National Park Service
U.S. Department of the Interior
Grand Teton / Yellowstone National Parks
John D. Rockefeller, Jr. Memorial Parkway
Wyoming / Montana / Idaho

Winter Use Plans
Environmental Assessment

November 2008

Winter Use Plans

Environmental Assessment

Summary

This environmental assessment considers two alternatives for a winter use plan in Yellowstone and Grand Teton National Parks and the John D. Rockefeller, Jr. Memorial Parkway. Alternative 1 is the No Action alternative: the 2004 winter use plans regulations would remain in place and neither snowcoach nor snowmobile access would be permitted. Wheeled vehicle travel would continue on roads that have been traditionally plowed, and the parks would be open to skiing and snowshoeing. Alternative 2 would continue recent trends of snowmobile and snowcoach access and is the preferred alternative. It would allow 318 snowmobiles per day in Yellowstone for a period of up to three winters (i.e., through the winter of 2010-2011). In Yellowstone, this alternative requires that all recreational snowmobiles be best available technology, and travel with commercial guides. Seventy-eight snowcoaches would be authorized to operate daily in Yellowstone. All would be commercially guided, and also allowed for the same three-winter period as snowmobiles. For Grand Teton and the Parkway, a total of 50 snowmobiles would be allowed, but not subject to the three-year limitation. Snowmobile use on Jackson Lake and the Grassy Lake Road would not be required to be commercially guided; snowmobiles on Jackson Lake must be best available technology. Snowmobiles being operated between Flagg Ranch and the South Entrance of Yellowstone must be accompanied by a guide.

Public Comment

If you wish to comment on the environmental assessment, you may post comments online at http://parkplanning.nps.gov/yell, mail comments to National Park Service, Management Assistant's Office, P.O. Box 168, Yellowstone National Park, Wyoming 82190, or hand-deliver them to the same address. Comments must be RECEIVED BY Nov. 17, 2008.

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. Although you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

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Winter Use Plans
Environmental Assessment

Yellowstone and Grand Teton National Parks
John D. Rockefeller, Jr. Memorial Parkway

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CHAPTER 1: PURPOSE AND NEED

Winter Use Planning History

1974 *Master Plan* and *Final Environmental Statement*

The 1974 *Master Plan* states "Yellowstone will be managed on a year-round use basis. There are two defined periods of heavy use, and the management and operation must be geared to such for maximum enjoyment of the resources by the visitor – May 1 through October 31 and December 1 through March 15." Further elaboration is provided in the *Final Environmental Statement* (for the Master Plan, p. 10): "No visitor protection concept can be considered complete if it did not address itself to the rapidly emerging phenomena of winter use. To this end, present and proposed programs diagrammed in the following sketch suggest the hierarchy of challenge possible within the park proper. A fleet of 12 passenger snow machines (Bombardiers) provide daily scenic introductory tours along prime wildlife winter ranges. For the more hearty individual, snowmobiling along designated and maintained road corridors is available. Proposed for those willing to test their mettle against the Yellowstone winter will be a number of cross-country ski or snowshoeing routes."

The 1990 *Winter Use Plan*

In 1990, the National Park Service completed a Winter Use Plan for Yellowstone National Park, Grand Teton National Park, and the John D. Rockefeller, Jr. Memorial Parkway (the Parkway; collectively, the parks). That plan projected that by the year 2000, winter visitation to Yellowstone would be 143,000 visitors. Visitation to the parks grew at a rate much faster than expected, and reached the forecasted level by the winter of 1992–1993 (total visitors to Yellowstone and Grand Teton in that year were 142,744 and 128,159, respectively). That same winter, the Continental Divide Snowmobile Trail (CDST) opened in Grand Teton.

These changes (increased visitation and the CDST opening) prompted the Greater Yellowstone Coordinating Committee, composed of national park superintendents and national forest supervisors within the Greater Yellowstone Area (GYA), to collect information and analyze winter use in the entire GYA. The interagency study team released its results in 1999 as "Winter Visitor Use Management: A Multi-agency Assessment." The assessment identified desired conditions for the GYA, current areas of conflict, issues and concerns, and possible ways to address them. The final document incorporated many comments from the public, interest groups, and local and state governments surrounding public lands in the GYA.

The 1997 Fund for Animals, et al., Lawsuit

In May 1997, the Fund for Animals, Biodiversity Legal Foundation, and certain other plaintiffs filed suit against the NPS in the U.S. District Court for the District of Columbia (D.C. District Court). The suit was prompted in part by the extraordinary winter of 1996–1997 and the killing of 1,084 Yellowstone bison that winter. The groups alleged violations of the Endangered Species Act and the National Environmental Policy Act (NEPA), and other laws. In October 1997, the Department of the Interior and the plaintiffs reached a settlement agreement wherein the NPS agreed, in part, to prepare an environmental impact statement (EIS) for new winter use plans for the parks.

The EIS and Decision of 2000

In preparing the EIS, nine county, state, and federal agencies joined the NPS as cooperating agencies. These were the states of Montana, Idaho, and Wyoming; Fremont County in Idaho, Gallatin and Park Counties in Montana, Park and Teton Counties in Wyoming; and the U.S. Forest Service. The NPS released the Final EIS (FEIS) on October 10, 2000. Based on the FEIS, NPS Intermountain Regional Director Karen Wade signed the Record of Decision (ROD) on November 22, 2000. The decision was to eliminate both snowmobile and snowplane use from the parks by the winter of 2003–2004, and provide visitor access via an NPS-managed mass-transit snowcoach system. The decision was based upon the finding that existing snowmobile and snowplane use impaired the parks' resources and values (specifically its wildlife, air quality, natural soundscapes, and visitor experience), thus violating the statutory mandate of the NPS.

Following publication of a proposed rule and its public comment period, a final rule implementing the decision was published in the *Federal Register* on January 22, 2001, becoming effective on April 22, 2001. The rule provided for a phase-out of snowmobiles beginning with the winter of 2002-2003, with full implementation of the plan in the winter of 2003-2004.

On December 6, 2000, the International Snowmobile Manufacturers' Association (ISMA) and several other plaintiffs filed a lawsuit in the U.S. District Court for the District of Wyoming (Wyoming District Court). They alleged, among other things, that in preparing the FEIS and ROD, the NPS violated the National Environmental Policy Act (NEPA) and the Administrative Procedure Act (APA). On June 29, 2001, a settlement agreement was reached in which the NPS would prepare a Supplemental Environmental Impact Statement (SEIS) to provide additional opportunities for public involvement and to consider information on cleaner and quieter snowmobile technology.

The *Supplemental EIS* and Decision of 2003

In late 2001, the National Park Service began the SEIS, focusing on the cleaner and quieter snowmobiles that were becoming commercially available. In addition to the nine cooperating agencies that participated in the 2000 EIS, the NPS also used the expertise of the Environmental Protection Agency (EPA). On February 20, 2003, the NPS issued the Final SEIS, pursuant to the settlement agreement. The Regional Director signed the ROD on March 25, 2003, and the NPS published the new regulation governing winter use in the parks in the *Federal Register* on December 11, 2003. The decision was to continue allowing snowmobile use under strict conditions: winter visitation was to be limited to no more than 950 snowmobiles daily in Yellowstone; all snowmobiles would have to use the best available technology; and 80 percent of snowmobile users would have to be led by commercial guides. The remaining 20 percent were to be non-commercially guided. Other operational restrictions were also put in place.

On December 16, 2003, the D.C. District Court ruled on lawsuits filed by the Fund for Animals and the Greater Yellowstone Coalition earlier in 2003 regarding the SEIS. The Fund for Animals alleged that the 2003 decision failed to address the issue of bison and road grooming, and the Greater Yellowstone Coalition alleged that the decision to allow managed snowmobile use was not supported by the 2003 SEIS. The court's ruling vacated the regulation of December 11, 2003 and the SEIS, and effectively reinstated the January 22, 2001, regulation phasing out recreational snowmobiling (based on the initial ROD). Specifically, up to 493 snowmobiles a day were to be allowed into Yellowstone for the 2003–2004 season, and another 50 in Grand Teton and the

Parkway combined. All snowmobiles in Yellowstone were required to be led by a commercial guide. Snowmobiles were to be phased out entirely from the parks in the 2004–2005 season.

In early December 2003, ISMA and the State of Wyoming reopened their December 2000 lawsuit against the Interior Department and the NPS. On February 10, 2004, the Wyoming District Court issued a preliminary injunction preventing the NPS from continuing to implement the snowmobile phase-out (the January 22, 2001, regulation). The court also directed the superintendents of Yellowstone and Grand Teton to issue winter use rules that were "fair and equitable" to all parties to allow visitation to continue for the remainder of the 2003-2004 winter season. The NPS responded by allowing up to 780 snowmobiles a day into Yellowstone and up to 140 into Grand Teton and the Parkway combined. In Yellowstone, the requirement that all snowmobile users travel with a commercial guide remained in effect.

The *Temporary Winter Use Plans EA* of 2004

Because the vacatur of the two prior winter use plans left the agency with no clear rules under which to manage Yellowstone for the winter of 2004-2005, the NPS prepared a *Temporary Winter Use Plans Environmental Assessment* in 2004. The temporary plan was intended to provide a framework for managing winter use in the parks for a period of three years, and was approved in November 2004 with a "Finding of No Significant Impact" (FONSI) and a Final Rule published in the *Federal Register*, and implemented with the 2004–2005 winter season. Its provisions included:

- 720 snowmobiles were allowed to enter Yellowstone each day, and 140 per day were allowed in Grand Teton and the Parkway.
- All snowmobiles in Yellowstone had to be commercially guided.
- All recreational snowmobiles entering the parks had to meet Best Available Technology (BAT) requirements for reducing noise and air pollution (with limited exceptions at Grand Teton and the Parkway).

The temporary plan was in effect through the 2006–2007 winter season, during which time the NPS prepared another new long-term winter use plan and EIS for the parks. The new long term winter use plan was necessary since the provisions of the temporary winter use rules that allowed for the operation of both snowmobiles and snowcoaches in the parks expired at the end of the 2006-2007 winter season. Thus, without a new plan upon which to base rulemaking, the use of snowmobiles and snowcoaches would not have been allowed after the 2006-2007 winter season pursuant to the 2004 regulations.

Several litigants challenged the temporary plan in both the Wyoming District Court and the D.C. District Court. In October 2005, the Wyoming District Court ruled on a suit from the State of Wyoming and the Wyoming Lodging and Restaurant Association against the NPS contesting the temporary winter use plan, upholding the validity of the 2004 rule. The D.C. District Court denied the Fund for Animals and Federal defendants' motions for summary judgment and denied a motion by the Greater Yellowstone Coalition that would have had a practical effect of enforcing the adaptive management standards of the 2003 decision. In September 2006, the Fund for Animals filed a motion renewing their previous request for summary judgment; the motion was dismissed as moot in September 2007. In June 2007, the Wyoming District Court ruled on a suit from Save Our Snowplanes, upholding the validity of the temporary winter use

plan and final regulation and their provisions prohibiting snowplane use on Jackson Lake. That ruling is on appeal to the 10th Circuit Court of Appeals.

The 2007 *Winter Use Plans, Final Environmental Impact Statement*

In September 2007, the NPS released the *Winter Use Plans Final Environmental Impact Statement*, with the associated *Record of Decision* signed in November and the pertinent rule published in the *Federal Register* on December 13, 2007. On July 16, 2008, the NPS approved a *Record of Decision Amendment* regarding avalanche management on Sylvan Pass in Yellowstone. Although the FEIS and associated rule-making continued most of the provisions of the *2004 Temporary Winter Use Plans* for the winter of 2007-08, they would have implemented the following changes beginning with the winter of 2008-09:

- 540 snowmobiles would have been permitted to enter Yellowstone per day, along with 83 snowcoaches.
- All snowmobilers would have been guided, with Best Available Technology (BAT) requirements continuing for snowmobiles and implemented for snowcoaches.
- In Grand Teton, 25 snowmobiles would have been permitted daily on the Grassy Lake Road (with no BAT or guiding requirement) and 40 on Jackson Lake (no guiding requirement). The Continental Divide Snowmobile Trail would have been closed.

Several litigants challenged the validity of the 2007 Final Rule. In the U.S. District Court for the District of Columbia, the Greater Yellowstone Coalition (and others) and National Parks Conservation Association filed separate suits; on September 15, 2008, that court vacated and remanded to the agency the 2007 FEIS, ROD, and Final Rule. In the U.S. District Court for the District of Wyoming, the State of Wyoming and Park County, Wyoming filed separate suits. A hearing was held on the merits of their case on September 15, 2008; a decision from the court is pending.

Purpose and Need

The purpose of the *2008 Winter Use Plans Environmental Assessment* is to ensure that visitors to Yellowstone have a range of appropriate winter recreational opportunities for an interim period, pending court decisions and NPS actions to respond. The purpose of this EA is also to ensure that these recreational activities are in an appropriate setting and that they do not impair or cause unacceptable impacts to park resources or values. The NPS Organic Act, which is the fundamental law guiding national park management, mandates each of these purposes in that it requires that the NPS conserve park resources and values, prevent their impairment, and promote their enjoyment.

There is substantial confusion and uncertainty among the public about winter use, in part due to uncertainty posed by continued litigation. Another purpose of the *2008 Winter Use Plans EA* is to provide the public with some degree of certainty about how winter use will be managed in Yellowstone for an interim period.

The final purpose of this EA is to provide a structure for winter use management in Yellowstone for an interim period. Due to recent court decisions, it is currently unclear what winter use management plan will be in place for the winter of 2008-2009 or future winters and whether snowmobiles will be permitted. However, the purpose of this EA is to provide an interim winter

use plan that will have no significant adverse effects on park resources or values pending NPS's response to guidance provided by relevant court decisions.

This EA is not intended to result in a permanent regulation authorizing continued public recreational snowmobile and snowcoach use in Yellowstone. A permanent regulation on snowmobile and snowcoach use in Yellowstone may be the product of future winter use analysis.

In addition, the EA is intended to serve all of the same purposes for Grand Teton and the Parkway, except that for these two park areas, the EA is expected to serve as the basis for a long-term regulation to guide winter use management.

Need

The NPS is taking action through this EA to shape the course of winter use management in the three parks. As stated in the introduction of this chapter, the U.S. District Court for the District of Columbia vacated the 2007 ROD and Final Rule on September 15, 2008.

Due to this and other court decisions, none of the winter use regulations promulgated in 2001, 2003, and 2007 are currently in effect in the parks. Rather, the 2004 regulation is the extant rule in the parks. The rule does not authorize snowmobile or snowcoach access after the winter of 2006-07. The NPS general regulations governing snowmobile use at 36 CFR 2.18 state that snowmobiles are prohibited in units of the National Park System unless snowmobile routes and water surfaces are promulgated as special regulations in accordance with the Administrative Procedure Act. Regarding snowcoaches, the NPS general regulations also state (at 36 CFR 1.2 (c)) that the regulations contained in part 7 are special regulations that may amend, modify, relax, or make more stringent the regulations contained in parts 1 through 5 of 36 CFR. Furthermore, 36 CFR 1.5(b) clearly states that designating or restricting use requires rule making.

Thus, the need for this EA is to outline the type and extent of public recreational snowmobile and snowcoach access to Yellowstone for up to three winters, as well as at Grand Teton and the Parkway. Part of the decision includes the type and extent of restrictions on public recreational snowmobile and snowcoach use, if it is allowed; how winter use will be managed in the three park units; and specifically, whether snowmobiles and snowcoaches will be permitted. This EA process will culminate with revisions to the parks' winter use regulations at 36 CFR 7.13, 7.21, and 7.22, if those revisions are indeed needed (i.e. if Alternative 2 is selected).

The desired condition of the three parks for winter use has not changed since the 2000 EIS was prepared. As stated on pages 6–7 of the 2007 Final EIS, the desired condition stems from NPS mandates, which include legislation, regulations, executive orders, and governing policies.

The desired conditions are:

- Visitors have a range of appropriate winter recreation opportunities from primitive to developed. Winter recreation complements the unique characteristics of each landscape within the ecosystem.

- Recreational experiences are offered in an appropriate setting; they do not take place where they will irreparably impact air quality, wildlife, cultural areas, the experiences of other park visitors, or other park values and resources.
- High quality facilities are provided in parks to support the need for safety and enhanced visitor experiences.
- Conflicts among user groups are minimal.
- Visitors know how to participate safely in winter use activities without damaging resources.
- Oversnow vehicle sound and emission levels are reduced to protect employee and public health and safety, enhance visitor experience, and protect natural resources.

The desired objectives are:

- Provide the public with some degree of certainty about how winter use will be managed in Yellowstone for an interim period.
- Provide a structure for winter use management in Yellowstone for an interim period.
- Provide an interim winter use plan pending court decisions and NPS response that will have no significant adverse effects on Yellowstone resources or values.

Figure 1-1: Yellowstone National Park.

