in an impairment of park resources that fulfill specific purposes identified in the establishing legislation or that are essential to the integrity of the park.

PARK OPERATIONS AND MANAGEMENT

This section addresses the impacts of the various alternatives to park operations and management, including needs for staffing, equipment, and facilities within all divisions of the National Park Service at Denali.

METHODOLOGY

Previous management actions in Denali National Park and Preserve and management actions in other units of the national park system (such as those from Rocky Mountain National Park, Zion National Park, Mount Rainier National Park, and Shenandoah National Park) were used to determine impacts to park management from each of the alternatives. For example, examination of operations of Denali's current backcountry quota system indicates the National Park Service can expect impacts of an expanded registration system to be similar to those that have occurred during the last 25 years that the current quota system has been in place.

ACTIONS COMMON TO ALL ACTION ALTERNATIVES

The National Park Service would continue to manage the growth of recreational uses of the park. This would require additional staff time and funding to provide for research, monitoring, education, cooperative planning, and regulatory enforcement. These requirements and other impacts to park operations and management will vary depending on the alternative selected. The consequences that are common to all alternatives are described in the following paragraphs. The consequences for specific alternatives are described in the discussions for each alternative.

The National Park Service would follow through with its commitment to conduct ecological monitoring and research to implement the plan. Additional park staff and funding will be needed to carry out the baseline studies, research, and subsequent monitoring that is an inherent requirement of the successful implementation of the adaptive management approach that is promoted by this plan. The complexity of monitoring to determine if desired resource conditions are being met is greater than simply regulating a carrying capacity limit such as the number of permits. In general, the need for timely and effective information will increase with the amount, extent, and type of the use that is allowed to occur under each alternative. For example, higher levels of recreational snowmachine use will trigger a greater need for research and monitoring than other forms of backcountry recreation because of the larger number of potential users and the greater spatial impact of a single user per unit of time. However, regardless of the alternative selected, an increase of approximately 10% to the total resource management and research staffing and funding for the park would be required to implement this adaptive management approach for the nearly 6-million acres of the

backcountry. It would require some alteration of monitoring and research priorities or expanding the scope of the existing research and resource management program over the full life of the plan (next 15 years). One permanent position to direct a soundscape monitoring would be required, in addition to the funding for equipment and logistics. Two additional seasonal positions would be required to assist with vegetation and wildlife monitoring. Additional funding would be required for contracted research to shift between physical, biological, and sociological topics as needed, as well as provide for long-term implementation of monitoring. This level of change could be absorbed into existing infrastructure and would be a minor impact to park operations and management.

An increase of six staff would be needed to supervise and adequately operate the existing backcountry registration and education programs to the level of service described to be common for all alternatives. At existing visitor use levels, an additional two backcountry law enforcement rangers would be required to protect park resources values to the standard described as common to all alternatives. This staff would be absorbed into existing infrastructure and represent only a minor impact to park operations.

An increase of 200 hours of flight time for law enforcement would be required to provide the level resource protection described as common to all alternatives, and to provide the monitoring information necessary to implement the adaptive management approach. This increased activity would be absorbed into existing infrastructure and represent only a minor impact to park operations.

Additional staff would be needed to work with the Federal Aviation Administration, pilots, and air taxi and scenic air tour operators to develop solutions and mitigation measures to protect the park's soundscape and to follow through with the commitment to pursue land exchanges. This would be a long-term commitment, requiring the equivalent of about 25% total time annually of an outdoor-recreation planner or management assistant, and would be a minor impact to park operations and management.

Management of commercial services to the standards common in all alternatives would require an additional 25% total time annually of an outdoor-recreation planner or management assistant, and would be a minor impact to park operations and management.

The management provisions included in the action alternatives would result in backcountry visitors' being more prepared for their experience and in improved awareness and understanding of regulations. The reduced need for enforcement and search and rescue would generally be a minor impact to park operations and management, depending on the alternative selected.

An important long-term beneficial impact on park operations is the plan's documentation and formalization of standards, limits, guidance, and policies for actions in the backcountry. Park administration and personnel change eventually, and the proposed plan would provide for continuity and consistency of management, decreasing variability and uncertainty about appropriate activities, including commercial activities, in the backcountry.