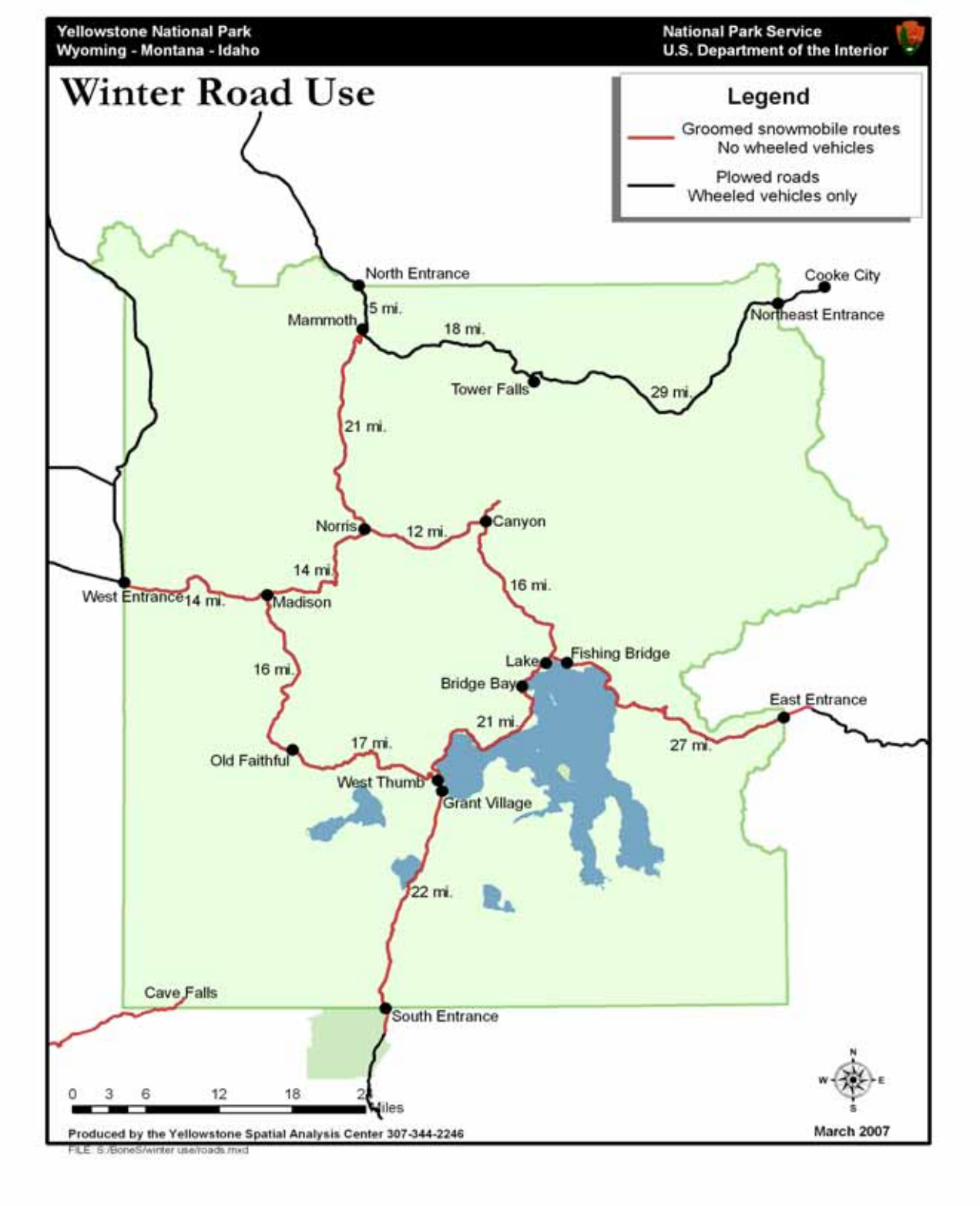
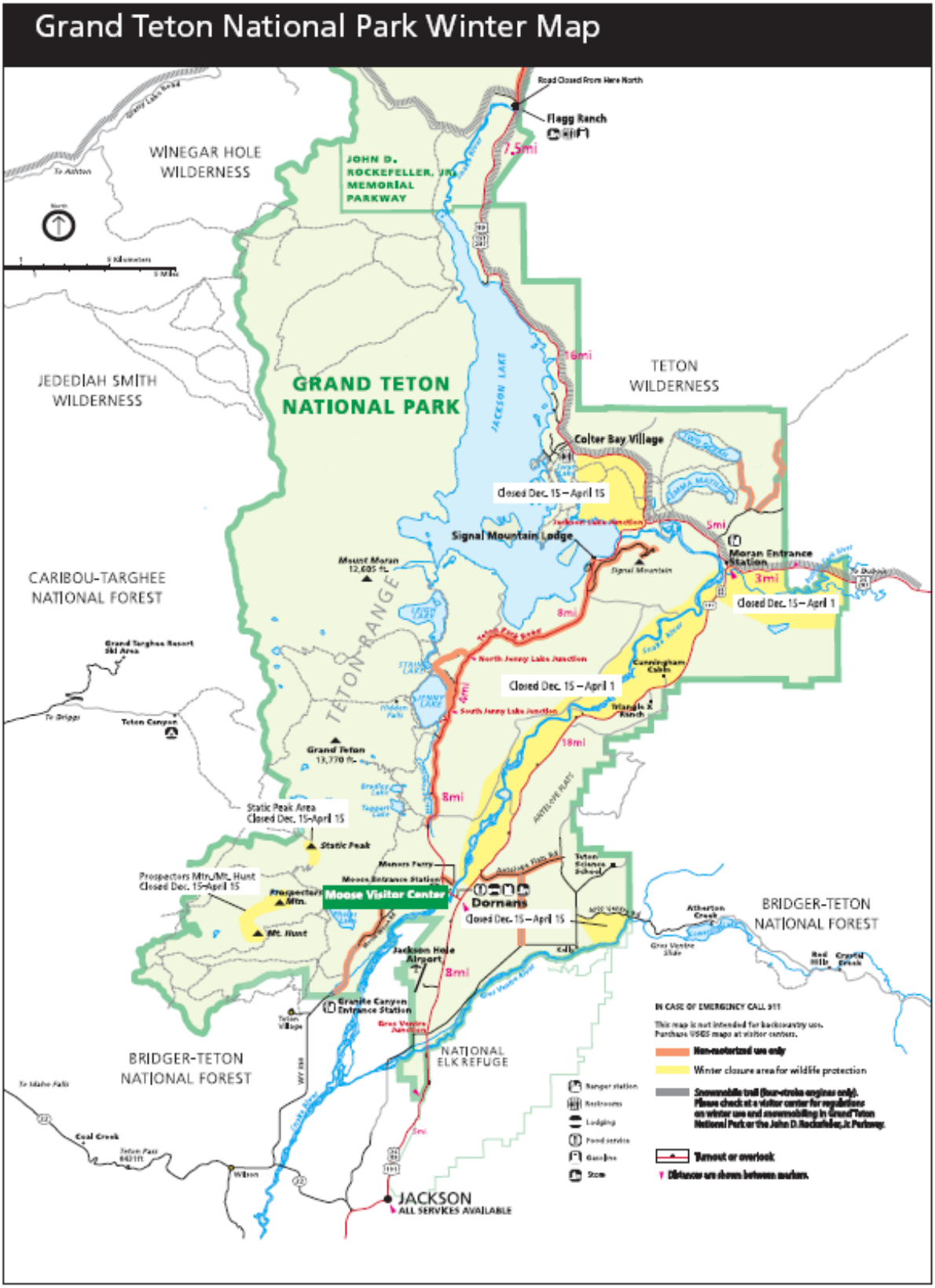


Figure 1-2: Grand Teton National Park and the John D. Rockefeller, Jr. Memorial Parkway.



Appropriate Use

Section 1.5 of *Management Policies* (2006), "Appropriate Use of the Parks," directs that the National Park Service must ensure that park uses that are allowed would not cause impairment of, or unacceptable impacts on, park resources and values. A new form of park use may be allowed within a park only after a determination has been made in the professional judgment of the park manager that it will not result in unacceptable impacts.

Section 8.1.2 of *Management Policies* (2006), Process for Determining Appropriate Uses, provides evaluation factors for determining appropriate uses. All proposals for park uses are evaluated for

- consistency with applicable laws, executive orders, regulations, and policies;
- consistency with existing plans for public use and resource management;
- actual and potential effects on park resources and values;
- total costs to the Service; and
- whether the public interest will be served.

Park managers must continually monitor all park uses to prevent unanticipated and unacceptable impacts. If unanticipated and unacceptable impacts emerge, the park manager must engage in a thoughtful, deliberate process to further manage or constrain the use, or discontinue it.

From Section 8.2 of *Management Policies*: "To provide for enjoyment of the parks, the National Park Service will encourage visitor use activities that

- are appropriate to the purpose for which the park was established, and
- are inspirational, educational, or healthful, and otherwise appropriate to the park environment; and
- will foster an understanding of and appreciation for park resources and values, or will promote enjoyment through a direct association with, interaction with, or relation to park resources; and
- can be sustained without causing unacceptable impacts to park resources and values."

Sections 8.2.3 and 8.2.3.2 of the *Management Policies* provide more specific guidance regarding motorized uses and snowmobile use in particular. The relevant sections are provided in Appendix A.

The 1974 *Master Plan* states "Yellowstone will be managed on a year-round use basis. There are two defined periods of heavy use, and the management and operation must be geared to such for maximum enjoyment of the resources by the visitor – May 1 through October 31 and December 1 through March 15." Oversnow vehicular winter use of Yellowstone National Park has been occurring since 1949, and snowmobiles have been used for 45 of the park's 136 years. Distances between attractions at Yellowstone are great, and some form of vehicular access is needed to access various destination areas. Snowmobiles and snowcoaches are used in winter,

as private vehicles and buses are used in summer. The master plan and other winter use documents decided that winter vehicle use of Yellowstone is appropriate, so the next question is whether such use, and the associated necessary and appropriate impacts, can be sustained without causing unacceptable impacts to park resources and values. That analysis is found in the *Environmental Consequences* section.

Impairment and Conservation of Park Resources and Values

National Park Service's *Management Policies, 2006* require analysis of potential effects to determine whether or not actions would impair park resources (see Appendix A for specific *Management Policies* citations). The fundamental purpose of the national park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. National Park Service managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adversely impacting park resources and values.

However, the laws do give the National Park Service the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the National Park Service the management discretion to allow certain impacts within park, that discretion is limited by the statutory requirement that the National Park Service must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible National Park Service manager, would harm the integrity of park resources or values. An impact to any park resource or value may, but does not necessarily, constitute an impairment, but an impact would be more likely to constitute an impairment when there is a major or severe adverse effect upon a resource or value whose conservation is:

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- key to the natural or cultural integrity of the park; or
- identified as a goal in the park's general management plan or other relevant NPS planning documents.

Impairment may result from National Park Service activities in managing the park, visitor activities, or activities undertaken by concessioners, contractors, and others operating in the park. A determination on impairment is made in the *Environmental Consequences* section for natural and cultural resource topics.

In addition to mandating the prevention of impairment, the Organic Act requires that the NPS prioritize conservation over use whenever the two are found to be in conflict. The NPS complies with this mandate by ensuring that a proposed use of the parks will not result in unacceptable impacts to park resources and values.

Scoping

Scoping is an early and open process to determine the breadth of environmental issues and alternatives to be addressed in an environmental assessment. Scoping and public comment opportunities on previous winter use plans were extensive. The public was provided opportunities to comment on the 1990 *Winter Use Plan*, the 2000 *Winter Use Plan,* the 2003 *Winter Use Plan*, the 2004 *Temporary Winter Use Plan EA*, and the 2007 *Winter Use Plans*. The Park Service has a good understanding of public concerns on these issues, and because there is only a short time to get a new rule in place prior to the December 15, 2008 winter use season, previous scoping comments were used for this environmental assessment.

Impact Topics

In this section, the NPS takes a "hard look" at all potential impacts by considering the direct, indirect, and cumulative effects of the proposed action on the environment, along with connected and cumulative actions. Impacts are described in terms of context and duration. The context or extent of the impact is described as localized or widespread. The duration of impacts is described as short-term, ranging from days to three years in duration, or long-term, extending up to 20 years or longer. The intensity and type of impact is described as negligible, minor, moderate, or major, and as beneficial or adverse. The NPS equates "major" effects as "significant" effects. The identification of "major" effects would trigger the need for an EIS. Where the intensity of an impact could be described quantitatively, the numerical data is presented; however, most impact analyses are qualitative and use best professional judgment in making the assessment.

The NPS defines "measurable" impacts as moderate or greater effects. It equates "no measurable effects" as minor or less effects. "No measurable effect" is used by the NPS in determining if a categorical exclusion applies or if impact topics may be dismissed from further evaluation in an EA or EIS. The use of "no measurable effects" in this EA pertains to whether the NPS dismisses an impact topic from further detailed evaluation in the EA. The reason the NPS uses "no measurable effects" to determine whether impact topics are dismissed from further evaluation is to concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail as required by CEQ regulations at 1500.1(b).

In this section of the EA, NPS provides a limited evaluation and explanation as to why some impact topics are not evaluated in more detail. Impact topics are dismissed from further evaluation in this EA if:

- they do not exist in the analysis area,
- they would not be affected by the proposal, or the likelihood of impacts are not reasonably expected, or
- through the application of mitigation measures, there would be minor or less effects (i.e. no measurable effects) from the proposal, and there is little controversy on the subject or reasons to otherwise include the topic.

Due to there being no effect or no measurable effects, there would either be no contribution towards cumulative effects or the contribution would be low. For each issue or topic presented below, if the resource is found in the analysis area or the issue is applicable to the proposal, then a limited analysis of direct and indirect, and cumulative effects is presented. There is no

impairment analysis included in the limited evaluations for the dismissed topics because the NPS's threshold for considering whether there could be an impairment is based on "major" effects.

Social and Economic Issues

Public and cooperating agency comments on previous winter use planning documents voiced concern about the potential economic impacts of various winter use elements on local businesses and economies. Comments range from statements that protection of park resources is paramount, to the social and economic benefits of various access options. Some commentors raised concern about potential closure or allocation changes at various entrances. Some desired a balance between resource protection and socioeconomics.

Human Health and Safety

Three primary health and safety issues regarding winter visitor use were identified, and are addressed in this EA, which affect different areas of the three NPS units to a varying extent:

- The effect of motorized vehicular emissions and noise on employees and visitors;
- Avalanche hazards; and
- Safety problems where different modes of winter transport are used in the same place or in close proximity.

Wildlife

The impact of snowmobiles, snowcoaches, and oversnow vehicle road grooming on wildlife was identified and are addressed in this EA, including the topic of ungulate use of groomed roads. The issue of whether or not groomed roadways affect bison movements, habitats, and population distribution has played a large role in the history of winter use planning and associated litigation. Analysis in this EA is informed by recently published papers, monitoring results, and other recent reports. The information is summarized in the *Affected Environment* section.

Air Quality

The impact of recreational snowmobile and snowcoach travel on air quality, including emissions, visibility, and air quality-related values, was raised and is addressed in this EA. The issue is a question of how much pollution emitted by oversnow vehicles is acceptable relative to laws and policies governing national park units. Air quality is a key resource in itself as well as a highly prized (and expected) element of the park visitor experience. Analysis in this EA is based primarily upon monitoring information from the last five winters.

Natural Soundscapes

The impact of noise from recreational snowmobile and snowcoach travel on the natural soundscape was raised and is addressed in this EA. The issue is a question of whether the character and amount of sound emitted by these vehicles is acceptable relative to laws and policies governing national park units. Soundscapes are a key resource, as well as a highly prized (and expected) element of the park visitor experience. Analysis in this EA is based primarily upon monitoring data collected over the past five winters.

Visitor Use and Access

Various user groups contend that the parks offer either too much or not enough of various types of use. Those who advocate for snowmobile use indicate that there is a right to personal (individual) access to the parks for this use. Those who advocate for snowcoach-only access indicate that snowmobile technology does not adequately protect park resources. Others advocate that any motorized use is inappropriate during the winter season. For these reasons, visitor use and access is addressed in this EA.

Visitor Experience

Expectations for quality winter recreation experiences vary among individuals and among user groups. This creates conflict between those who expect to find quiet, solitude, and clean air in the parks and the impacts of oversnow vehicles, especially when facilities for these different groups are in close proximity. At issue is the nature of visitor enjoyment and its relationship to the management and conservation of park resources and values. For these reasons, visitor experience is addressed in this EA.

Impact Topics Dismissed from Further Consideration

The decision to be made in this EA will not hinge on these topics relative to direct, indirect or cumulative impacts, nor is there new information to indicate that these issues require analysis in this EA. Therefore, the following topics are dismissed from additional analysis as indicated in each discussion below.

Ungulates Other Than Bison and Elk

No new information on ungulate species other than bison and elk is available to report in the affected environment and no new impacts are associated with the alternatives presented in this EA. For these reasons, this topic is dismissed from further consideration.

Black Bear (Ursus americanus)

Previous analysis has demonstrated that existing winter recreation activities in the parks does not affect black bears. Destruction of den sites or den habitat does not appear to be an issue in the parks. Bears are not being disturbed while they are preparing or occupying den sites (Reinhart and Tyers 1999; Podruzny et al. 2002; Haroldson et al. 2002). The main concern is the potential for bear-human conflicts and displacement of bears while they are foraging during the pre-denning and post-emergence periods. The current winter recreation season in the parks does not overlap with most bear activity and, therefore, precludes most risks of bear-human conflicts. For these reasons, impacts on black bear are dismissed from further consideration.

Mid-Sized Carnivores

Mid-sized carnivores not addressed further in this analysis include the bobcat *(Felis rufus)* and red fox *(Vulpes vulpes)*. These species are not considered rare or in need of special protection in the parks. No new information on mid-sized carnivore species other than wolverine (*Gulo gulo*) and coyote (*Canis latrans*), both which are discussed further under *Other Species of Concern* and Canada lynx (*Lynx canadensis*), which are addressed under *Threatened and Endangered Species*, is available to report in the affected environment, and no new impacts are associated with the

alternatives presented in this FEIS. For these reasons, mid-sized carnivores other than wolverine, coyote, and Canada lynx are dismissed from further consideration.

Subnivian Fauna

Subnivian fauna are small mammals that live under snow during winter, including shrews, voles, pocket gophers, and mice. They are active throughout the year, eat a variety of plant and animal foods, and generally occupy habitats on or below the ground. They are important prey species for a variety of birds and mammals. In general, subnivian fauna are abundant residents of the parks and any potential loss of habitat caused by road grooming or plowing operations is compensated for by the vast amount of unroaded area found in the parks. Since OSV travel is only allowed on hard road surfaces that are driven upon during non-winter months, no impacts to subnivian species or their habitat are likely. Research in other areas indicates that subnivian pits and burrows have been located under roads groomed for oversnow vehicle use and in snowmobile play areas (Wildlife Resource Consultants 2004). Therefore, subnivian fauna are dismissed from further consideration.

Birds

Most bird species are not addressed further in this analysis because they only occur in the parks in the summer or their habits are not considered threatened by winter recreation. This includes peregrine falcons *(Falco peregrinus),* a species of special concern that was removed from the endangered species list in 1999. Peregrines' seasonal occurrence precludes them from being affected by winter recreation. No new information on bird species, other than those listed below, is available to report in the affected environment, and no new impacts are associated with the alternatives presented in this EA. For these reasons, this topic is dismissed from further consideration.

Bald eagles *(Haliaeetus leucocephalus)* and trumpeter swans *(Cygnus buccinator)* are discussed under *Other Species of Concern*. Ravens *(Corvus corax)* may be affected by human recreational activities due to their tendency to habituate to human use and activity and are discussed under *Other Species of Concern*.

Vegetation, including Plant Species of Special Concern and Threatened Plants

Most documented vegetation impacts from snowmobiles occur when they are driven away from established roads and trails. In the parks, oversnow motorized activities are limited to roads and along road margins where motorized use is allowed throughout the year. Because little to no vegetation exists on these routes, oversnow motorized use would have negligible impact on vegetation (Stangl 1999). For this reason, and others stated below, impacts upon endangered or threatened plants are dismissed without further analysis. Two species of plants considered to be of special concern are discussed below.

Ross' bentgrass *(Agrostis rossiae)* and Yellowstone sand verbena *(Abronia ammophila)* are unique to Yellowstone National Park, restricted to very specialized habitats within the park. These species are of special management concern because of their rarity and localized occurrences. Ross' bentgrass is found primarily on marl around hot springs and geysers near Old Faithful. Despain (1990) theorized that bison or elk may transport the seeds of Ross' bentgrass between thermal areas. Because of its highly localized habitat, this species is probably the vascular plant most vulnerable to extinction in Wyoming (Clark et al. 1989). Yellowstone

sand verbena, a sand obligate, is found along sandy shorelines of Yellowstone Lake; extensive searches have failed to find it elsewhere in the park. Little is known of its life history. Winter use is not expected to affect either species (Whipple, pers. comm., 2000).

The threatened Ute Ladies' tresses orchid *(Spiranthes diluvialis)* is the only plant listed under the ESA that may potentially occur in the parks. However, this orchid has never been reported within the parks. Known populations occur in Idaho, Montana, and Wyoming at elevations lower than the Yellowstone plateau. Therefore, this species is not addressed.

Exotic Species - Plants

About 200 nonnative plant species are known to occur in the parks (Whipple, pers. comm., 2000). The parks maintain aggressive exotic weed control programs using an Integrated Weed Management approach that relies on prevention, early detection and control, and mechanical, cultural, and chemical control strategies. While winter recreation does not occur during the plant growing season, exotic weed propagation may occur through ground disturbance associated with winter-use facility construction and oversnow vehicles that may act as vectors for weed dispersal. Oversnow vehicles can be a source of weed propagation along park roads and in developed areas, but not nearly as likely a source as vehicles that enter the parks during other seasons. Because all motorized winter use in the parks occurs on roads or their immediate margins, because of existing aggressive control programs, and because no new information is available for consideration in the affected environment, no further analysis of the effects on or of exotic plant species is included in the EA.

Exotic Species - Animals

Mountain goats were historically found in the mountains of the northwest coast and the Rocky Mountains. Through state fish and game agency introductions, their distribution has expanded both within and outside of their historic range (Varley 1999). Consequently, although mountain goats were historically absent from the GYA, they currently inhabit most mountain ranges in the GYA. Throughout their range, mountain goats inhabit steep, rocky terrain during all seasons of the year. Winter range habitats include areas close to cliffs, and steep, rocky, south facing slopes. Potential impacts to mountain goats are not assessed in this document because they are non-native species and human winter recreation tends to occur well outside of mountain goat and/or bighorn sheep range in the parks. For these reasons, this topic is dismissed from further consideration.

Possible conflicts between the proposed action and other plans, policies, or controls

There are no conflicts between the proposed action and any other NPS plans, policies, or controls. The proposed action is also consistent with local and regional plans.

Energy requirements and conservation potential

Operations for all three park units use energy to maintain park facilities and operate motor vehicles throughout the winter. Alternative 1 (No Action) would result in substantially reduced energy use compared to Alternative 2. Within Alternative 2, most snowmobiles would utilize Best Available Technology (BAT). For snowmobiles, the BAT requirement has substantially cut snowmobile fuel consumption relative to historic conditions. Consequently, implementation of Alternative 2 would continue the lower energy consumption for visitor transportation and services seen in the last five years in Yellowstone.

Energy consumption for visitor transportation is discussed at the end of *Affected Environment*. Because administrative energy consumption would be similar across alternatives, that component of energy requirements and conservation potential is dismissed from further consideration.

Natural or depletable resource requirements and conservation potential

The range of alternatives and the purpose and need of this document are fully within the scope of NPS mandates and policies. No natural or depletable resources would be extracted under this plan nor will natural resource commodities be produced. Therefore, this topic is dismissed from further consideration.

Urban quality, historic and cultural resources and design of the built environment

The winter visitor use activities described in Alternative 2 would occur on existing roads, deep snowpack over frozen ground, or frozen lake surfaces. Therefore, it would not affect known archeological resources. To ensure that adequate consideration and protection are accorded potential archeological resources during the construction of visitor services (such as permanent warming huts and other day-use facilities) or of trails, archeological surveys would precede all significant ground-disturbing activities. Archeological monitoring would occur where less ground disturbance is expected. If previously undiscovered archeological resources are unearthed during construction activities, all work in the immediate vicinity of the discovery would be halted until the resources could be identified and documented and an appropriate mitigation strategy developed, if necessary. If construction impacts upon archeological sites could not be avoided, the recommended mitigation strategy of site testing and data recovery would be implemented after consulting with the Wyoming or Montana State Historic Preservation Office (as appropriate). Consultation would ensure that the informational significance of the sites would be preserved.

If permanent warming huts or other day-use facilities are erected either in or near historic districts or potential cultural landscapes, application of several guidelines would blend facilities into both the built and natural surroundings of the parks:

1) Sensitive design and location of facilities;

2) Use of appropriate materials and colors in construction; and

3) Select plantings of native vegetation as visual buffers.

If historic structures are adaptively rehabilitated for visitor services, the integrity and character of each structure's exterior would be preserved while establishing the most efficient use of the interior's available space. All work would be performed in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties (1995). Materials removed during rehabilitation of historic structures would be evaluated to determine their value to the parks' museum collections or for their comparative use in future preservation work at the sites. Any corresponding visual, audible, and atmospheric intrusions associated with increases in visitation would not be significant enough to alter or diminish the integrity of historic districts or potential cultural landscapes.

The plowing of roads and highways and maintenance of groomed motorized routes throughout the winter season would have no effect upon roads or road systems that are either potentially eligible to be listed in the National Register of Historic Places or are contributing elements of

potential cultural landscapes. Existing road contours would be unaltered. There would be no adverse impacts to known ethnographic resources. No new information is available to report in the affected environment and no new impacts are associated with the alternatives presented in this EA. For these reasons, this topic is dismissed from further consideration.

Socially or economically disadvantaged populations

Presidential Executive Order 12898, *General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing the disproportionately high and/or adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. The proposed action would not have disproportionate health or environmental effects on minorities or low-income populations or communities as defined in the U.S. Environmental Protection Agency environmental justice guidance (U.S. EPA 1998). Therefore, environmental justice was dismissed as an impact topic in this EA.

Wetlands and Floodplains

Executive Order 11988 and NPS policy require that impacts on floodplains be considered in NPS undertakings. The intent of the order and guidelines is to provide for human safety and protect floodplain functions by preventing development in 100-year floodplains. Floodplains for all three units are well defined. There are no actions proposed in this EA that would occur in or encroach upon floodplains and all actions would occur during the winter months when there is little concern for flooding. With this finding, no further analysis of floodplains is necessary.

Similarly, Executive Order 11990 and NPS policy require that impacts on wetlands be considered in NPS undertakings. The intent of the order and guidelines is to protect the high resource values found in wetlands by requiring that evaluation of alternatives occur and mitigation be designed prior to development in wetlands. Wetlands for all three units are well defined. There are no actions proposed in this EA that would occur in or encroach upon wetlands and all actions would occur during the winter months on primarily paved roads that are open for wheeled vehicle travel in the summer. For these reasons, this topic is dismissed from further consideration.

Prime and unique agricultural lands

Private land in-holdings exist within the boundaries of Grand Teton National Park. None of the actions proposed in the range of alternatives would affect such lands, access to them, or their agricultural properties. Therefore, this topic is dismissed.

Important scientific, archeological, and other cultural resources; sacred sites and Indian Trust resources

Effects on wildlife, air quality, and soundscapes are discussed in *Affected Environment* and *Environmental Consequences* sections of the EA. The two alternatives evaluated in this EA, with their prescribed mitigations, would not create adverse effects on geothermal, archeological or historic resources, ethnographic resources, cultural landscapes, sacred sites or Indian Trust resources. Previous consultation, public and agency review of the 2007 Draft EIS, and scoping on that DEIS and other winter planning documents has not identified any impacts on sacred sites or Indian trust resources. As part of government-to-government relationships, consultation

with affiliated tribes has and will occur on winter use and other planning and management topics. For these reasons, this topic is dismissed from further consideration.

Ecologically critical areas, wild and scenic rivers, and other unique natural resources

The range of alternatives and the purpose and need are fully within the scope of NPS mandates and policies. No action proposed in the range of alternatives would affect the eligibility or designation of a wild and scenic river or wilderness area. The scope of the purpose and need for action does not allow consideration of alternatives that directly affect proposed or recommended wilderness in the parks. Therefore, there are no actions proposed, such as trails, grooming, facility construction, or motorized use that would impact wilderness values.

Wilderness values consist of elements that are intrinsic to wilderness, as well as elements that are experiential and relative to people's appreciation of wilderness. The analysis does consider impacts on wilderness values like natural quiet, scenic quality, wildlife, and air quality. Such elements are recognized as important wilderness components and impacts on them are considered as disclosure of indirect impacts. Because of this disclosure, and because proposed actions are overtly designed to avoid impacting proposed and recommended wilderness, this topic is dismissed from further discussion.

Climate Change and Sustainability

Although climatologists are unsure about the long-term results of global climate change, it is clear that the planet is experiencing a warming trend that affects ocean currents, sea levels, polar sea ice, and global weather patterns. Although these changes will likely affect winter precipitation patterns and amounts in the parks, it would be speculative to predict localized changes in snow water equivalency or average winter temperatures, in part because there are many variables that are not fully understood and there may be variables not currently defined. Therefore, the analysis in this document is based on past and current weather patterns and the effects of future climate changes are not discussed further.

In part to address and prepare for such changes, the NPS commissioned a report quantifying the historic snow water equivalent and temperatures for the parks, comparing snow water equivalency with opening and closing dates of oversnow vehicle travel, and providing estimated opening and closing dates that would have been possible over the historic period of record (Farnes and Hansen 2005). That information was used in the analysis for this EA and will be used in winter operations under any alternative chosen.

Yellowstone has a strong track record of environmental stewardship, particularly in the last decade with implementation of initiatives such as the Greening of Yellowstone. The Greening initiative includes recycling, waste reduction, energy reduction, building a compost facility for park wastes, LEED building certification, and the use of hybrid vehicles and bio-fuels in summer and winter. Although all the projects and initiatives undertaken in and near the parks are too numerous to list here, the reader should be aware that although this topic is specifically dismissed from the analysis, the parks continue to lead the region in environmental education and action, including steps to reduce activities that contribute to climate change.

Water and Aquatic Resources

One of the longer-term monitoring projects in the parks has measured deposition of pollution in the snowpack. Work by the U.S. Geological Survey has been underway since about 1996 to measure regional trends as well as the effect of oversnow vehicles. The regional perspective has provided a picture of pollution deposition in the snowpack throughout the northern Rocky Mountains, including the parks. The local measurement has increased our understanding of deposition from oversnow vehicles.

Although there is a clear relationship between oversnow vehicle use and pollutant deposition in the snowpack, monitoring has not shown more than negligible to minor quantities of oversnow-related pollution in snowmelt. Any detectable vehicle-related pollution in snowmelt has been found to be in the range of background or near-background levels (Ingersoll et al. 2005).

The NPS and USGS will continue to monitor pollution deposition in the snowpack, and with any of the alternatives, application of a monitoring program and adaptive management would represent appropriate protective actions regarding water and aquatic resources. The alternatives in this EA are not expected to appreciably differ in their impact on aquatic resources; therefore, this topic is dismissed from further consideration.

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CHAPTER 2: ALTERNATIVES

Introduction

This chapter presents a detailed description of two alternatives for winter visitor use in Yellowstone National Park, Grand Teton National Park, and the John D. Rockefeller, Jr. Memorial Parkway. Both of the alternatives must meet the stated purpose and need for action (see *Purpose and Need* section). The alternatives are presented in a comparative form and mitigation measures are described. This EA is intended to provide guidance for winter use management in Yellowstone for the next three years only. During that time period, the National Park Service will seek a longer term resolution to the winter use controversy, along with associated rules under which the parks will operate. The EA is also intended to provide a framework for management of winter use in Grand Teton and the Parkway for the foreseeable future. The three-year limitation would not apply in Grand Teton and the Parkway, and any references to the interim, or three year limit, are applicable only to Yellowstone National Park.

Alternative 1 is the "No Action" alternative, the management of the parks that will result if the agency takes no action. Alternative 2 is the action alternative; it would allow motorized oversnow visitation to continue, for the next three winters (i.e. through the winter of 2010-11) only.

Formulation of the Alternatives

Two alternatives were formulated in response to:

- Recent monitoring and studies;
- Court decisions in Washington, D.C. and pending in Wyoming;
- Public comments on the 2004 *Temporary Environmental Assessment* and the 2007 *Environmental Impact Statement*, from a wide variety of stakeholders; and
- Past winter planning processes and the wide range of ideas that were explored in the 2000 EIS, 2003 SEIS, 2004 EA and 2007 EIS.

Definitions

In both alternatives, the following definitions apply:

Commercial guide: A guide who operates for a fee or compensation and is authorized to operate in the park(s) under a concession contract or commercial use authorization, or is affiliated with a commercial guiding service or commercial tour.

Commercial tour: One or more persons traveling on an itinerary that has been packaged, priced, or sold for leisure/recreational purposes by an organization that realizes financial gain through the provision of the service.

Designated "non-motorized recreation" route: A marked or otherwise indicated oversnow travel route.

Gateway communities: The towns of Jackson and Cody, Wyoming, and Gardiner, Cooke City, and West Yellowstone, Montana.

Historic snowcoach: A Bombardier snowcoach manufactured in 1983 or earlier. Any other snowcoach is considered a non-historic snowcoach.

Oversnow vehicles (OSVs): Self-propelled vehicles intended for travel on snow, driven by a track or tracks in contact with the snow, and that may be steered by skis or tracks in contact with the snow. This term includes both snowmobiles and snowcoaches.

Oversnow route: That groomed portion of the unplowed roadway located between the road shoulders and designated by snow poles or other poles, ropes, fencing, or signs erected to regulate over-snow activity. Oversnow routes include pullouts or parking areas that are groomed or marked similarly to roadways and are adjacent to designated oversnow routes.

Snowcoaches: Self-propelled, mass transit vehicles intended for travel on snow, with a curb weight of over 1,000 pounds (450 kg), driven by a track or tracks, steered by skis or tracks, and that have a capacity of at least eight passengers. A snowcoach has a maximum size of 102 inches wide, plus tracks (not to exceed 110 inches wide with tracks); a maximum length of 35 feet; and a Gross Vehicle Weight Rating (GVWR) not to exceed 25,000 pounds.

Snowmobiles: Self-propelled vehicles intended for travel on snow, with a curb weight of not more than 1,000 pounds (450 kg), driven by a track or tracks in contact with the snow, and that may be steered by a ski or skis in contact with the snow.

Snowplane: A self-propelled vehicle intended for oversnow travel and driven by an air-displacing propeller.

Management Zones

For both alternatives, the parks are divided into four management zones, as shown in Figures 2-1 and 2-2 and described below. Zones, and their definitions, do not change by alternative, although the impact definition thresholds for each impact category may differ between the zones. Each zone is compared to one of the land classifications used under the Recreation Opportunity Spectrum (ROS), a recognized framework for inventorying, planning, and managing the recreational experience and setting of federal lands.

Developed area: Areas in the direct influence of human development and dominated by human structures. These range in size from small areas such as the Indian Creek warming hut to large areas such as Old Faithful. Structures include buildings, sewage treatment facilities, campgrounds, employee housing areas, maintenance yards and structures, boardwalks, hotels, and lodges. This zone is most similar to ROS classes "Rural" and "Urban." It includes areas within 100 yards of developed areas (but does not include backcountry cabins or utility lines).

Road corridor: Areas directly influenced by roads; specifically, all primary and secondary roads open to either visitor or administrative motorized travel in the winter. As with the Developed area, this zone extends out to 100 yards on either side of the road's center line. This zone is most similar to ROS class "Roaded Natural." Note that

this zone for purposes of this EA would not include roads open in the summer to motorized use but closed in the winter to OSV use. Boardwalks and some utility lines would appear in this zone, but no buildings (which are zoned as developed areas).

Transition zone: Areas indirectly influenced (mainly by sight and sound) by developed areas and roads. Specifically, they include all areas between 100 yards and 1.5 miles from either a developed area or a road corridor. This zone would include those roads not open to OSV travel in winter (with the possible exception of NPS authorized ski trail grooming equipment) but that may be open to motorized travel in summer. Yellowstone's Blacktail Plateau Drive, Bunsen Peak Road, and Lone Star Geyser Trail are examples of secondary roads included within transition zones. For Grand Teton, examples of areas designated as transition zones include the Teton Park Road and Jackson Lake. When a groomed ski trail is designated a transition zone, the zone would be 100 yards on either side of the groomed trail's center line. This zone would be most similar to ROS class "Roaded Natural" within ½ mile of roadways. From ½ mile to 1.5 miles from roads, "Semi-Primitive Non-motorized" would be the nearest ROS class or, as is sometimes used, "Semi-Primitive Wilderness," since these areas are recommended wilderness. Some utility lines could appear within this zone.

Backcountry: Areas where natural sights, sounds, and smells dominate and human-caused activities are minimal or completely absent. Specifically, this zone includes all areas more than 1.5 miles from the nearest road or developed area. This zone would be most similar to the "Primitive" ROS class.