ALTERNATIVE 1 (NO ACTION)

Alternative 1 differs from the action alternatives in that the backcountry would continue to be administered according to previous plans that contain limited direction for backcountry management. This would result in several impacts to park operations and management.

Under Alternative 1 the park would continue to respond to backcountry resource concerns and user conflicts as they arise. This would continue to result in less efficient management than would be possible under the action alternatives. Responding to crises is more costly than are routine operations because the problems are usually more extensive than if dealt with before a crisis is reached. In addition, employee overtime is often necessary in crises, but is the exception rather than the rule for routine operations.

The frequency and subsequent cost of search and rescue emergencies would increase because more people would use the backcountry. Routine operations require occasional, scheduled flight time, rather than the nearly continuous flight time required during emergency response. However, because emergency response is only a part of overall park operations and management, the overall impacts would be minor.

Under the no-action alternative, there would be no expansion of the backcountry registration system. As a result, use in almost two thirds of the total park and preserve area would continue to be unregulated and the type and extent of use unknown. Park managers would lack information on impacts to resources since monitoring programs would not be expanded to track backcountry use. Management decisions would not be fully informed and managers would not be able to meet legal and policy goals for the park. Lack of information would lead to reactive rather than proactive management. This would lead to drastic and disruptive responses rather than planned actions. These impacts would be felt throughout the park operation, not just within operations directly related to backcountry management. As a result there would be major impacts over the life of the plan that would severely diminish the park's overall capability to prevent impairment.

The no-action alternative does not include provisions for determining visitor capacity as the plan is implemented over the next several years. Managers would also lack information on whether or not visitors are satisfied with their experiences since there would not be additional visitor capacity studies specific to backcountry use. This would make it very difficult to determine carrying capacity and subsequently make wise management decisions to meet legal and policy goals for protecting resources and visitor experiences. This would be a major impact on park management throughout the life of the plan, since many of these goals are not discretionary (see chapter 1 for description of legal and policy requirements). This condition would leave open the possibility for legal challenges with a required response that would divert staff time away from other critical park operation needs.

Cumulative Effects

Past, present, and reasonably foreseeable future actions such as private and commercial development in and near the park and regional increases in recreational uses will require substantial additional time and effort from park management in the next 20 years.

Impacts to park management would be major because these projects will have serious ramifications on the visitor experience and condition of the park. Existing staff are fully utilized with existing projects; therefore, new duties would require new staff. To work effectively on these and other projects, more funding would be necessary and/or existing staff would have to shift priorities. This, combined with the specific changes described under the no-action alternative in the backcountry management plan, would result in major impacts to park management because a variety of topics, such as commercial uses of the park, climbing and mountaineering, and snowmachine use, are not addressed at a general management planning level.

Conclusion

Without a comprehensive backcountry management plan, crisis management will take away from effective resource protection in other park programs. The no-action alternative would therefore result in major adverse impacts to park operations and management in the 20 years that the backcountry management plan is expected to be in effect and creates a situation where park management could not prevent impairment of park resource values.

ALTERNATIVE 2

Impacts to park management under Alternative 2 are generally the same as those described in Actions Common to All Action Alternatives with a few exceptions as described.

A lower level of administrative presence would be required to manage the lower level of use, particularly motorized use that is envisioned by this alternative. Even though registration is required for all overnight backcountry users and some summer and winter day users under Alternative 2, this can be accomplished within the staffing levels described under Actions Common to All Alternatives because recreational snowmachine use as well as other forms of motorized access would be limited. Typical access under this alternative to the backcountry would generally be through locations where there are existing NPS facilities and staff such as Talkeetna that can be used adaptively used to implement the registration program envisioned. Implementing the program would have a negligible impact on park operations.

No additional law enforcement staff or aviation patrol time would be required to manage recreational backcountry use beyond the levels described in Actions Common to All Action Alternatives. The reduction of recreational snowmachine use from current levels,

and limitations on other motorized forms of access for recreation would actually allow the redistribution of some staff time to accomplish resource monitoring. As a result, there would be a minor positive impact to park operations.