Figure 2-1: Yellowstone National Park Management Zones

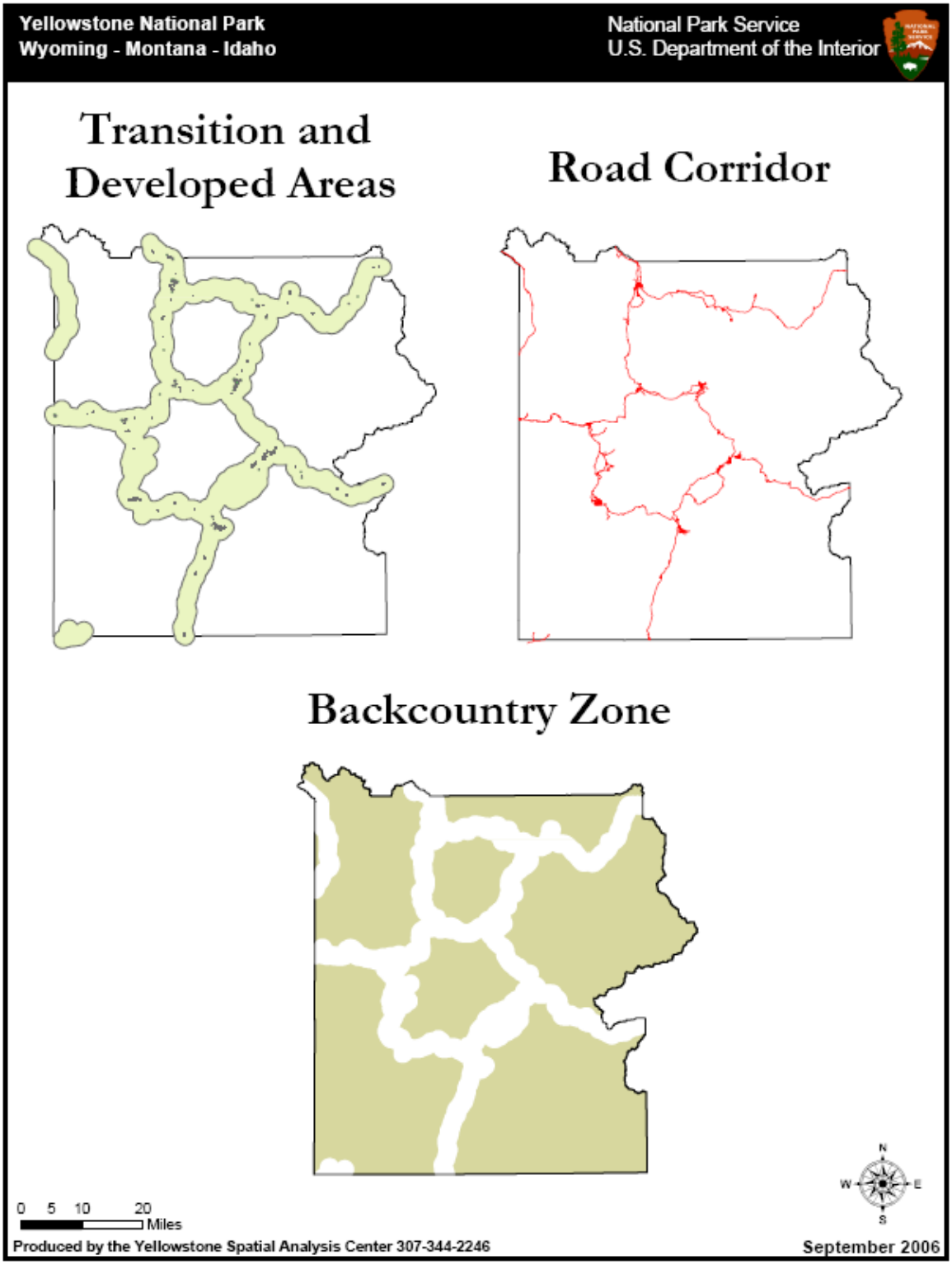
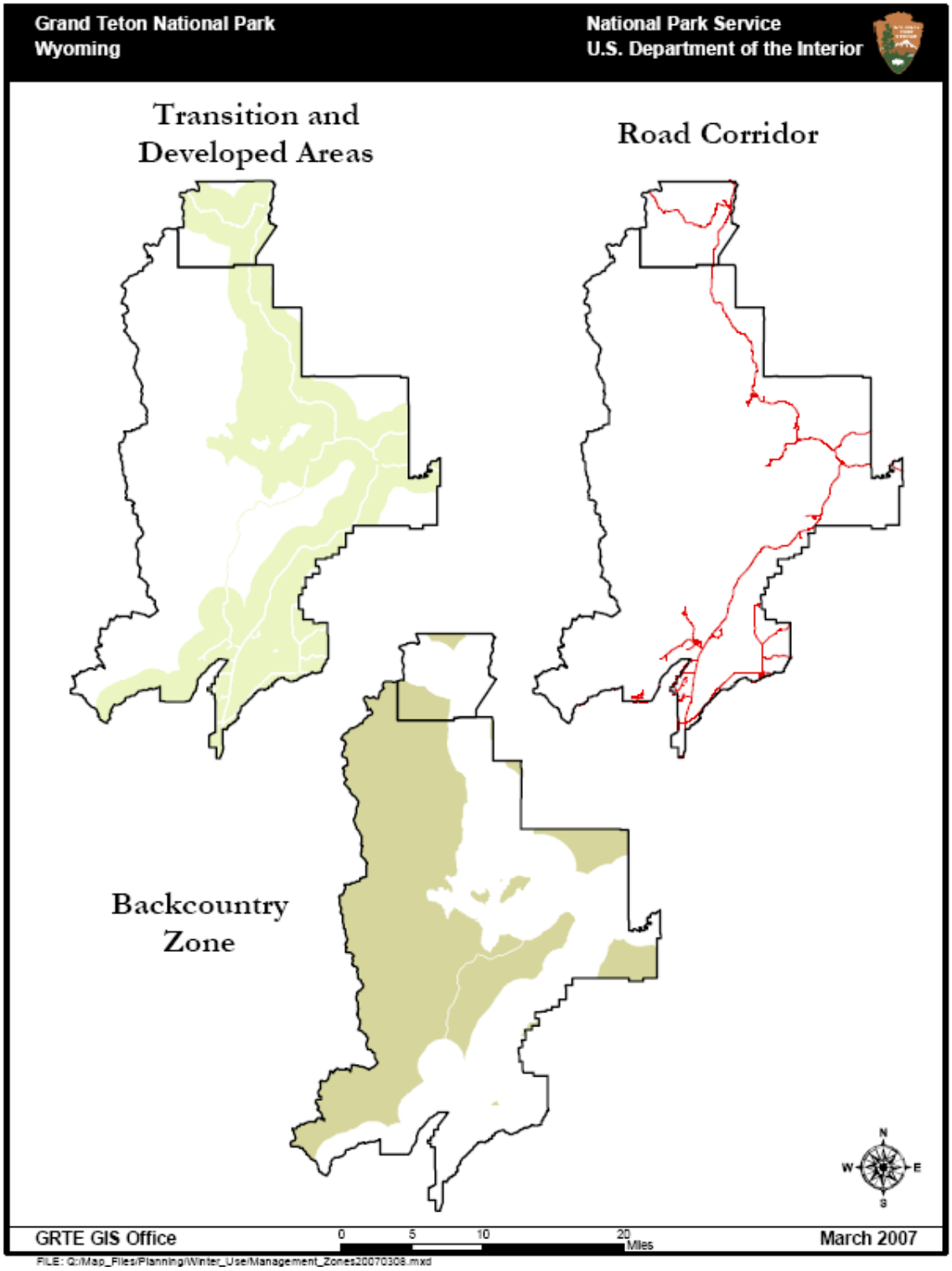


Figure 2-2: Grand Teton National Park Management Zones



Alternatives Dismissed from Further Consideration

Comments received during scoping for the 2007 EIS, at meetings and open houses associated with that planning, and during review of the 2007 DEIS included suggestions for alternatives or actions within alternatives. For various reasons, most of these ideas were eliminated from further study. Such ideas and the rationale for those decisions are presented here.

Allow snowcoaches (only) into Yellowstone—ban snowmobiles.

Some interested stakeholders have long advanced the position of converting all oversnow vehicle traffic in Yellowstone to snowcoaches (banning snowmobiles). Considered in the 2007 FEIS (as Alternative 2), that alternative is not considered in this EA for the following reasons:

- According to the modeling done for alternative 2 in the 2007 EIS, snowcoaches-only resulted in major soundscapes impacts because they would be audible for 70% of the time in travel corridors and 78% of the time at the West Thumb developed area. These results were from modeling recreational vehicles only and did not factor in the contribution of administrative vehicles or other mechanical sounds. Alternative 2 called for up to 120 coaches per day. Since the NPS has never implemented a snowcoach-only winter management, the agency must rely upon modeling to determine its likely impacts. An objective of this EA was that the preferred alternative has no major adverse effects (no significant effects) on park resources or values.
- As computed in the 2007 EIS, snowcoaches consume more fuel to transport the same number of people the same distance as either snowmobiles or wheeled vehicles (they consume 2.5 times as much fuel as do wheeled vehicles for this task, for example). There is a direct correlation between fuel consumed and carbon dioxide, the most common greenhouse gas, emitted into the atmosphere. Providing transportation by only the most carbon-intensive mode of transportation possible, when other less carbon-intensive modes are available, would contribute unnecessarily to global warming.
- According to wildlife monitoring for the past several winters, snowcoaches elicit greater wildlife response than do snowmobiles, probably because of their larger visual profile. Specifically, last winter 10% of wildlife responses to groups of only snowcoaches were travel, alarm, or flight, while only 7% of such responses to groups of only snowmobiles were this severe (McClure and Davis 2008; Davis 2007). Although the 2007 FEIS predicted that a snowcoaches-only management system would have moderate or less impacts on wildlife, the NPS remains concerned about the potential impacts of conversion to snowcoaches as the only form of winter transportation in Yellowstone. Such a management scheme could even result in major impacts, considering that coach numbers could increase four-fold over recent use levels.
- With the increase of snowcoach numbers from an average of 15 per day historically to a peak day of 60 last winter, park staff have become increasingly concerned about damage to snow roads (Van De Polder 2006). Both snowmobile

and snowcoach use wears on the snow road surface. Snowmobiles tend to create moguls or bumps, while snowcoaches create ruts, especially heavier coaches operating in soft snow conditions (Alger et al. 2002). These ruts can be several inches deep, making travel challenging and sometime hazardous. This has become more pronounced as coach numbers have increased and their size and weight (in pounds per square inch) has also increased. That is why the NPS imposed a size and weight limit on coaches. Allowing coach numbers to quadruple (as alternative 2 in the 2007 EIS would have allowed) could exacerbate the safety issue.

- Snowmobiles offer a different experience to park visitors—an experience that, in some ways, is more directly connected to nature—than snowcoaches do. The regulated use of snowmobiles (i.e., with BAT and guide restrictions) promotes the enjoyment of park resources and values in a different, and appropriate, way than do snowcoaches. Converting to snowcoaches-only would diminish the ways in which NPS can promote the appropriate enjoyment of park resources.

Alternatives with higher numbers of snowmobiles or snowcoaches.

Some stakeholders have consistently desired alternatives allowing higher numbers of snowmobiles, while others have desired higher numbers of snowcoaches. Alternatives with higher numbers of vehicles (540, 720, 1025 snowmobiles; 120 snowcoaches) were identified in the 2007 EIS as having major adverse impacts. Specifically, all of these limits were modeled to incur major sound impacts because they would be audible too much of the day or would have high sound levels, and 1025 snowmobiles was modeled to have major air quality impacts because of the amount of carbon monoxide produced. In addition, because of concerns with the levels of impacts on wildlife, air quality, and soundscapes associated with the 540-snowmobile limit in the 2007 FEIS expressed by the U.S. District Court for the District of Columbia in its recent opinion, that level was not considered in this EA. Therefore, no alternatives allowing higher amounts of oversnow vehicle use were considered in this EA.

Alternatives with lower numbers of snowmobiles or snowcoaches.

Other stakeholders have suggested alternatives with lower numbers of snowmobiles or snowcoaches allowed into the park on a daily basis. Although such alternatives might meet the purpose and need for this EA, they would unnecessarily limit the amount of visitor use and access of the park. Additionally, as revealed in this EA, both snowmobiles and snowcoaches have environmental impacts, although the kinds of impacts are somewhat different. Reducing one form of visitation severely would likely mean an increase in the other form; doing such would mean that some impacts would be too severe, while balancing winter use between the two forms of visitation reduces the impacts of each form of transportation to acceptable levels. For example, converting all visitation to only snowcoaches or only snowmobiles could result in major soundscapes impacts, while balancing use between the two forms of access reduces the distinctive soundscapes impacts of each to acceptable levels (see *Affected Environment* for more discussion of their soundscape impacts).

Return to the 1983 regulations guiding winter use in the parks/remove limits to visitor use and eliminate best available technology requirements on some or all routes and for some or all visitors.

These regulations are supported by the 1990 *Winter Use Plan Environmental Assessment*. They restrict snowmobile use to designated routes in the parks. However, the 1983 regulations describe a type and amount of snowmobile use that was found to constitute impairment of park resources and values in the 2000 Record of Decision and the 2003 SEIS and 2007 EIS. This alternative may not be legally permissible and thus does not meet the purpose and need's criteria for detailed consideration in this EA.

Allow unguided and non-commercially guided snowmobile use.

A number of commentors have presented suggestions for varying levels of unguided and/or non-commercially guided tours, ranging from 20 to 100 percent. Because the U.S. District Court for the District of Columbia identified concerns with snowmobile impacts upon wildlife as one of the reasons in its decision, and because unguided snowmobilers can contribute disproportionately to such impacts (because unguided snowmobilers may not know how to minimize their impacts upon wildlife), provisions for any unguided or non-commercially guided snowmobile use were not considered.

Establish a monorail system in Yellowstone.

Constructing a monorail in Yellowstone would be prohibitively expensive, particularly given Yellowstone's seismically active nature, unstable thermal ground, harsh weather, and remoteness. A 1994 study, for example, estimated the cost of building a 16-mile monorail through Hayden Valley at $880 million (BRW Inc. 1994). Ongoing maintenance costs would be exorbitant in Yellowstone's harsh climate. Many of these costs would have to be passed on to the visitor, which would dramatically increase the cost of a Yellowstone visit, making it unaffordable for many. Further, the visitor experience would be substantially altered, as a monorail could only stop and discharge passengers at fixed locations (unlike snowcoaches, buses, or automobiles, which may stop almost anywhere), and the monorail would physically distance visitors from the natural world much more than any other mode of transportation. Additionally, even though such a monorail would presumably be constructed on or near existing roadways, its intrusion upon the landscape would be far greater than that of contemporary roadways and traffic in the parks (BRW Inc. 1994). Such limitations of the visitor experience and visual intrusions could constitute an unacceptable impact or impairment of park resources, which would violate the purpose of this EA. Finally, it is uncertain whether wildlife would learn to pass under the monorail system. If they did not, one of the needs for this EA would not be addressed. In any event, the monorail could not possibly be constructed prior to December 15, the normal start to the winter season, presenting another reason that this alternative would not meet the purpose and need for this EA. Therefore, this alternative is dismissed.

Plow park roads and allow private vehicles on them.

The idea of plowing Yellowstone's roads in winter was first suggested in 1932, has been debated numerous times since then, and was an alternative in both the 2007 EIS and the 2000 EIS (plowing only roads on the west side of Yellowstone, not those on the east or south sides, which receive much more snow). Plowing the west-side roads, which receive

a moderate amount of snow, is quite feasible. However, given the temporary intent of this EA and the fact that most winter snowmobile and snowcoach operators have already purchased machines for use this winter, plowing park roads in the next three years would present undue hardships on these businesses. Although many snowcoaches could be used on plowed roads because many are converted passenger vans, not all can be, and snowmobiles cannot be used on plowed roads. Consequently, these businesses would lose substantial investments that they were justified in making, given the assumption that the 2007 Final Rule would actually be implemented in the parks. In addition, the *Master Plan* identifies that the park will have an oversnow motorized winter season (for perspective on the *Master Plan* and the era in which it was written, see Yochim (in press)). It would be more appropriate to amend the *Master Plan* through a long-term planning document. Finally, converting to plowed roads with just a month's notice would add more uncertainty to an issue already clouded by great levels of uncertainty in the last five years. For these reasons, the idea of plowing park roads is dismissed.

Nothing in this discussion is meant to preclude plowing park roads in the event of an emergency or insufficient snowfall.

Options for management of Cooke Pass to the east of Cooke City, Montana.

Because this road is outside of Yellowstone and the roadbed is not owned by the park, the NPS does not have management authority over its operation. Therefore, this alternative is outside of the scope of this EA. However, the NPS will work with the decision makers (the States of Wyoming and Montana, the Federal Highway Administration, and the United States Forest Service) to evaluate year-round plowing of the eight miles of road between Cooke City, Montana and the Pilot Creek Pit area in Wyoming (over Cooke Pass) should this become a possibility.

Remove limits on snowmobile use on Jackson Lake.

Because snowmobile noise travels great distances over flat ice, allowing unlimited numbers of snowmobiles on Jackson Lake would result in unacceptable impacts upon Grand Teton's natural soundscape. Consequently, this suggestion would not meet the purpose or need of this EA.

Re-evaluate non-motorized winter use activities in Grand Teton.

This EA will not reevaluate measures previously adopted for the regulation and facilitation of non-motorized activities in Grand Teton National Park such as trail marking, grooming, or areas available (and not available) for cross-country skiing, snowshoeing, or similar activities.

Allow snowplane use on Jackson Lake and OSV use on Teton Park Road.

This EA will not reevaluate decisions about the management of winter recreational use that have already been implemented. This includes the prohibition of snowplanes on Jackson Lake and motorized activities on Teton Park Road. Snowplane use on Jackson Lake was found to impair park resources and values in the analysis for the 2000 EA and the NPS supports the validity of that study. The prohibition on such use was upheld by the U.S. District Court for the District of Wyoming; the plaintiffs have appealed this decision and the appeal is pending. Changes to discontinue snowmobile use of the Teton Park Road were made before the 2002-2003 season began, and will also not be

reconsidered. Both of these decisions were supported by the analysis in the 2000 EIS, which remains relevant and is incorporated by reference.

Prohibit cross-country skiing on routes groomed for oversnow vehicle travel.

The NPS currently allows cross-country skiing, snowshoeing, and walking on its groomed OSV routes. Such uses are little different than pedestrian use of roadways in summer. Under most alternatives, the continued use of commercial guides in Yellowstone creates large windows of time free of motorized traffic on the roads, reduces conflicts between user groups, and improves safety. Guides are trained to navigate around pedestrians safely and in a manner that reduces disturbances to all users. Prohibiting such use would not meet the purpose of this EA, because it would unnecessarily restrict the range of visitor activities.

Alternate periods (days or weeks) of motorized and non-motorized use.

Effective management of concessions, businesses, and park facilities demands a level of consistency within and between seasons and in use and types of use from year to year. Further, visitors need a level of predictability in making their travel plans. This alternative would be too logistically difficult to implement and would not provide the range of activities desired in the purpose of this EA.

Designate an area either inside or outside of Yellowstone as an off-trail or extreme snowmobiling area.

Off-trail use of snowmobiles in national parks is prohibited by Executive Order 11644 and its implementing regulations. Although the NPS does not have management authority outside of national parks, many off-trail areas already exist in other areas near the parks.

Consider managing all snowmobiles by a daily or annual group limit.

Although the analysis for the 2007 FEIS included this concept, as well as the suggested group size of 6 snowmobiles, the EIS did not adopt this idea. The NPS believes that for the alternative that allows snowmobile use in the parks, allocating a set number of snowmobile entries per entrance provides guides and visitors with the greatest flexibility. Under a daily group limit, some groups would not be filled to the group size limit (for example, if the group size limit were 6, some groups would be only four snowmobiles in size, or three, or two, etc.). Managing visitor use by a daily entrance limit would allow more visitors to tour the park. Additionally, minimum and maximum group sizes were successfully utilized for the duration of the Temporary Plan; these same limits are carried forward in the preferred alternative. Also, an inherent part of the analysis, especially for soundscapes, was the concept of grouping snowmobiles.

Allow snowbikes on snowroads.

A comment during public review of the 2007 DEIS suggested the parks allow snowbikes. Snowbikes are modified bicycles with large, low-pressure tires to facilitate use on groomed routes. The NPS believes that the use of snowbikes could conflict with and/or create safety hazards along routes on which substantial numbers of snowmobiles and snowcoaches operate, such as the groomed roads in Yellowstone. Within units of the

National Park System, bicycles may only be used on park roads, parking areas, and on routes designated for such use by special regulation. The NPS may consider whether the use of snowbikes would be appropriate on certain groomed roads in Grand Teton where conflicts with oversnow vehicles, other visitors, or wildlife are not an issue.

Allow a variable daily limit.

This alternative would allow more vehicles on holidays and weekends and fewer during mid-week periods. This concept was set aside because of the administrative challenge of overseeing variable limits and because of the potential for major adverse impacts on the higher user days and denying even more people access on mid-week days. Historically holidays and Saturdays were the peak days, far exceeding mid-week periods. One of the changes in visitor use patterns over the past five years has been a flattening of use. Mid-week days are nearly as high as weekends, and in some weeks, Tuesday or Wednesday is the peak visitation day (this is the summer daily pattern). Thus reducing the mid-week limit significantly below 318 would turn even more people away. Increasing the holiday and weekend limit much above 318 could result in major adverse impacts on those days. Therefore this concept is not considered further in this temporary EA.

Manage using a seasonal limit.

This concept would establish a seasonal limit for the guides and outfitters and allow them to bring as many people as they wish (perhaps within some upper daily cap) per day until that allocation is consumed. This concept was explored in alternative 5 of the 2007 EIS, and it is employed by the U.S. Forest Service for some winter guiding activities in the national forests of the Greater Yellowstone Area. The result could be significantly higher numbers over the early, holiday parts of the season, with resulting major adverse impacts, and virtually no use (assuming the allocations are used up) at the end of the winter season, denying visitors access to the park throughout the winter season. Therefore this concept is not considered further in this temporary EA.

Alternative 1: Eliminate Motorized Recreational Oversnow Travel (No Action)

Chapter 36 of the Code of Federal Regulations states, “Snowmobiling is generally prohibited except on designated routes and water surfaces available for motorized use at other times” (36 CFR 2.18). Parks must designate routes for snowmobile use in order for that use to be authorized. For Yellowstone, Grand Teton and the Parkway, routes were designated for snowmobile and snowcoach use in 36 CFR Part 7 (Sections 7.13, 7.21 and 7.22). Regarding snowcoaches, the NPS general regulations state (at 36 CFR 1.2 (c)) that the regulations contained in part 7 are special regulations that may amend, modify, relax, or make more stringent the regulations contained in parts 1 through 5 of 36 CFR. Furthermore, 36 CFR 1.5(b) clearly states that designating or restricting use requires rule making. Sections 7.13, 7.21 and 7.22 of the CFR made more stringent the conditions for use of snowcoaches in the parks and authorized their use.

Oversnow vehicle use for the winter of 2007-08 was authorized under the rules published in the *Federal Register* on December 13, 2007 (72 *Federal Register* 239: 70781-70804—the final rule associated with the 2007 FEIS). That rule was vacated by the U.S. District Court for the District of Columbia, reinstating the rule from the *Temporary*

Winter Use Plan of 2004 (69 *Federal Register* 217: 65348-65366). That rule is still valid, but it only provided for oversnow vehicle use—either snowmobile or snowcoach—for three winters, through the winter of 2006-07. Therefore, in the absence of any action on the part of the agency, these means of motorized oversnow access to the park are no longer authorized; no form of oversnow vehicle use can be permitted for the winter of 2008-09 forward. Continued snowmobile and/or snowcoach use of the parks requires action (rulemaking and associated analysis) on the part of the NPS. Thus, the no action alternative would have neither snowmobile nor snowcoach use in the parks. Alternative 1 represents the continuation of current management direction and regulation, and is therefore the "no action" alternative.

Alternative 1 most specifically addresses the purpose and need related to park resource and values, and bison in particular. In Yellowstone, the primary visitor access would be via wheeled vehicles from Yellowstone's North to Northeast Entrances. The balance of Yellowstone would be accessible for skiing and snowshoeing. In Grand Teton, traditionally plowed roads would continue to be plowed for wheeled vehicle access and certain short access routes would remain open for snowmobile travel. The backcountry would remain open throughout both parks.

Key Actions

Routes: No recreational snowmobile or snowcoach use would be allowed in any of the parks, except snowmobiles operating on these short routes in Grand Teton:

- On the CDST between the east boundary of GTNP and the Buffalo Fork River.
- From the parking area at Shadow Mountain directly along the unplowed portion of the road to the east park boundary.
- Along the unplowed portion of the Ditch Creek Road directly to the east park boundary.

The superintendent may open or close these oversnow routes, or portions thereof, after taking into consideration the location of wintering wildlife, adequate snowpack, public safety, and other factors. Notice of such opening or closing would be provided by one or more of the methods listed in 36 CFR 1.7(a).

The following roads in Yellowstone would continue to be plowed:

- From the North Entrance to Mammoth Hot Springs
- From Mammoth Hot Springs to the Upper Terrace Drive
- From Mammoth Hot Springs to Tower Junction and the Northeast Entrance
- Roads within the developed areas at Mammoth Hot Springs, Tower Ranger Station, Lamar Ranger Station, Northeast Entrance, and Gardiner.

In GTNP and the Parkway, the following roads would continue to be plowed:

- Highway 26/89/191, from the south boundary of GTNP to Moran
- Highway 89/191/287, from Moran to Flagg Ranch
- Highway 26/287, from Moran to the east boundary of GTNP

- Teton Park Road, from Moose Junction to Taggart Lake Trailhead
- Teton Park Road, from Jackson Lake Junction to Signal Mountain Lodge
- Pacific Creek Road, from Highway 89/191/287 to the GTNP boundary
- Gros Ventre Road, from Gros Ventre Junction to east boundary, via Kelly and Kelly Warm Springs
- The road from Kelly to end of pavement, approximately two miles north of Mailbox Corner
- Teton Science School Road to the east boundary
- The Moose–Wilson Road, from the Granite Canyon Entrance to the Granite Canyon Trailhead

Current winter closures would remain in effect on the Snake River floodplain, the Buffalo Fork River floodplain, and the Uhl Hill area, Willow Flats, Kelly Hill, Static Peak, Prospectors Mountain, and Mount Hunt.

Motorized access to inholdings and adjacent public and private lands would continue to be available through a combination of plowed roads for wheeled vehicles and staging areas for snowmobiles traveling to immediately adjacent lands.

Reasonable and direct access to adjacent public and private lands, or to privately owned lands within the park with permitted or historical motorized access, would continue via paved and plowed routes or via oversnow routes from GTNP.

Destination and support facilities may continue to be provided at Moose Triangle X, Colter Bay, and Flagg Ranch, and warming hut facilities may be available along the Teton Park Road to provide visitor services and interpretive opportunities.

Non-Motorized Access

The parks' backcountry would remain open for non-motorized access. In Yellowstone, backcountry non-motorized use would continue to be subject to the Winter Severity Index program. The program restricts backcountry use of the park when winter snowpack and weather conditions become severe and appear to be adversely affecting wildlife.

In Yellowstone, groomed ski routes and boardwalks accessible from the Gardiner to Cooke City road could remain groomed or shoveled. In Grand Teton, the Teton Park Road may continue to be groomed.

Actions and Assumptions Common to all Park Units

Emergency Action

None of the actions in this alternative preclude closures for safety, resource protection, or other reasons as identified in 36 CFR 1.5 or 2.18. The superintendents would continue to have the authority under 36 CFR 1.5 to take emergency actions to protect park resources or values.

Administrative Use

Non-recreational, administrative use of snowmobiles would be allowed by park personnel or parties duly permitted under the provisions of 36 CFR 1.5 and 1.6. Permitted parties must meet BAT requirements (as described in Alternative 2) unless specifically authorized otherwise by the park superintendent. Such use would not be subject to guiding requirements.

Administrative use of snowmobiles may be supplemented with administrative snowcoaches. When administrative snowmobiles are necessary, the NPS would generally use BAT snowmobiles. Some non-BAT snowmobiles would be permitted for law enforcement, search and rescue, and other administrative purposes on a limited basis.

Contractors, researchers, and other partners working in the parks would be encouraged to use snowcoaches and they would be required to use BAT snowmobiles unless non-BAT machines are necessary for a particular project and are approved in advance of use by the NPS. The need for non-BAT machines outside the parks does not constitute a reason to use the non-BAT snowmobile in the park when a BAT snowmobile or snowcoach would suffice.

NPS employees and their families living in the interior of Yellowstone (and their visitors) may continue to use snowmobiles. Subject to available funding, the NPS would provide BAT snowcoaches and snowmobiles for employee use. In order to encourage the conversion of all employee-owned snowmobiles to BAT by 2011-2012 (after the term of this temporary plan), the NPS would encourage employees to replace their non-BAT machines during the life of this plan. It is expected that beginning in the 2011-2012 season, all employee-owned snowmobiles operated in the parks must meet BAT requirements, and visitors to these employees must also use BAT snowmobiles or snowcoaches.

Concessioners and their employees and families living in the interior of Yellowstone (and their visitors) may continue to use snowmobiles. To the extent practicable (through permits and contracts), concessioners, their employees and families would be required to use BAT snowmobiles and encouraged to use snowcoaches. In order to encourage the conversion of all concession employee-owned snowmobiles to BAT by 2011-2012 (after the term of this temporary plan), the NPS would encourage concession employees to replace their non-BAT machines during the life of this plan. It is expected that beginning in the 2011-2012 season, all concession employee-owned snowmobiles operated in the parks must meet BAT requirements, and visitors to these concessioner employees must also use BAT snowmobiles or snowcoaches.

Administrative oversnow vehicle travel by NPS employees, their families, and their guests and by concession employees, their families, and their guests would occur only on groomed roads that meet safety criteria and are open for travel.

Plowed Roads

Sand, or an equally environmentally neutral substance, may be used for traction on all plowed winter roads. No salts would be used, and sand would be generally spread only in the shaded, icy, or hilly areas of plowed roads. Before spring opening, sand removal operations would be conducted on all plowed park roads.

Accessibility

This alternative continues implementation of transition and action plans for accessibility and support the philosophy of universal access in the parks. The NPS would make reasonable efforts to ensure accessibility to buildings, facilities, programs, and services.

The NPS would develop strategies to ensure that new and renovated facilities, programs, and services (including those provided by concessioners) are designed, constructed, or offered in conformance with applicable policies, rules, regulations, and standards, including but not limited to the Architectural Barriers Act of 1968, the Americans with Disabilities Act of 1990, the Uniform Federal Accessibility Standards of 1984, and the Guidelines for Outdoor Developed Areas of 1999. The NPS would evaluate existing buildings and existing and new programs, activities, and services, including telecommunications and media, to determine current accessibility and usability by disabled winter visitors. Action plans to remove barriers would be developed.

Personal Protective Equipment

Personal protective equipment is recommended for snowmobilers, including helmet, snowmobile suit and gloves, proper footwear, and hearing protection. Persons traveling by snowcoach should also wear or have access to appropriate personal protective equipment including winter clothing, footwear, and hearing protection. Non-motorized users are also recommended to wear and carry personal protective equipment as appropriate for their winter travel. For all user groups, personal protective equipment should include avalanche rescue gear (shovel, probe, and transceiver) as appropriate.

Mitigating Measures/Monitoring

Monitoring of Winter Visitor Use and Park Resources

In addition to the mitigating measures above, scientific studies and monitoring of winter visitor use and park resources (including air quality, natural soundscapes, wildlife, employee health and safety, water quality, and visitor experience) would continue. Selected areas of the parks, including sections of roads, may be closed to visitor use if studies indicate that human presence or activities have unacceptable effects on wildlife or other park resources that could not otherwise be mitigated. The appropriate level of environmental analysis under NEPA would be completed for all actions as required by the Council on Environmental Quality regulations (40 CFR 1500–1508). A one-year notice would be provided before any such closure would be implemented unless immediate closure is deemed necessary to avoid impairment of park resources.

A Monitoring and Adaptive Management Program is a key element of this Alternative (see Appendix B). Generally non-emergency changes in park management implemented under the adaptive management program would be implemented only after at least one or two years of monitoring, followed by a 6- to 12-month notification and waiting period. The superintendents would continue to have the authority under 36 CFR 1.5 to take emergency actions to protect park resources or values.

Wildlife

Bison and Roads

The NPS would implement the research proposal by Robert A. Garrott and P.J. White entitled "Evaluating Key Uncertainties Regarding Road Grooming and Bison Movements" (at http://www.nps.gov/yell/parkmgmt/winterusetechnicaldocuments.htm). This proposal specifically addresses the uncertainty recognized in the 2007 FEIS as to whether grooming of the Madison to Norris road segment (Gibbon Canyon) has led to alterations of bison movements and distribution in Yellowstone, a question identified in the report by Cormack Gates et al., "The Ecology of Bison Movements and Distribution In and Beyond Yellowstone National Park" (2005, posted at above site).

Garrott and White propose to analyze existing data on GPS-collared bison, track additional GPS-collared bison for 5 years, and deploy cameras along travel routes to gain information on the relationship between road grooming and bison travel without closing the Gibbon Canyon Road to motorized oversnow administrative vehicle travel (during this five-year period).

During the five year period, other roads or routes may be investigated to help describe the relationship between snow depth, grooming, and bison movement. For example, the Firehole Canyon Drive may be closed to oversnow travel, forcing bison to travel cross country or along the ungroomed Firehold Canyon Drive. Similarly, the Madison to Norris Road may be fenced or gated in the vicinity of the new bridge over the Gibbon River (proposed to be built in 2009) to restrict bison movement on the groomed roadway and force bison to travel cross country (while permitting snowmobile and snowcoach travel). Thus bison movement and snow depth and roads may be tested without closing a main road.

After five years of such data gathering and analysis (beyond the term of this temporary plan), the NPS would consider closing the main road between Madison and Norris in its entirety to observe bison response. It is uncertain until the five-year period of data gathering and analysis has finished whether such closure would yield informative data or conclusions. Such a closure, if determined to be appropriate, would likely be a multi-year closure.

Other recommendations of the Gates report would be evaluated as part of Yellowstone's bison management program.

Other Wildlife, Including Federally Protected Species and Species of Special Concern

At periodic intervals when snow depth warrants, routine plowing operations would include laying back roadside snow banks that could be a barrier to wildlife exiting the road corridor.

NPS personnel would patrol sensitive resource areas to ensure compliance with area closures.

The parks would continue to support the objectives of the Greater Yellowstone Bald Eagle Management Plan, and the eagle population would continue to be monitored to identify and protect nests.

Monitoring of wolves would continue.

Monitoring of grizzly bear populations would continue in accordance with the Interagency Grizzly Bear Management Guidelines and the parks' bear management plans.

Wildlife-proof garbage holding facilities for interior locations would be provided as part of regularly-occurring park operations.

Monitoring and protection of trumpeter swan habitats and nests would continue, including the closure of nest sites to public access when warranted.

Monitoring potential or known winter use conflicts would result in area closures if necessary to protect wildlife and their habitat.

If monitoring indicates that undesirable impacts are occurring, further measures including avoiding, minimizing, rectifying, reducing, or compensating for those impacts would be identified and taken.

Cultural Resources

If human remains, funerary objects, sacred objects, or objects of cultural patrimony are discovered, applicable provisions of the Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001) would be followed.

Water Resources

Best management practices would be used during the construction, reconstruction, or winter plowing of trails and roads to prevent unnecessary vegetation removal, erosion, and sedimentation.

Water resource monitoring, which has not indicated a problem in recent years, would continue on an as-needed basis. If necessary, best management practices would be implemented.

Alternative 2: Continue Recent Use Levels (Preferred Alternative)

Description of the Alternative

Alternative 2 would allow 318 snowmobiles and 78 snowcoaches in Yellowstone and 50 snowmobiles in Grand Teton. These numbers are a reflection of the recent (previous five years) use trends in the parks, especially snowmobile use trends in Yellowstone. There has been a 3.6% average annual increase in daily snowmobile use since 2003-2004. The 318 number represents a maximum 8.2% increase over the next three years compared to the 2007-2008 average of 294 snowmobiles and 35 snowcoaches per day. Snowmobile numbers have averaged between about 240 and 300 for this time period, with the higher numbers seen in the last two years. This alternative would approximate that level of usage while allowing for a small level of potential growth.

Because there have been several winters with use approximating that proposed in this alternative, the NPS has actual use and monitoring information for snowmobile use levels at about 318 per day to rely upon for the analysis. That monitoring information did not indicate major adverse effects from current use levels.

One of the objectives of this EA was to provide an interim winter use plan that would have no significant impacts on park resources or values. A snowmobile use level of 318 was analyzed in the 2004 EA (also Alternative 2 in that plan), and the impacts of the alternative in that analysis were no more than moderate. Due to the short time frame for this EA, it was practical and reasoned to develop an alternative at the 318 snowmobile use level that could use previous analysis in the 2004 EA and current monitoring information.

This proposed level of use also derives from the number of snowmobile outfitters at Yellowstone's various entrances, and is specifically calculated as shown in the following table:

Table 2-1: Snowmobile limits and allocations for Alternative 2.

Entrance	Number of Snowmobile Guide Companies Under Permit or Contract to NPS	Snowmobiles authorized per Company under Alternative 2	Total
West	8	20	160
South	12 (including Flagg Ranch)	9 (with an allocation of 15 to Flagg Ranch)	114
East	1	20	20
North	1 (Xanterra)	12	12
Old Faithful	1 (Xanterra)	12	12
Total			318

Seventy-eight snowcoaches are currently permitted in Yellowstone. This alternative would carry forward the same number of snowcoaches because NPS is midway through 10-year contracts with concessioners.

For Yellowstone National Park all snowmobiles would be required to meet NPS Best Available Technology (BAT) requirements for air and sound emissions and all snowmobilers would have to travel with a commercial guide. This alternative would also manage several side-roads with temporal and spatial zoning to facilitate a variety of uses (some side-roads would be snowcoach-only in the mornings or all day, while others would be open to all OSVs all day).

Sylvan Pass would be open for oversnow travel (both motorized and non-motorized) from December 22 through March 1 each winter, subject to weather-related constraints and NPS fiscal, staff, infrastructural, equipment, and other safety-related capacities. A combination of avalanche mitigation techniques may be used, including forecasting and helicopter and howitzer dispensed explosives. The results of previous safety evaluations of Sylvan Pass by the Occupational Safety and Health Administration (OSHA) and an Operational Risk Management Assessment (ORMA) would be reviewed and updated, and the NPS would evaluate additional avalanche mitigation techniques and risk assessment tools to further improve safety and visitor access.

From March 2 to March 15, the NPS would maintain the road segment from the East Entrance to a point approximately four miles west of the entrance station to provide for

opportunities for cross-country skiing and snowshoeing. Limited snowmobile and snowcoach use would be allowed in order to provide drop-offs for such purposes.