The funding and staffing additions describe in Actions Common to All Action Alternatives for research and monitoring would be adequate to implement Alternative 2. Development of baseline inventories, monitoring protocols, and monitoring programs could progress at a predictable pace that would be a minor additional impact to park operations under this alternative because much of the urgency for immediate answers regarding threats to park resource values would be diminished due to the absence of motorized recreational access into the backcountry.

Reducing the amount of other basic research activities that are not directly related to the adaptive management provisions of the backcountry plan may serve to restrict impacts to resources and visitors, but the actual park operations may be negatively affected due to a lack of necessary information for future decisions. There would be a greater number of areas where researchers would have less flexibility in their activities. On balance, this would be a minor impact to park operations within the life of the plan.

The elimination of the 14,000-foot administrative camp on Mount McKinley would imply also the elimination of the high altitude helicopter and some patrol staff, since all work together as a system that requires acclimatized patrol staff to base out of the 14,000-foot camp. This action would create the opportunity for a redistribution of a significant amount of park funds to other park priorities. This would be a moderate beneficial impact to other park operations but could result in higher rescue costs, fewer successful rescues, and more periodic cleanup time and cost for garbage and waste. Mountaineering management would focus on initial contact at Talkeetna rather than a continuous presence on Mount McKinley to provide an immediate rescue response.

Cumulative Effects

Past, present, and reasonably foreseeable future actions, such as private and commercial development in and near the park and regional increases in recreational uses would require additional time and effort from park management over the next 20 years. Impacts to park management would be major because these projects will have serious ramifications on the visitor experience and condition of the park. Existing staff are fully utilized with existing projects; therefore, new duties would require new staff. To work effectively on these and other projects, more funding would be necessary and/or existing staff would have to shift priorities.

Conclusion

There would be some requirements for additional staff, but most proposals under Alternative 2 could be implemented by reallocating funding, reassigning existing staff, and changing management emphasis or priorities during the first 5 years of plan

implementation. Impacts that have been identified would be mitigated to the degree that the overall impacts to park management under actions from Alternative 2 would be minor.

ALTERNATIVE 3

The establishment of a limited number of recreational snowmachine corridors and the continuation of recreational access by airplane and motorboat would cause a minor increase in the complexity of a registration program that could be absorbed within the staff level increases already described as necessary in the Actions Common to All Alternatives section. This alternative also calls for the establishment of a new visitor contact station in the Broad Pass area that would require an additional permanent and 2 seasonal staff. The increased snowmachine use levels would require three permanent backcountry patrol rangers. These staffing additions would require additional operating funds to provide the yearly training, equipment, and supplies necessary for them to conduct their work. Overall, these increases would represent an expansion on existing services and activities and a minor impact on park operations and management.

Higher levels of use in the backcountry would require 300 flight hours of aerial patrols to enforce regulations and gather resource monitoring information. The infrastructure and staffing exist to absorb this increase with only minor impacts on park operations.

The National Park Service would maintain the same level of administrative presence on Mount McKinley and the overall impacts to park operations and management would be negligible over 5-10 years of plan implementation.

Maintenance of new facilities such as the new contact station in the Cantwell/Broad Pass area and structures to support winter use in the park headquarters area would require additional operating funds for contract services as well as the addition of one permanent and one seasonal employee. The trail development and maintenance envisioned by this alternative would require an additional trail crew for the north side of the park. The impacts to park operations and management of facilities would be minor over the period of plan implementation given the scale of existing maintenance operations.

There would be no additional staffing requirements for research and monitoring activities beyond those describe in the Actions Common to All Alternatives section which were considered to be a minor impact.

Cumulative Effects

Past, present, and reasonably foreseeable future actions, such as the private and commercial development in and near the park and regional increases in recreational uses will require additional time and effort from park management for the next 20 years. Impacts to park management would be major because these projects will have serious

ramifications on the visitor experience and condition of the park. Existing staff are fully utilized with existing projects; therefore, new duties would require new staff. To work effectively on these and other projects, more funding would be necessary and/or existing staff would have to shift priorities.

Conclusion

While there would be increases in park staff and funding to manage greater use and additional facilities, proactive management would negate the need for a reactive (and thus, a more costly and effort-intensive) approach to management. Implementing actions under Alternative 3 would cause moderate impacts to park operations and management in some areas during 5-10 years of plan implementation, but other actions include mitigation and even beneficial effects that would occur throughout the life of the plan. Therefore, overall impacts to park management under Alternative 3 would still be minor.