This alternative includes an intensive monitoring and adaptive management program, outlined in Appendix B. The NPS would continue monitoring of park resources and values, including air quality, natural soundscapes, wildlife, employee health and safety, and visitor experience. This would provide the NPS with the ongoing information necessary to assess the impacts resulting from implementation of this alternative on park resources and values, and visitor access, and to make adjustments, as appropriate, in winter use management. The thresholds within the adaptive management framework are a tool for managers to help them determine if the goals and objectives of the winter use plans are being achieved. Managers would use monitoring results, along with changes in technology and other new information, to help inform future actions. Managers have at their disposal a wide variety of tools. Some of the management techniques available include adjustments in snowmobile or snowcoach use levels (up or down), adjustment in BAT requirements, visitor and guide education, timing of entries, and group sizes. Through adaptive management, if monitoring of use levels of snowmobiles and snowcoaches allowed under this alternative indicates acceptable conditions, the NPS would increase use levels to the extent acceptable conditions can be maintained. Conversely, if monitoring of use levels of snowmobiles and snowcoaches allowed under this alternative indicates unacceptable conditions, the NPS would reduce use to the levels at which acceptable conditions can be maintained.

In Grand Teton National Park, 25 snowmobiles would be allowed on Jackson Lake each day in order to provide access for ice fishing, subject to the condition that they meet BAT requirements for air and sound emissions and their operators be in possession of a valid Wyoming fishing license. The use of snowmobiles on Jackson Lake may be adjusted up or down by the Superintendent depending on the results of monitoring and adaptive management. A maximum of 40 per day would be allowed. The use of snowmobiles not meeting BAT requirements would continue to be allowed on certain designated routes in order to access inholdings or adjacent public and private lands. The interim, or three year limit, would not apply in Grand Teton.

Within the John D. Rockefeller, Jr. Memorial Parkway, 25 snowmobiles would be allowed to access the Grassy Lake Road at Flagg Ranch each day. The BAT requirement would not apply to snowmobiles using the Grassy Lake Road, and the daily entry limit would apply to snowmobiles originating a trip at Flagg Ranch. The interim, or three year limit would not apply in the Parkway.

The Continental Divide Snowmobile Trail (CDST) within both Grand Teton and the Parkway is a portion of a much longer trail that extends through northwest Wyoming to the Pinedale and Lander areas. Except for the segment of the CDST between the east boundary of Grand Teton and the vicinity of Moran Junction, this route would no longer be designated for snowmobile use, in essence converting it to a trailered segment of the CDST. Snowmobiles could be hauled by trailer between Moran Junction and Flagg Ranch, at that point connecting with the Grassy Lake Road and oversnow access to points in the Caribou-Targhee National Forest and beyond.

Key Actions

Actions Specific to Yellowstone

Routes Open to Snowmobile Use

The superintendent may open or close these routes, or portions thereof, for snowmobile travel after taking into consideration the location of wintering wildlife, adequate snowpack, public safety, and other factors. Notice of such opening or closing would be provided by one or more of the methods listed in 36 CFR 1.7(a).

The following routes are designated for snowmobile use:

- Grand Loop Road, from its junction with Upper Terrace Drive to Norris Junction
- Norris Junction to Canyon Junction
- Grand Loop Road, from Norris Junction to Madison Junction
- West Entrance Road, from the park boundary at West Yellowstone to Madison Junction
- Grand Loop Road, from Madison Junction to West Thumb
- South Entrance Road, from the South Entrance to West Thumb
- Grand Loop Road, from West Thumb to its junction with the East Entrance Road
- East Entrance Road, from the East Entrance to its junction with the Grand Loop Road
- Grand Loop Road, from its junction with the East Entrance Road to Canyon Junction
- South Canyon Rim Drive
- Lake Butte Road
- Firehole Canyon Drive, from noon to 9 p.m. only
- North Canyon Rim Drive, from noon to 9 p.m. only
- Riverside Drive, from noon to 9 p.m. only
- Cave Falls Road, with no BAT or guiding requirement, and a daily entry limit of 50 snowmobiles (which does not count against the 318 total in Yellowstone)
- Roads in the developed areas of Madison Junction, Old Faithful, Grant Village, West Thumb, Lake, East Entrance, Fishing Bridge, Canyon, Indian Creek, and Norris.

Routes Open to Snowcoach Use

The superintendent may open or close the following oversnow routes, or portions thereof, or designate new routes for snowcoach travel after taking into consideration the location of wintering wildlife, adequate snowpack, public safety, and other factors.

Notice of such opening or closing would be provided by one or more of the methods listed in 36 CFR 1.7(a).

All routes designated for snowmobile use are also open to snowcoach use. In addition, the following routes are open to snowcoaches:

- Firehole Canyon Drive, all day (7 a.m. to 9 p.m.)
- Fountain Flat Road
- North Canyon Rim Drive, all day (7 a.m. to 9 p.m.)
- Riverside Drive, all day (7 a.m. to 9 p.m.)
- Grand Loop Road from its junction with Mammoth Terrace Drive to its junction with North Entrance Road (rubber-tracked coaches only)
- Roads in the developed area of Mammoth Hot Springs (rubber-tracked coaches only)
- Grand Loop Road, from Canyon Junction to the Washburn Hot Springs overlook.

Guiding Requirements

All snowmobilers in Yellowstone, except those on the Cave Falls Road, would be required to travel with a commercial guide who is affiliated with a commercial guiding service that is authorized by contract to operate in the park.

No more than eleven snowmobiles would be permitted in a group including at least one commercial guide. That is, group numbers include the commercial guide sled(s).

All snowcoaches operating in the park would have to operate in accordance with a concessions contract. Private snowcoaches would not be allowed.

All businesses providing commercial guiding services and other commercial services in the park are required to have contracts authorizing their operation.

Snowmobile and Snowcoach Limits

Table 2-2: Yellowstone Daily Snowmobile and Snowcoach Entry Limits

Entrance	Commercially Guided Snowmobiles	Commercially Guided Snowcoaches
West Entrance	160	34
South Entrance	114	13
East Entrance	20	2
North Entrance	12	13
Old Faithful	12	16
Total	318	78

Plowed Roads

The following roads in Yellowstone would continue to be plowed:

- From the North Entrance to Mammoth Hot Springs
- From Mammoth Hot Springs to the Upper Terrace Drive
- From Mammoth Hot Springs to Tower Junction and the Northeast Entrance
- Roads within the developed areas at Mammoth Hot Springs, Tower Ranger Station, Lamar Ranger Station, Northeast Entrance, and Gardiner.

Non-Motorized Access

Backcountry non-motorized use would continue to be allowed throughout the park (see the "sensitive areas" exception below), subject to the Winter Severity Index program. The program restricts backcountry use of the park when winter snowpack and weather conditions become severe and appear to be adversely affecting wildlife.

Snow road edges may continue to have track set for skiing where feasible.

About 35 miles of roads would continue to be groomed for cross-country skiing in Yellowstone. These are mainly roads used by summer vehicles, but which are closed to oversnow vehicle travel. These roads may continue to be machine groomed for skiing. Existing and new routes could be evaluated in the future, and changes announced through one or more of the methods listed in 36 CFR 1.7(a). The Virginia Cascades Road in Yellowstone may be groomed for skiing.

Ski and snowshoe use of the South Entrance Road and East Entrance Road, as noted above, would be allowed to continue after the balance of roads close to winter operations (during spring plowing). When spring plowing operations approach the entrances, the roads would then be closed to skiing and snowshoeing for safety concerns. Bear management closures of the park's backcountry would continue as in previous years.

Sensitive areas within the inner gorge of the Grand Canyon of the Yellowstone and the McMinn Bench bighorn sheep area would continue to be closed to recreational winter use.

East Entrance Road

Sylvan Pass would be open for oversnow travel (both motorized and non-motorized) for a limited core season, from December 22 through March 1 each winter, subject to weather-related constraints and NPS fiscal, staff, infrastructural, equipment, and other safety-related capacities. A combination of avalanche mitigation techniques may be used, including forecasting and helicopter and howitzer dispensed explosives. The results of previous safety evaluations of Sylvan Pass by OSHA and an Operational Risk Management Assessment would be reviewed and updated, and the NPS would evaluate additional avalanche mitigation techniques and risk assessment tools in order to further improve safety and visitor access.

From March 2 to March 15, the NPS would maintain the road segment from the East Entrance to a point approximately four miles west of the entrance station to provide for opportunities for cross-country skiing and snowshoeing. Limited snowmobile and snowcoach use would be allowed in order to provide drop-offs for such purposes. In addition, from March 2 to March 15, the road segment between Fishing Bridge and Lake Butte Overlook would be maintained for oversnow vehicle travel, subject to weather-related safety constraints.

Speed Limits

The speed limit from the West Entrance to Madison to Old Faithful would remain at 35 mph. The remaining snow-roads have a 45 mph limit, except where posted at lower speeds in designated segments to protect wildlife and natural soundscapes and to enhance visitor safety.

Winter Oversnow Vehicle Season

In general, Yellowstone's winter season would begin December 15 and close March 15 each year. Actual opening or closing dates for oversnow travel would be determined by adequate snowpack or snow water equivalency. Early closures of the Grand Loop Road, from its junction with Upper Terrace Drive to Madison Junction and from Norris Junction to Canyon and Fishing Bridge Junction, would occur to facilitate spring plowing. To protect road surfaces, the NPS would continue to implement temporary vehicle type restrictions (for example, rubber-tracked vehicles only), as necessary. As discussed above, Sylvan Pass would be open for a limited core season, from December 22 to March 1 each year, subject to weather-related safety constraints and NPS fiscal, staff, infrastructural, equipment, and other safety-related capacities.

In Yellowstone, the NPS would continue to plow the roads from Gardiner to Mammoth, Mammoth to Tower, and Tower to the Northeast Entrance (Cooke City) throughout the winter. U.S. Highway 191 would continue to be plowed in Yellowstone. Rubber tracked vehicles would not be allowed on these roads.

Facilities

Warming huts may be available for visitor use at Old Faithful, Norris, Madison, Canyon, Fishing Bridge, Indian Creek, Mammoth Terraces, and other appropriate sites.

Actions Specific to Grand Teton and the Parkway

Routes Open to Snowmobile Use

The superintendent may open or close these routes, or portions thereof, for snowmobile travel and may establish separate zones for motorized and non-motorized use on Jackson Lake, after taking into consideration the location of wintering wildlife, adequate snowpack, public safety and other factors. Notice of such opening or closing would be provided by one or more of the methods listed in 36 CFR 1.7(a).

The following routes are designated for snowmobile use:

- The CDST along U.S. 26/287, from the east boundary of GTNP to the vicinity of Buffalo Fork River.
- In the developed area of Flagg Ranch.

- U.S. 89/191/287 from Flagg Ranch to the north boundary of the Parkway.
- Grassy Lake Road (Flagg-Ashton Road), from Flagg Ranch to the west boundary of the Parkway.
- The frozen surface of Jackson Lake for purposes of ice fishing by persons possessing a valid Wyoming state fishing license and the proper fishing gear. Jackson Lake would be open generally from the time that the ice reaches sufficient thickness to make the lake safe for snowmobile use. The season would extend until late March or early April, depending on lake conditions, public safety, and resource concerns.

Routes Open to Snowcoach Use

The superintendent may open or close these oversnow routes, or portions thereof, or designate new routes for snowcoach travel after taking into consideration the location of wintering wildlife, adequate snowpack, public safety, and other factors. Notice of such opening or closing would be provided by one or more of the methods listed in 36 CFR 1.7(a).

- U.S. Highway 89/191/287, from Flagg Ranch to the north boundary of the Parkway.
- In the developed area of Flagg Ranch.

Guiding Requirements

Snowmobile use on Jackson Lake and the Grassy Lake Road would not require the use of commercial guides; however, requests to provide commercial guiding services would be considered by the NPS. Snowmobiles being operated between Flagg Ranch and the South Entrance of Yellowstone must be accompanied by a guide.

All snowcoaches operating in the Parkway would have to be operated in accordance with a concessions contract, or other NPS-issued permit.

Snowmobile Limits

Table 2-3: Grand Teton and the Parkway Daily Snowmobile Entry Limits

Entrance	Snowmobiles
Grassy Lake Road (Flagg-Ashton Road)	25*
Jackson Lake	25**
Total	50

* As measured by counting snowmobiles originating a westbound trip at Flagg Ranch.

** The use of snowmobiles on Jackson Lake may be adjusted up or down by the Superintendent depending on the results of monitoring and adaptive management. A maximum of 40 per day would be allowed.

Non-Motorized Access

Non-motorized winter use would continue to be managed consistent with prior decisions and rules.

Snow road edges may continue to have track set for skiing where feasible.

About 15 miles of the Teton Park Road are currently groomed for cross-country skiing in Grand Teton. This road may continue to be machine groomed for skiing.

Plowed Roads

In GTNP and the Parkway, the following roads would continue to be plowed:

- Highway 26/89/191, from the south boundary of GTNP to Moran
- Highway 89/191/287, from Moran to Flagg Ranch
- Highway 26/287, from Moran to the east boundary of GTNP
- Teton Park Road, from Moose Junction to Taggart Lake Trailhead
- Teton Park Road, from Jackson Lake Junction to Signal Mountain Lodge
- Pacific Creek Road, from Highway 89/191/287 to the GTNP boundary
- Gros Ventre Road, from Gros Ventre Junction to east boundary, via Kelly and Kelly Warm Springs
- The road from Kelly to end of pavement, approximately two miles north of Mailbox Corner
- Teton Science School Road to the east boundary
- The Moose–Wilson Road, from the Granite Canyon Entrance to the Granite Canyon Trailhead

Current winter closures would remain in effect on the Snake River floodplain, the Buffalo Fork River floodplain, and the Uhl Hill area, Willow Flats, Kelly Hill, Static Peak, Prospectors Mountain, and Mount Hunt.

Motorized access to inholdings and adjacent public and private lands would continue to be available through a combination of plowed roads for wheeled vehicles and staging areas for snowmobiles traveling to immediately adjacent lands.

Reasonable and direct access to adjacent public and private lands, or to privately owned lands within the park with permitted or historical motorized access, would continue via paved and plowed routes or via oversnow routes from GTNP.

Snowmobiles that meet the best available technology requirements would be phased in for administrative use, subject to the availability of funding during the term of this temporary plan. The NPS, and other parties authorized by the NPS, may continue to use non-BAT snowmobiles where necessary for specialized purposes, such as search and rescue, law enforcement, facility repair and maintenance, and other emergency operations.

Destination and support facilities may continue to be provided at Moose, Triangle X, Colter Bay, and Flagg Ranch, and warming hut facilities may be available along the Teton Park Road to provide visitor services and interpretive opportunities.

Winter Season

The winter use season would generally coincide with the season established for Yellowstone, from December 15 to March 15 each year. Actual opening or closing dates for oversnow travel would be determined by adequate snowpack, snow water equivalency, or the condition of the frozen surface of Jackson Lake, as applicable.

Grassy Lake Road

The approximately 6 mile portion of the Grassy Lake (Flagg - Ashton) Road within the Parkway is currently, and historically has been, groomed by the Fremont County, Idaho, Department of Parks and Recreation. The grooming of this route is performed in conjunction with grooming of the snowmobile route through the Caribou-Targhee National Forest. In the event that Fremont County ever chooses not to, or is unable to continue grooming the road, the National Park Service does not intend to undertake that responsibility. Therefore, unless another other entity were available to provide that service, that portion of the Grassy Lake (Flagg – Ashton) Road within the Parkway would no longer be designated as being open to oversnow vehicle use.

Actions and Assumptions Common to all Park Units

Emergency Action

None of the actions in this alternative preclude closures for safety, resource protection, or other reasons as identified in 36 CFR 1.5 or 2.18. The superintendents would continue to have the authority under 36 CFR 1.5 to take emergency actions to protect park resources or values.

Administrative Use

Non-recreational, administrative use of snowmobiles would be allowed by park personnel or parties duly permitted under the provisions of 36 CFR 1.5 and 1.6. Permitted parties must meet BAT requirements unless specifically authorized otherwise by the park superintendent. Such use would not count against daily recreational entry limits and would not be subject to guiding requirements.

Administrative use of snowmobiles may be supplemented with administrative snowcoaches. When administrative snowmobiles are necessary, the NPS would generally use BAT snowmobiles. Some non-BAT snowmobiles would be permitted for law enforcement, search and rescue, and other administrative purposes on a limited basis.

Contractors, researchers, and other partners working in the parks would be encouraged to use snowcoaches and they would be required to use BAT snowmobiles unless non-BAT machines are necessary for a particular project and are approved in advance of use by the NPS. The need for non-BAT machines outside the parks does not constitute a reason to use the non-BAT snowmobile in the park when a BAT snowmobile or snowcoach would suffice.

NPS employees and their families living in the interior of Yellowstone (and their visitors) may continue to use snowmobiles. Subject to available funding, the NPS would provide BAT snowcoaches and snowmobiles for employee use. In order to complete the conversion of all employee-owned snowmobiles to BAT by 2011-2012 (after this temporary plan has ended), the NPS would encourage employees to replace their non-BAT machines during the life of this plan. It is expected that beginning in the 2011-2012 season, all employee-owned snowmobiles operated in the parks must meet BAT requirements, and visitors to these employees must also use BAT snowmobiles or snowcoaches.

Concessioners and their employees and families living in the interior of Yellowstone (and their visitors) may continue to use snowmobiles. To the extent practicable (through permits and contracts), concessioners, their employees and families would be required to use BAT snowmobiles and encouraged to use snowcoaches. In order to complete the conversion of all concession employee-owned snowmobiles to BAT by 2011-2012 (after this temporary plan has ended), the NPS would encourage concession employees to replace their non-BAT machines during the life of this plan. It is expected that beginning in the 2011-2012 season, all concession employee-owned snowmobiles operated in the parks must meet BAT requirements, and visitors to these concessioner employees must also use BAT snowmobiles or snowcoaches.

Administrative oversnow vehicle travel by NPS employees, their families, and their guests and by concession employees, their families, and their guests would occur only on groomed roads that meet safety criteria and are open for travel. Between December 22 and March 1, Sylvan Pass would only be open for administrative travel when the pass is open to the public.

Hours of Operation

Motorized travel from 9 p.m. to 7 a.m. would be prohibited except for emergency purposes or when approved by the superintendent for administrative use or by special permit for necessary travel. Yellowstone's East Entrance would open to recreational snowmobile and snowcoach travel no earlier than 8 a.m.

Plowed Roads

Sand, or an equally environmentally neutral substance, may be used for traction on all plowed winter roads. No salts would be used, and sand would be generally spread only in the shaded, icy, or hilly areas of plowed roads. Before spring opening, sand removal operations would be conducted on all plowed park roads.

Accessibility

This alternative continues implementation of transition and action plans for accessibility and support the philosophy of universal access in the parks. The NPS would make reasonable efforts to ensure accessibility to buildings, facilities, programs, and services.

The NPS would develop strategies to ensure that new and renovated facilities, programs, and services (including those provided by concessioners) are designed, constructed, or offered in conformance with applicable policies, rules, regulations, and standards, including but not limited to the Architectural Barriers Act of 1968, the Americans with Disabilities Act of 1990, the Uniform Federal Accessibility Standards of 1984, and the

Guidelines for Outdoor Developed Areas of 1999. The NPS would evaluate existing buildings and existing and new programs, activities, and services, including telecommunications and media, to determine current accessibility and usability by disabled winter visitors. Action plans to remove barriers would be developed.