ALTERNATIVE 4 (PREFERRED ALTERNATIVE)

The continuation of snowmachine, airplane, and motorboat use throughout the park and preserve additions as well as continued use of airplanes, motorboats, stock, and bicycles in the Old Park implies major new management responsibilities and operational impacts that are not a consequence of either Alternatives 2 or 3. A well-staffed and funded backcountry management operation along with a research and resource management program that is specifically assigned to address backcountry visitor use related issues would be necessary to implement the actions of this alternative and the resource protection strategies described in this plan.

Three additional permanent positions and 12 additional seasonal positions distributed between visitor contact stations at Park Headquarters, Broad Pass, Talkeetna, and perhaps along the Peterville Road or at Trapper Creek would eventually be necessary to provide visitor information and registration services. An additional supervisory Park Ranger would be needed to oversee a backcountry district that would include four backcountry law-enforcement field Rangers. Two additional staff, one permanent, and one seasonal would be necessary to increase the winter patrol coverage capabilities of the park kennels operation. The establishment of this comprehensive program, which is essential to the accomplishment of the adaptive management strategy inherent in this plan, would be a major impact on park operations.

Higher levels of use in the backcountry, particularly during the winter from snowmachine use, would require 400 flight hours of aerial patrols to enforce regulations and gather resource monitoring information. The infrastructure and staffing exist to absorb this increase with only minor impacts on park operations.

The addition of one permanent park planner or management assistant would be required to coordinate the implementation of proposals in Alternative 4 such as working with air

taxi and scenic air tour operators to reduce aircraft noise, accomplishing required updates to the plan, and carrying out the evaluation of information from required monitoring. The position would also lead the planning for any subsequent adaptive management actions that may be necessary. An additional 50% of a permanent position would be required to work with concessions management to develop provisions for future commercial use authorizations and monitor the increased level of commercial activity.

The National Park Service would maintain the same level of administrative presence on Mount McKinley and the overall impacts to park operations and management would be negligible over 5-10 years of plan implementation.

An additional seasonal trail crew on the north side of the park would be required to construct and maintain trails that are included within this plan. Given the current scale of the trails program, this would be a minor impact.

Maintenance of new facilities such as the new contact station in the Cantwell/Broad Pass area and structures to support winter use in the park headquarters area would require additional operating funds for contract services as well as the addition of one permanent and one seasonal employee.

Approximately a 25 % increase in research and monitoring staffing and funding would need to implement the level of research and monitoring that is required by this alternative. The allowance for motorized access and higher levels of scenic air tour activity would increase the need for the research and monitoring information on natural soundscapes, wildlife disturbance, vegetation damage, and visitor capacity. Four new permanent positions in these disciplines would be needed to help meet the obligations in this alternative for adaptive management. Four new seasonal positions to assist in monitoring implementation would be required. Funding sufficient to conduct concurrent contracted research studies on soundscape, vegetation, wildlife, and sociological topics would be required given that the use levels and types of use allowed by this alternative would require more immediate information. These additions would exceed the capabilities of existing administrative and facility infrastructure and create related impacts to other aspects of park operations, and as a result represent a major impact to park operations overall.

Cumulative Effects

Past, present, and reasonably foreseeable future actions, such as the private and commercial development in and near the park and regional increases in recreational uses will require additional time and effort from park management for the next 20 years. Impacts to park management would be major because these projects will have serious ramifications on the visitor experience and condition of the park. Existing staff are fully utilized with existing projects; therefore, new duties would require new staff. To work effectively on these and other projects, more funding would be necessary and/or existing staff would have to shift priorities.

Conclusion

Despite the fact that there would be increases in park staff and funding to manage increased use and additional facilities, and that proactive management would negate the need for a reactive (and thus, a more costly and effort-intensive) approach to management, major impacts to park operations and management would still occur in several important aspects of park operations during 5-10 years of plan implementation. These changes would be of a degree that cannot be absorbed within existing infrastructure. The required staffing and funding are of a magnitude that would trigger the need for major secondary responses in support services such as administration, particularly human resources, as well as facility maintenance activities. Overall, there would still be major impacts to park operations as a consequence of this alternative. Without the staffing and funding increases described above, it would not be possible to prevent impairment of park resource values given the use increases called for by this alternative.

ALTERNATIVE 5

Under this alternative the National Park Service would provide for a high level of recreational use. The allowance for higher levels of snowmachine, airplane, and motorboat use throughout the park and preserve additions as well as continued use of airplanes, motorboats, stock, and bicycles in the Old Park implies major management responsibilities and operational impacts. A well staffed and funded backcountry management operation along with a research and resource management program that is specifically assigned to address backcountry visitor use related issues would be necessary to implement the actions of this alternative and the resource protection strategies describe in this plan.

The increased level of motorized access, commercial services, trails, and access corridors anticipated by this alternative would require a proactive program of visitor information, even without a registration requirement. Three additional permanent positions and twelve additional seasonal positions distributed between visitor contact stations at Park Headquarters, Broad Pass, Talkeetna, and perhaps along the Peterville Road or at Trapper Creek would still eventually be necessary to provide visitor information. An additional supervisory Park Ranger would be needed to oversee a backcountry district, which would include six backcountry law-enforcement field Rangers. Two additional staff, one permanent and one seasonal, would be necessary to increase the winter patrol coverage capabilities of the park kennels operation. Additional field staff would be necessary because the lack of a registration system would require more field patrols and contacts to gather the information that is still necessary to meet the adaptive management requirements of this plan. The establishment of this comprehensive program would be a major impact on park operations.

Higher levels of use in the backcountry and the lack of the capability to gather information via a registration system, particularly during the winter from snowmachine use on the south side of the park, would require 400 flight hours of aerial patrols with NPS aircraft to enforce regulations and gather resource monitoring information. An additional 50 hours of contracted flight time would be necessary from the Talkeetna area because some of the most extensive use concerns are on the south side of the park and NPS aircraft would likely remain stationed on the north side of the park. Still, the infrastructure and staffing exist to absorb this increase with only minor impacts on park operations.

South District operations would need to be expanded to accommodate increases in visitation and scenic air tours as well as the lack of registration system. This would require two additional full-time positions to gather the information in the field rather than gathering it from visitors before they enter the backcountry, which could largely be done within the staffing levels described in Actions Common to All Alternatives. For example, staff would be needed to conduct visitor capacity studies and evaluate limits on climber numbers. These actions and staffing requirements would result in a moderate impact to mountaineering and glacier landing management during the 5-10 years of plan implementation.

The addition of one permanent park planner or management assistant would be required to coordinate the implementation of proposals in Alternative 5 such as working with air taxi and scenic air tour operators to reduce aircraft noise, accomplishing required updates to the plan, and carrying out the evaluation of information from required monitoring. The position would also lead the planning for any subsequent adaptive management actions that may be necessary. An additional permanent position would be required to work with concessions management to develop provisions for future commercial use authorizations and monitor the increased level of commercial activity.

The park road maintenance crew would need to be available to keep the park road to the Savage River Campground open all winter. Park staff would need to be available to deal with road closures and stranded visitors during unexpected winter storms. An additional position would be required to patrol the road and provide for visitor safety during adverse winter weather conditions.

Two additional seasonal trail crews, one on the north side of the park and one on the south side, would be required to construct and maintain trails in areas designated as Backcountry Hiker areas. National Park Service staff would be required to oversee the construction of campsites the Wildhorse Creek area and public use cabins along the south side boundary in cooperation with the State of Alaska. An additional crew would need to be available for the construction work. The establishment of a trail maintenance program on the south side of the park, combined with these other actions constitutes a major change to park operations and would result in major impacts to park management throughout the life of the plan.

Maintenance of new facilities such as the new contact station in the Cantwell/Broad Pass area and structures to support winter use in the park headquarters area would require additional operating funds for contract services as well as the addition of one permanent and one seasonal employee.

Park kennel operations would need to change methods of conditioning dogs, training staff, and orienting visitors. Additional kennel staff time would be required to load and transport dogs for short, early season conditioning runs (letter from K. Fortier, Kennels Manager, 8/20/98). Starting runs from the Savage River Campground area would necessitate crossing the Savage River, which is generally not frozen until late November to early December (letter from K. Fortier, Kennels Manager, 7/25/00). This would be more difficult for park staff, so it would require additional time.