Personal Protective Equipment

Personal protective equipment is recommended for snowmobilers, including helmet, snowmobile suit and gloves, proper footwear, and hearing protection. Persons traveling by snowcoach should also wear or have access to appropriate personal protective equipment including winter clothing, footwear, and hearing protection. Non-motorized users are also recommended to wear and carry personal protective equipment as appropriate for their winter travel. For all user groups, personal protective equipment should include avalanche rescue gear (shovel, probe, and transceiver) as appropriate.

Measures to Minimize Environmental Harm

Best Available Technology (BAT)

If the EPA adopts standards for any class of oversnow vehicle that are more stringent than the requirements resulting from this NEPA process and decision, the EPA standards would replace the NPS standard.

The NPS recommends the use of environmentally preferred fuels and lubricants for all motorized winter vehicle use for all alternatives. For example, this could include lubricants meeting the EPA "highly biodegradable" classification, and fuels like biodiesel and ethanol blends. Additionally, the NPS encourages the use of fuel-efficient winter vehicles in the parks.

Revisions to testing procedures may be described and implemented per NPS procedures used to certify a snowmobile or snowcoach as BAT.

Individual snowcoaches or snowmobiles may be subject to periodic inspections to determine compliance with the emission and sound requirements.

Snowmobile BAT

All recreational snowmobiles operating in the parks must meet BAT requirements, except:

- Snowmobiles traveling on the Grassy Lake Road to and from Flagg Ranch would be exempt from BAT requirements.
- Snowmobiles using the Cave Falls Road in Yellowstone would not be required to be BAT.
- Snowmobiles using routes within Grand Teton established to allow access to inholdings or adjacent public or private lands.
- Snowmobiles using the portion of the CDST between the east park boundary and Moran Junction.

The superintendents would maintain a list of approved snowmobile makes, models, and years of manufacture that meet the BAT requirements and a procedure to certify a

snowmobile as BAT. The list would be posted on the park website, and notice would be provided by one or more of the methods listed in 36 CFR 1.7(a).

The NPS anticipates that snowmobile manufacturers would conduct research to continually improve sound and emissions in available machines. Information on the full spectrum of pollutant criteria is critical to prevent an inadvertent increase in some pollutants.

Once approved, a snowmobile would be certified as BAT for a period of six years. In the absence of new emissions and sound information, after six years a snowmobile make and model would no longer be BAT-certified and its use would not be allowed in the parks. In recognition of the possibility that some privately owned snowmobiles used for ice fishing on Jackson Lake may have relatively low mileage after a period of 6 years, the certification for these snowmobiles may be extended up to a total of 10 years, as long as the mileage of the individual machine does not exceed 6,000 miles.

Snowmobiles that have been modified in a manner that may affect air or sound emissions may be prohibited by the superintendent.

In addition, all critical snowmobile emission, sound and odometer-related components that were originally installed by the manufacturer must be in place and functioning properly. Such components may only be replaced with the original equipment manufacturer (OEM) component or its equivalent. If OEM parts are not available, aftermarket parts may be used if they do not worsen sound or emission characteristics.

Snowmobile Air Emissions Requirements

All snowmobiles must achieve a 90% reduction in hydrocarbons and a 70% reduction in carbon monoxide emissions, relative to EPA's baseline emissions assumptions for conventional two-stroke snowmobiles. Specifically, beginning with the 2005 model year, all snowmobiles must be certified under 40 CFR 1051 and 1065 to a Family Emission Limit no greater than 15 g/kW-hr for hydrocarbons and 120 g/kW-hr for carbon monoxide. If the existing procedures or requirements of 40 CFR 1051 and 1065 and the Family Emission Limit are superseded, all snowmobiles must be certified by their manufacturer to meet the above emission requirements.

For 2004 model year snowmobiles, measured emissions levels (official emission results with no deterioration factors applied) must comply with the emission limits specified above.

Pre-2004 model year snowmobiles may be operated only if they have been shown to have emissions that do not exceed the limits specified above.

Snowmobiles must be tested on a five-mode engine dynamometer, consistent with the existing test procedures specified by EPA (40 CFR 1051 and 1065).

Snowmobile Sound Requirements

Snowmobiles must operate at or below 73dBA as measured at full throttle according to Society of Automotive Engineers (SAE) J192 test procedures (revised 1985).

Snowmobiles may be tested at any barometric pressure equal to or above 23.4 inches Hg uncorrected (as measured at or near the test site).

The NPS recognizes that the SAE procedures changed in 2003 and are continuing to change; thus the 2003 procedures may be supplanted. The NPS intends to continue to work with industry to update the BAT sound measurement procedures. NPS would consider such new protocols or procedures as they are modified by SAE.

Snowcoach Air Emission and Sound Requirements

During the duration of this temporary plan, all non historic snowcoaches must meet air emission requirements, which will be the EPA emissions standards in effect when the vehicle was manufactured. This will be enforced by ensuring that all critical emission-related exhaust components are functioning properly. Malfunctioning critical emissions-related components must be replaced with the original equipment manufacturer (OEM) component where possible. If OEM parts are not available, aftermarket parts may be used. In general, catalysts that have exceeded their useful life must be replaced unless the operator can demonstrate the catalyst is functioning properly. Modifying or disabling a snowcoaches' original pollution control equipment is prohibited except for maintenance purposes. Individual snowcoaches may be subject to periodic inspections to determine compliance with emission and sound requirements.

However, for the duration of this plan, the NPS will encourage snowcoach operators to replace or retrofit their coaches with models that meet higher emission standards. In the 2007 FEIS, the NPS anticipated that snowcoach air and sound emission requirements would go into effect in 2011-2012, after the duration of this temporary plan. Thus these recommendations will assist snowcoach operators anticipating future possible requirements.

During these intervening years, the NPS will recommend that diesel vehicles with a Gross Vehicle Weight Rating (GVWR) of 8,500 pounds or more meet, at a minimum, the EPA 2004 "engine configuration certified" diesel air emission standards. The NPS will further recommend that diesel vehicles meet the 2007 "engine configuration certified" air emission standard. If a new vehicle is being purchased, the NPS recommends that operators confirm that the vehicle has, at a minimum, an engine that meets the 2004 standard. If it is the operator's intention to purchase a vehicle with the newest diesel emission technology, the NPS recommends that the vehicle has a "2007 standard" engine. If a diesel engine is being purchased for retrofit into an existing vehicle, the above recommendations apply. If the diesel vehicle has a GVWR between 8,500 and 10,000 pounds, there may be a configuration that meets the EPA light duty Tier II standards, which would achieve the best results from an emissions perspective.

For air emissions from gasoline vehicle air emissions, the NPS will recommend the vehicle's engine meet EPA Tier 1 emission requirements. The NPS will further recommend that gasoline vehicles meeting EPA Tier II requirements be used. If a new vehicle is being purchased, the NPS will recommend the vehicle has, at a minimum, an engine that meets the Tier I requirements or more ideally, the vehicle will meet Tier II requirements. If an existing gasoline engine and exhaust system is being retrofitted, the vehicle should have, at a minimum, a computer controlled, port-fuel injected engine and a catalytic converter in the exhaust system (Bishop 2007).

Regarding the sound emission recommendations, the NPS will recommend that new and retrofitted snowcoaches not exceed 73 dBA when measured by operating the coach at or near full throttle for the test cycle. Thus a coach might be travelling at a speed of 25-30

miles per hour for the passby test to determine if the vehicle produces no more than 73 dBA.

Monitoring of Winter Visitor Use and Park Resources

Scientific studies and monitoring of winter visitor use and park resources (including air quality, natural soundscapes, wildlife, employee health and safety, water quality, and visitor experience) would continue. Selected areas of the parks, including sections of roads, may be closed to visitor use if studies indicate that human presence or activities have unacceptable effects on wildlife or other park resources that could not otherwise be mitigated. The appropriate level of environmental analysis under NEPA would be completed for all actions as required by the Council on Environmental Quality regulations (40 CFR 1500–1508). A one-year notice would be provided before any such closure would be implemented unless immediate closure is deemed necessary to avoid impairment of park resources.

A Monitoring and Adaptive Management Program is a key element of this Alternative (see Appendix B). Generally non-emergency changes in park management implemented under the adaptive management program would be implemented only after at least one or two years of monitoring, followed by a 6- to 12-month notification and waiting period. The superintendents would continue to have the authority under 36 CFR 1.5 to take emergency actions to protect park resources or values.

Wildlife

Bison and Roads

The NPS would implement the research proposal by Robert A. Garrott and P.J. White entitled "Evaluating Key Uncertainties Regarding Road Grooming and Bison Movements" (at http://www.nps.gov/yell/parkmgmt/winterusetechnicaldocuments.htm). This proposal specifically addresses the uncertainty as to whether grooming of the Madison to Norris road segment (Gibbon Canyon) has led to alterations of bison movements and distribution in Yellowstone, a question identified in the report by Cormack Gates et al., "The Ecology of Bison Movements and Distribution In and Beyond Yellowstone National Park" (2005, posted at above site).

Garrott and White propose to analyze existing data on GPS-collared bison, track additional GPS-collared bison for 5 years, and deploy cameras along travel routes to gain information on the relationship between road grooming and bison travel without closing the Gibbon Canyon Road to public motorized oversnow vehicle travel (during this five-year period).

During the five year period, other roads or routes may be investigated to help describe the relationship between snow depth, grooming, and bison movement. For example, the Firehole Canyon Drive may be closed to oversnow travel, forcing bison to travel cross country or along the ungroomed Firehold Canyon Drive. Similarly, the Madison to Norris Road may be fenced or gated in the vicinity of the new bridge over the Gibbon River (proposed to be built in 2009) to restrict bison movement on the groomed roadway and force bison to travel cross country (while permitting snowmobile and snowcoach travel). Thus bison movement and snow depth and roads may be tested without closing a main road.

After five years of such data gathering and analysis (beyond the term of this temporary plan), the NPS would consider closing the main road between Madison and Norris in its entirety to observe bison response. It is uncertain until the five-year period of data gathering and analysis has finished whether such closure would yield informative data or conclusions. Such a closure, if determined to be appropriate, would likely be a multi-year closure.

Other recommendations of the Gates report would be evaluated as part of Yellowstone's bison management program.

Other Wildlife, Including Federally Protected Species and Species of Special Concern

At periodic intervals when snow depth warrants, routine plowing operations would include laying back roadside snow banks that could be a barrier to wildlife exiting the road corridor.

NPS personnel would patrol sensitive resource areas to ensure compliance with area closures.

The parks would continue to support the objectives of the Greater Yellowstone Bald Eagle Management Plan, and the eagle population would continue to be monitored to identify and protect nests.

Monitoring of wolves would continue.

Monitoring of grizzly bear populations would continue in accordance with the Interagency Grizzly Bear Management Guidelines and the parks' bear management plans.

Wildlife-proof garbage holding facilities for interior locations (including Old Faithful Snowlodge) would be provided as part of regularly-occurring park operations.

Monitoring and protection of trumpeter swan habitats and nests would continue, including the closure of nest sites to public access when warranted.

Monitoring potential or known winter use conflicts would result in area closures if necessary to protect wildlife and their habitat.

If monitoring indicates that undesirable impacts are occurring, further measures including avoiding, minimizing, rectifying, reducing, or compensating for those impacts would be identified and taken.

Cultural Resources

If human remains, funerary objects, sacred objects, or objects of cultural patrimony are discovered, applicable provisions of the Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001) would be followed.

Water Resources

Best management practices would be used during the construction, reconstruction, or winter plowing of trails and roads to prevent unnecessary vegetation removal, erosion, and sedimentation.

Water resource monitoring, which has not indicated a problem in recent years, would continue on an as-needed basis. If necessary, best management practices would be implemented.

Environmentally Preferred Alternative

The environmentally preferred alternative is the alternative that promotes the national environmental policy as expressed by §101 of the National Environmental Policy Act. That section states that it is the responsibility of the federal government to improve and coordinate federal plans, functions, programs, and resources "to the end that the Nation may:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
- Ensure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
- Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
- Preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;
- Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources."

In this analysis, Alternative 2 would fulfill the responsibilities of our generation as trustee of the environment because all park resources would be preserved. Yellowstone impacts would only be seen for the life of this plan—3 years—and all resource impacts are moderate or less (and only for soundscapes, and public and employee health and safety). Alternative 2 would also ensure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings more so than Alternative 1, under which few people would get to experience Yellowstone in winter. Alternative 2's provisions for commercial guiding and BAT technology would assure safe and healthful surroundings, as well. Alternative 2 would provide for a much wider range of uses of the environment than Alternative 1, which would only allow visitors to enter the park on foot, ski, or snowshoe. The visitation limits of Alternative 2, along with the BAT use and mandatory guiding, would preserve Yellowstone and Grand Teton's cultural, historic, and natural heritage. While Alternative 1 would also provide for this, it would not provide a diversity of individual choice, for most visitors would find it impossible to enjoy park amenities. Neither alternative would consume park resources, but Alternative 1 would not allow most people to enjoy Yellowstone's amenities because the parks would be effectively closed.

In sum, Alternative 2 in this EA balances the preservation of nature with human visitation better than does Alternative 1, and so Alternative 2 is the environmentally preferred alternative according to the criteria stated above. While Alternative 1 would certainly preserve nature, it would hardly allow any people to experience the sights of Yellowstone and Grand Teton. Alternative 2, in short, achieves the two halves of the NPS mission better than Alternative 1 does.

Table 2-4: Summary and Comparison of Alternatives

	Alternative 1: No Action	Alternative 2: Continue Recent Use Levels
General Description	Recreational oversnow vehicle access would cease in all 3 parks	Allows for levels of snowmobile and snowcoach use approximating the past several winters.
Daily Snowmobile Limits in Yellowstone	Snowmobiles prohibited	318 Snowmobiles/day: West-160; South-114; East-20; North-12; Old Faithful-12
Daily Snowmobile Limits in Grand Teton National Park and the John D. Rockefeller, Jr. Memorial Parkway	Snowmobiles prohibited	50 snowmobiles/day: 25 on Grassy Lake Road and 25 on Jackson Lake
Snowmobile Guide Requirements	Snowmobiles prohibited	Commercial guides required for all snowmobiling visitors in Yellowstone; not required in Grand Teton or on the Grassy Lake Road in the Parkway (but required from Flagg Ranch to Yellowstone's South Entrance)
Best Available Technology Requirements for Snowmobiles	Snowmobiles prohibited	All must be BAT in Yellowstone. In GTNP, all snowmobiles on Jackson Lake must be BAT, but not those on Grassy Lake Road
Maximum Group Size	Snowmobiles prohibited	11 with one guide
Use of YNP Side Roads by Snowmobiles	Snowmobiles prohibited	Washburn Overlook and Freight Road: snowcoach only. Firehole Canyon Drive, Canyon North Rim Drive and Riverside Drive: open in afternoon to snowmobiles. Lake Butte and Canyon South Rim: open to snowmobiles. Virginia Cascades: non-motorized only.
Daily Snowcoach Limits in YNP and Snowcoach BAT	Snowcoaches prohibited	78 Snowcoaches per day: West-34, South-13, East-2, Old Faithful-16,

	Alternative 1: No Action	Alternative 2: Continue Recent Use Levels
		North-13. All are encouraged to meet snowcoach BAT.
Road Grooming	No road grooming for visitors	Road grooming would be done for visitor use.
Non-motorized use in YNP (no changes planned for GTNP)	Allowed subject to Winter Severity Index	Allowed subject to Winter Severity Index
Estimated maximum number of daily vehicle passengers in YNP	None	636 via snowmobile (2 passengers per machine) + 936 via snowcoach (estimated at 12 per coach)

Table 2-5: Summary and Comparison of Impacts

	Alternative 1: No Action	Alternative 2: Continue Recent Use Levels
Wildlife	Negligible impacts because no oversnow motorized visitor use would be permitted.	Negligible to minor direct, short-term, and adverse impacts, due to moderate levels of visitor use (with possible moderate effects on swans and eagles). Guiding would minimize most such effects.
Soundscapes	Minor impacts because no oversnow motorized visitor use would be permitted but administrative use and sound from West Yellowstone would continue.	Negligible to moderate direct, short-term, and adverse impacts, due to audibility and maximum sound levels in Yellowstone; effects in Grand Teton and the Parkway would be minor.
Socioeconomic environment	Impacts would range from beneficial, negligible to major, adverse, resulting from direct and indirect actions. All would be long-term and regional, and are due to the termination of oversnow visitor use.	Negligible, beneficial to minor adverse, long-term and regional, because oversnow visitor use would continue at current levels, but at levels reduced over historic levels.
Air Quality	Negligible, direct, adverse, and lasting for the duration of this plan, because no oversnow motorized visitor use would be permitted in Yellowstone. In Grand Teton and the Parkway, effects would be long-term, negligible, direct, and adverse.	Negligible, direct, adverse, and lasting for the duration of this plan because BAT technologies and strict visitor limits will limit emissions in Yellowstone. In Grand Teton and the Parkway, effects would be long-term, negligible, direct, and adverse.
Public and Employee	Moderate, adverse, short to long-term, and direct effects on	Moderate, adverse, direct, and long-term impacts for both visitors and

	Alternative 1: No Action	Alternative 2: Continue Recent Use Levels
Health and Safety	employees due to rougher roads and possible high snowmobile noise exposure levels; effects on visitors would be negligible.	employees due to possible high snowmobile noise exposure levels and avalanche danger at Sylvan Pass but mitigated in several ways in Yellowstone. In Grand Teton, risk levels would be expected to be less, so effects there are predicted to be minor, direct, adverse, and long-term.
Visitor Access and Circulation	In Yellowstone, effects would be major, adverse, direct, and long-term impacts to most visitors due to termination of oversnow vehicle access; the minority of the public that desires reduced or eliminated snowmobile access would experience beneficial, major, direct, and long-term impacts. In Grand Teton and the Parkway, effects would be long-term, direct, minor, and adverse because access to Jackson Lake and Grassy Lake Road would cease.	In Yellowstone, effects would be minor, long-term, adverse (or beneficial for those who wish to see fewer snowmobiles in the parks), and direct because all current routes would be open to oversnow (both snowmobiles and snowcoaches) vehicle travel, including the East Entrance road/Sylvan Pass. In Grand Teton and the Parkway, effects would be long-term, direct, minor, and beneficial because access to Jackson Lake and Grassy Lake Road would continue.
Visitor Experience	In Yellowstone, effects would be major, adverse, long-term, and direct due to the closure of most park roads to oversnow vehicle travel. In Grand Teton and the Parkway, effects would be direct, long-term, minor, and adverse, due to closure of park roads to snowmobiles, although some visitors might characterize the effect as beneficial for the same reason.	In Yellowstone, effects would be minor, adverse, long-term, and direct because visitation would be possible (enabling enjoyment of wildlife, scenery, clean air and silence), but limited, and roads could be rough. In Grand Teton and the Parkway, effects would be long-term, direct, beneficial, and minor, because OSV visitation would remain possible; however, some visitors might characterize the effect as adverse for the same reason.