A 35% increase in research and monitoring staffing and funding would need to implement the level of research and monitoring that is required by this alternative. The allowance for motorized access and higher levels of scenic air tour activity would increase the need for the research and monitoring information on natural soundscapes, wildlife disturbance, vegetation damage, and visitor capacity. Four new permanent positions in these disciplines would be needed to help meet the obligations in this alternative for adaptive management. Another permanent data management and GIS oriented position would be needed to assist in these efforts. Four new seasonal positions to assist in monitoring implementation would be required. Additional funding beyond the level projected for Alternative 4 would be required to conduct concurrent contracted research studies on soundscape, vegetation, wildlife, and sociological topics given the further increases in use levels and the more immediate need for information that these increases trigger. These additions would exceed the capabilities of existing administrative and facility infrastructure and create related impacts to other aspects of park operations, and as a result represent a major impact to park operations overall.

Cumulative Effects

Past, present, and reasonably foreseeable future actions, such as the private and commercial development in and near the park and regional increases in recreational uses will require additional time and effort from park management for the next 20 years. Impacts to park management would be major because these projects will have serious ramifications on the visitor experience and condition of the park. Existing staff are fully utilized with existing projects; therefore, new duties would require new staff. To work effectively on these and other projects, more funding would be necessary and/or existing staff would have to shift priorities. To work effectively on these and other projects, more funding would be necessary and/or existing staff would have to shift priorities.

Conclusion

Implementing Alternative 5 would require a substantial increase in staffing to provide for a major increase in visitor use and visitor services while also preventing impairment of

park resources and values. In some cases, proactive management would negate the need for a reactive (and thus, a more costly and effort-intensive) approach to management. Moderate to major impacts to park operations and management would be realized in many areas during the 5-10 years of plan implementation and throughout the life of the plan. Other actions would include mitigation and even beneficial effects that would occur throughout the life of the plan. Despite the balancing effect and the fact that some impacts would be reduced once the plan was implemented fully, other major impacts would persist throughout the life of the plan as described above. These changes would be of a degree that cannot be simply absorbed within existing infrastructure. The required staffing and funding are of a magnitude that would trigger the need for major secondary responses in support services such as administration, particularly human resources, as well as facility maintenance activities. Without the staffing and funding increases described above, it would not be possible to prevent impairment of park resource values given the use increases called for by this alternative.

SUSTAINABILITY

ALTERNATIVE 1 (NO ACTION)

Relationship Between Short-Term Uses and Long-Term Productivity

The short-term use of the park additions and preserve for unlimited access for hiking, camping, and snowmachine use would lead to long-term decline in the productivity of park lands for wildlife habitat, subsistence, and recreation. Extensive use of places such as the Bull River/Broad Pass area, the Tokositna River valley, and the Stampede Trail corridor in either summer or winter could cause wildlife to move away from habitat that would otherwise be utilized, and thus compromise Denali's purpose as a wildlife sanctuary and an unaltered ecosystem as well as reducing subsistence opportunities. Extensive vegetation damage could result from hiking, camping, or snowmachine use.

The unlimited use of snowmachines, airplanes, and motorboats would lead to a decline in natural soundscape and wilderness resources, since much of the southern park additions and portions of the Old Park would not allow visitors to avoid signs of human presence, unnatural sounds, and other reminders of civilization. The scale of use would also create crowding in a few popular areas (such as the Ruth Amphitheater, Kahiltna Glacier, Bull River/Broad Pass, and Tokositna) that would make it impossible for the park resource to provide wilderness solitude.

Irretrievable or Irreversible Commitments of Resources

There would be no irreversible or irretrievable commitments of resources made under this alternative.

Unavoidable Adverse Environmental Impacts

As documented in other sections of this chapter, this alternative would have unavoidable adverse impacts to many park resources including natural soundscapes, wilderness resources, vegetation, ice-rich permafrost soils, and wildlife. These adverse impacts could be mitigated or avoided through future actions similar to those proposed in other alternatives of this plan.

ALTERNATIVE 2

Relationship Between Short-Term Uses and Long-Term Productivity

The short-term uses allowed under this plan would not significantly compromise any part of the long-term productivity of park resources, including wilderness recreational opportunities, wildlife habitat, and intact ecosystems. There are no future management options foreclosed through this action.

Irretrievable or Irreversible Commitments of Resources

There would be no irreversible or irretrievable commitments of resources made under this alternative.

Unavoidable Adverse Environmental Impacts

There would be unavoidable adverse impacts to the natural soundscape associated with ongoing commercial airplane landing activity at Portals on south-side glaciers including scenic air tour landings at Kahiltna Base Camp and in the Ruth Amphitheater and ongoing aircraft overflight activity within the parameters allowed by standards.

ALTERNATIVE 3

Relationship Between Short-Term Uses and Long-Term Productivity

The short-term uses allowed under this plan would not significantly compromise any part of the long-term productivity of park resources, including wilderness recreational opportunities, wildlife habitat, and intact ecosystems. There are no future management options foreclosed through this action.

Irretrievable or Irreversible Commitments of Resources

There would be no irreversible or irretrievable commitments of resources made under this alternative.

Unavoidable Adverse Environmental Impacts

There would be unavoidable adverse environmental impacts to natural soundscape and wilderness resources in areas where motorized access would be common, such as the southern glaciers (particularly the Ruth Glacier and at Portals) because of airplane access and the Corridors in the Broad Pass/Dunkle Hills and Tokositna River areas which could be used for recreational snowmachine access. There could also be damage to vegetation and ice-rich permafrost soils along Corridors. All of these impacts would be mitigated by the standards provided by management areas.

ALTERNATIVE 4 (PREFERRED ALTERNATIVE)

Relationship Between Short-Term Uses and Long-Term Productivity

The dispersed motorized access that would continue and grow in the Dunkle Hills/Broad Pass and lowland areas around the bases of the Kahiltna, Tokositna, and Ruth Glaciers could compromise the ability of the park to sustain wildlife resources, which could be displaced. Close to Cantwell these wildlife resources are also subsistence resources. The same displacement could occur in other areas of the park and preserve, particularly Kantishna, if snowmachine access became popular in the future. In addition, these areas could decline in their ability to provide wilderness recreational opportunities because of the high levels of motorized equipment and noise that would make it difficult for visitors to find solitude.

Irretrievable or Irreversible Commitments of Resources

There would be no irreversible or irretrievable commitments of resources made under this alternative.

Unavoidable Adverse Environmental Impacts

There would be unavoidable adverse environmental impacts to natural soundscape and wilderness resources in areas where motorized access would be common, such the southern glaciers between the Kanikula/upper Kahiltna and Ruth glaciers because of airplane access and the Corridors in the Broad Pass/Dunkle Hills and Tokositna River areas. There would also be damage to vegetation and ice-rich permafrost soils in Corridors and other areas where snowmachines commonly travel. All of these impacts would be mitigated by the standards provided by management areas.

ALTERNATIVE 5

Relationship Between Short-Term Uses and Long-Term Productivity

The dispersed motorized access that would continue and grow in the Dunkle Hills/Broad Pass and lowland areas around the bases of the Kahiltna, Tokositna, and Ruth Glaciers could compromise the ability of the park to sustain wildlife resources, which could be displaced. Close to Cantwell these wildlife resources are also subsistence resources. The same displacement could occur in other areas of the park and preserve, particularly Kantishna, if snowmachine access became popular in the future. In addition, these areas could decline in their ability to provide wilderness recreational opportunities because of the high levels of motorized equipment and noise that would make it difficult for visitors to find solitude.

Irretrievable or Irreversible Commitments of Resources

There are no irreversible or irretrievable commitments of resources made under this alternative.

Unavoidable Adverse Environmental Impacts

There would be unavoidable adverse environmental impacts to natural soundscape and wilderness resources in areas where motorized access would be common, such the southern glaciers between the Kahiltna and Eldridge glaciers because of airplane access and the Corridors in the Broad Pass/Dunkle Hills and Tokositna River areas. There would also be damage to vegetation and ice-rich permafrost soils in Corridors and other areas where snowmachines commonly travel. All of these impacts would be mitigated by the standards provided by management areas.