Table 2-6: How Each Alternative Meets Project Desired Conditions and Objectives

Desired Conditions and Objectives (from *Purpose and Need*).	Alternative 1: No Action	Alternative 2: Continue Recent Use Levels
Visitors have a range of appropriate winter recreation opportunities from primitive to developed. Winter recreation complements the unique characteristics of each landscape within the ecosystem.	Does not meet objective	Meets objective
Recreational experiences are offered in an appropriate setting; they do not take place where they will irreparably impact air quality, wildlife, cultural areas, the experiences of other park visitors, or other park values and resources.	Meets objective	Meets objective
Provide the public with some degree of certainty about how winter use will be managed in the parks for an interim period in Yellowstone.	Meets objective	Meets objective
Provide a structure for winter use management in the parks for an interim period in Yellowstone.	Meets objective	Meets objective
Provide an interim winter use plan in Yellowstone, pending court decisions and NPS response that will have no significant adverse effects on park resources or values.	Meets objective	Meets objective
High quality facilities are provided in parks to support the need for safety and enhanced visitor experiences.	Meets objective	Meets objective
Conflicts among user groups are minimal.	Meets objective	Meets objective
Visitors know how to participate safely in winter use activities without damaging resources.	Meets objective	Meets objective
Oversnow vehicle sound and emission levels are reduced to protect employee and public health and safety, enhance visitor experience, and protect natural resources.	Meets objective	Meets objective

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CHAPTER 3: AFFECTED ENVIRONMENT

Introduction

This chapter describes the environmental conditions of the area that could be affected by the alternatives being considered. This description is intended to present only the information necessary to provide a basis for understanding and comparing the impacts, both beneficial and adverse, of the alternatives presented in *Environmental Consequences*. As such, data and analyses are commensurate with the importance of the impacts. The importance of the impact is reflected largely by its relationship to a major issue, as presented in *Purpose and Need*.

The 2007 FEIS made comparisons to both the historic conditions prevailing in the parks in the 1990s as well as to the current conditions prevailing more recently. For this document, though, the baseline conditions ARE the current conditions (for soundscapes, existing ambient conditions), so comparisons with historic conditions will not be made systematically. Rather, the baseline will be considered the average use occurring in the last five winters: 240-300 snowmobiles per day and about 25-35 snowcoaches per day.

Supplementary information or greater detail regarding the topics in this section may be found in an appendix or in a separate document incorporated by reference. Necessary citations about where such materials may be found are presented with each individual topic. New information, where it exists, is presented in a separate section under each impact topic.

Wildlife

The affected environment for impacts to wildlife is generally limited to activities that occur within the parks, as discussed below. Some discussions include possible impacts to wildlife on adjacent lands or in the GYA.

Regulatory and Policy Overview

Wildlife and wildlife habitats are highly valued park resources and are addressed as such in the Organic Act. All policy statements regarding the conservation of park resources and values therefore apply to wildlife. Avoidance of unacceptable impacts (NPS 2006: 1.4.7.1) is notable in this regard, as it applies to all park resources and values. Park managers must not allow uses that would cause unacceptable impacts: i.e., those which would impede the attainment of desired conditions for natural resources, or diminish opportunities for current or future generations to enjoy and be inspired by those resources.

As regards biologic resources, NPS Management Policies provide general principles for managing wildlife, including restoration and preservation dictates. In particular, the management policies state, “The Service will successfully maintain native plants and animals by preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur” (NPS 2006: 4.4.1). Further emphasis is placed on the management of threatened or endangered species: “The Service will survey for, protect, and strive to recover all species native to national park system units that are listed under the Endangered Species Act” (NPS 2006: 4.4.2.3).

The general Management Policies wildlife directive is consistent with the North American Wildlife Conservation Model (NAWCM), which is the model utilized by the NPS and most (if

not all) federal and state agencies managing wildlife. That model stipulates that fish and wildlife belong to all North American citizens, and that those resources are to be managed in such a way that their populations will be sustained forever. Clearly, the emphasis on this model and in the Management Policies is on managing wildlife at the population level, although certain laws (such as the Endangered Species Act and the Migratory Bird Act) do require emphasis on individuals in special situations.

The NPS's snowmobile regulation, 36 CFR 2.18, provides that snowmobile use is not to "disturb wildlife or damage park resources." That does not mean that any disturbance of an individual animal precludes snowmobile use. That regulation does not create a new or different standard of wildlife management along snowmobile routes, but simply ensures that normal NPS wildlife management standards are met, that no unacceptable conditions are present, and that no impairment is suffered. As NPS noted in 1982 when promulgating that provision, "by conforming the regulation dealing with route designation to existing Service policy, this revision will provide a greater degree of Servicewide uniformity" (47 *Federal Register* 11598, March 17, 1982). NPS later used nearly identical language in its regulation on bicycle use, 36 CFR 4.30 (allowing designation of bicycle routes if they "will not disturb wildlife or park resources"), explaining that "the use of bicycles is allowed in park areas under the same basic conditions as are motor vehicles" and that "certain limitations on their use are necessary and appropriate in the interest of public safety, resource protection and the avoidance of visitor conflicts."

NPS thus applies the same basic wildlife management principles to snowmobile use, other motor vehicle use, bicycle use, and other uses in the park. Those principles are primarily *population-based*. In other words, the provision against disturbance of wildlife is consistent with NPS's efforts to manage at the population level. This is not to indicate that NPS views disturbance to individual animals as acceptable as long as a wildlife population is not disturbed; rather, NPS sees a *small* amount of disturbance to individual animals as acceptable and unavoidable (to allow visitation to occur) so long as the wildlife population is *not* disturbed, that no unacceptable conditions are present, and that impairment is avoided. Indeed, it is arguably impossible to allow any human visitation without at least a small level of disturbance to individual animals.

Overall, NPS's goal is to minimize human impacts and avoid significant effects from disturbance to abundances, diversities, dynamics, distributions, habitats, and behaviors of wildlife populations and the communities and ecosystems in which they occur, pursuant to 36 CFR § 2.18 and Management Policies 4.4.1. This concern is a major reason NPS has required commercial guides for all snowmobiling visitors in the past five years: guides help to minimize the effects to individuals that previously unguided snowmobiling caused (Taber 2006).

New Research and Monitoring

In the last few years, several new studies have investigated the interrelationship between wildlife and winter recreationists in YNP. Several of these studies are summarized in Appendix C. Four of the studies (Borkowski et al. 2006, Bruggeman et al. 2007, Bruggeman et al. 2006, and White et al. 2006) were part of a collaborative effort between the NPS and Montana State University-Bozeman to investigate the potential effects of winter recreation on wildlife. This section also includes some general or summary remarks about these studies and others investigating the relationship between recreationists and wildlife in the winter. Additionally, a recent study conducted by Drs. Cormack Gates and Brad Stelfox resulted in an April 2005 report "The Ecology of Bison Movements and Distribution in and Beyond Yellowstone National Park: A Critical Review with Implications for Winter Use and Transboundary Population

Management." This study, commissioned by the NPS, is commonly known as "the Gates Report," and is summarized in Appendix C. The entire report is available at http://www.nps.gov/yell/parkmgmt/gates.htm. Along with studies performed previously, these studies represent the state of knowledge and full sweep of scholarly perspective on bison distribution and demography, especially in Yellowstone National Park. It is this comprehensive collection of literature, published and unpublished, upon which the analysis of effects regarding wildlife in this EA is based.

In most cases, monitoring indicates that animals respond to threats by directing their attention toward the potential threat, a response that can be characterized as "vigilance." If the animal perceives a more serious and immediate threat, it may elevate its response, choosing an "active" response. Depending on the situation, this may be either travel away from the threat (generally walking away from it), taking flight away from it (generally running), or defense/attack (Borkowski et al. 2006; White et al. 2006). In most situations, the more energy expended in responding to a threat, the less energy the animal has for winter survival (Parker et al. 1984; Cassirer et al. 1992).

Table 3-1 compares the wildlife responses to motorized winter recreation as analyzed in two of the most comprehensive wildlife studies from this era. The studies illustrate that the majority of wildlife response to human recreationists were either no response (the animal shows no response to the people or OSVs) or a vigilance response (generally, the animal directs its attention toward the people or OSVs without moving – a response considerably less energy-intensive than active response, which include walking or running away from the human or OSV or—very rarely—charging).

Table 3-1: Wildlife Responses to Human Recreationists

Study[a]	% No Visible Response[b]	% Vigilance Response	% Active Responses
Borkowski (2006)	Bison: 80% Elk: 49% Swans: 57% Bald eagle: 17% Coyotes: 39%	Bison: 12.5% Elk: 44.3% Swans: 32.5% Bald eagle: 72.8% Coyotes: 36.7%	Bison: 7.1% Elk: 8% Swans: 10% Bald eagle: 10.5% Coyotes: 23.8%
White et al. 2006	Bison: 80% Elk: 48% Swans: 57% Bald eagle: 17% Coyotes: 39%	Bison: 12% Elk: 44% Swans: 33% Bald eagle: 73% Coyotes: 37%	Bison: 7% Elk: 7% Swans: 10% Bald eagle: 10% Coyotes: 24%

[a] These two studies used somewhat different methods and grouped responses differently. Borkowski 2006 included data from Jaffe et al. 2002, and White et al. 2006 used data from Davis et al. 2004 and White et al. 2004.

[b] No response means the animal did not respond in any visible way to the human or OSV. Vigilance response means the animal directed its attention at the OSV, but did not otherwise move. Active response means the animal walked or ran away or charged the human or OSV.

Certain factors help to explain the varying responses between wildlife groups. The likelihood and intensity of responses increased substantially if animals were on or near roads, groups of wildlife were smaller, the animals were approached by humans, or the animal movements were

impeded or hastened by vehicles. For example, 60% of encounters between bison and OSVs occurred when bison were traveling on groomed roads. Specifically regarding bald eagles, the fact that they begin nesting during the OSV season may account for their high percentage of vigilant behavior responses compared to some other species.

These studies are based in part upon wildlife monitoring data gathered by the NPS (in a collaborative effort with Montana State University-Bozeman) during the winter seasons from 1999 through 2006 (wildlife monitoring in winter has continued since and is discussed below). Human disturbance did not appear to be a primary factor influencing the distribution and movements of the wildlife species studied. The risk of vehicle-related mortality from snowmobiles was quite low and observed behavioral responses were apparently short-term changes that were later reversed. Bison, elk, and swans in YNP used the same core winter ranges during the past three decades despite large winter-to-winter variability in cumulative exposure to OSVs. There was no evidence that snowmobile use during the past 35 years adversely affected the demography or population dynamics of bald eagles, bison, elk, or trumpeter swans (Borkowski et al. 2006; White et al. 2006) (no data was available for coyotes). Wildlife monitoring reports are available on the NPS website at: http://www.nps.gov/yell/parkmgmt/winterusetechnicaldocuments.htm

As mentioned, wildlife monitoring has continued since the completion of data gathering for these studies in 2006, finding slightly lower wildlife responses to motorized winter use than the Borkowski and White studies summarized above (such responses could be within the range of natural variability, as they are not statistically significant). Biologists summarizing the wildlife monitoring program for the winter of 2007-08, which had an average daily use of 294 snowmobiles and 35 snowcoaches, found the following:

> Overall, the responses of all wildlife species observed to oversnow vehicles and associated humans were as follows: 70% of the observed responses by groups of wildlife were categorized as no apparent response, 21% look/resume, 4% travel, 4% attention/alarm, and 1% flight. Wildlife responses to motorized winter use were slightly lower for most species than in previous winters, with the "no apparent response" and "look-and-resume" categories accounting for greater than 91% of the bison, elk, and swan observations…. Comparing wildlife responses between snowmobiles and snowcoaches, during interactions wildlife responded 28% to snowmobiles and 21% to snowcoaches [these are vigilance and active responses added together]. However, wildlife responses greater than look/resume occurred during 7% of the interactions with snowmobiles and 10% with snowcoaches (McClure and Davis, 2008: 10; see Davis 2007 for a summary of the previous winter's wildlife monitoring).

In general, situations such as snowmobilers inadvertently or intentionally chasing animals on roadways, or birds taking flight as visitors approach too closely, are viewed by NPS as unacceptable. These situations are largely eliminated by the requirements to utilize commercial guides and/or snowcoaches (Taber 2006). Some such situations may still occur, which is one of the reasons NPS provides regular patrol efforts on winter roadways and educates guides and outfitters on proper touring behavior. Overall, NPS utilizes the guidance in its *Management Policies* (section 1.4.7.1) in determining what are unacceptable impacts on wildlife individuals and populations. For example, NPS will not tolerate situations wherein oversnow vehicle/wildlife conflicts result in unsafe conditions (another reason commercial guides and snowcoach drivers are important for winter visitation).

Existing Condition: Ungulates of Concern

*Bison and Elk (*Bison bison *and* Cervus elaphus*)*

Yellowstone is the only place in America in which bison have persisted in the wild since European colonization. Bison management in the GYE has progressed through several phases since the park's inception, including intensive husbandry operations, herd control, 'natural regulation' policy, and hunting (when the animals leave the park). This long and complex history is summarized in Gates et al. 2005.

Long-term data indicate that the YNP bison population has steadily increased from the cessation of herd control in 1966 to the modern era. Since 1980, the population has fluctuated between about 2,000 and 5,000 animals, with the 2008 late summer population estimated at about 3,000 animals. Generally, bison occur in two large herds within YNP, the Central and Northern. The Central herd usually summers in Pelican and Hayden Valleys, progressively moving west into the Firehole, Madison, and Gibbon river valleys as winter snow depths increase. The Northern herd summers in Lamar Valley and on the Mirror Plateau, wintering in the Lamar Valley and over to Mammoth and Gardiner, Montana. The two herds intermingle in summertime. In the last 20 years, bison movement ecology has changed and evolved in response to population-level dynamics (Gates et al. 2005, Fuller et al. 2007a, Coughenour 2005, Taper et al. 2000), leading to changes in movement from the central interior portions of Yellowstone to the northern portions of the park, regardless of winter use (Gates et al. 2005, Fuller et al. 2007a, Coughenour 2005). For example, pulses of bison movement during winter from the central to the northern portion of the park may have begun by 1982 (Coughenour 2005, Fuller et al. 2007a), but became more prevalent and included more bison after 1996 (NPS, unpublished data).

The increase in bison populations in the last 40 years has occurred simultaneous with a substantial increase in OSV recreation. Between 1968 and 2004, the number of winter visitors traveling in oversnow vehicles increased from 5,000 to nearly 100,000 people. Much of this increased use was in the west-central region of YNP, where bison are common. Since 2004, the number of winter visitors has fallen to between 50,000 and 60,000.

Since 1966, management removals at (or near) the park boundary and winter severity have been the main causes of bison mortality. The risk of transmission of brucellosis—a contagious bacterial disease—from bison to cattle and the economic cost associated with this risk have prompted the development of various bison management plans in the last twenty years. Starting in the mid-1980s, federal and state agencies negotiated a series of management agreements to manage bison moving outside the park, culminating in a Final Environmental Impact Statement/Plan for bison management in 2000. These management measures included hazing bison back into the park, capture and slaughter of bison that repeatedly leave the park, culling of bison by agency personnel, and hunting of bison outside the park.

In the wild, older bison and calves typically will die during major episodes of winter stress, low forage availability, and higher bison densities. Their carcasses are scavenged by many species, including mammals, birds, and insects, and thus play an important role in the ecology of the park (NPS 1998). Bison carcasses are especially important as a high-quality protein source for species of concern such as grizzly bears, bald eagles, and gray wolves (Swensen et al. 1986; Green et al. 1997; Smith et al. 1998).

Before the implementation of mandatory guiding, conflicts between OSV users and wildlife were common. Rangers were frequently dispatched to the scene of wildlife-visitor conflicts to

direct traffic and to ensure the safety of both visitors and wildlife. Another commonly observed situation occurred when snowmobiles drove into the middle of a group of bison, thus aggravating the group and increasing the danger from running animals that had no escape. According to one ranger, many of the snowmobilers that were cited for off-road violations claimed that they left the road in an attempt to evade or otherwise go around bison. Rangers noted that these and other unsafe and harassing behaviors occurred despite the availability of safety information that included recommendations for interacting with animals on the roadway. They attributed these behaviors largely to inexperienced snowmobilers, some of whom lacked the patience to wait for animals to cross or exit the roadway (Dimmick 2002, Dimmick 2003).

The implementation of mandatory guiding has substantially reduced this problem. Guides are trained in where wildlife are likely to occur in the parks and in how to pass wildlife on the roadways with a minimum of the de facto harassment that previously occurred. Guides provide enforcement of park travel regulations, including especially the speed limits and restrictions against off-road travel (Taber 2006). Because guides are trained in part by the NPS, they can also provide guidance to their clients on how to observe wildlife responsibly, such as by limiting observation time and the distance with which such groups approach wildlife. Such human behaviors can help to mitigate the fact that wildlife tend to alter their behaviors more around larger groups than around small groups. These same behaviors can help to minimize disturbance to wildlife individuals while avoiding completely disturbance to wildlife populations.

The groomed road system of YNP and its possible effect(s) on bison population dynamics have been the source of much debate. Some authors have suggested that groomed roads directly contribute to increasing bison abundance and observed changes in distribution by providing energy-efficient travel corridors. These authors assert that because the groomed roads are packed and easier than untracked snow to travel upon, bison selectively choose these routes. By saving energy in this manner, they believe bison populations have grown and their distribution throughout YNP has been altered. Such road use by bison is argued to be particularly important during stress-induced, exploratory dispersal, and that without an intended destination, exploratory travel is likely to occur on the energy-efficient, plowed or snow-packed roads (Meagher 1989; Meagher 1993; Meagher 1998; Taper et al. 2000; see also the discussions of Meagher's research in NPS 2000b: 143-147, NPS 2003: 117-120; and NPS 2004b: 80-81).

In more recent years, however, an increasing number of scientists have concluded that groomed road use by bison is less important to their population dynamics than other, natural factors. These scientists have found that bison "neither seek out nor avoid groomed roads" (Bjornlie and Garrott 2001:560) and point to lack of supporting evidence for the energy-efficient travel corridor, or Meagher, hypothesis (Cheville et al. 1998; Wagner 2006). Specifically, bison use their own trails more than groomed OSV routes or plowed roads and travel only short distances upon groomed routes (Bjornlie 2000; Kurz et al. 2000; Bjornlie and Garrott 2001). Additionally, the energy costs of adverse interactions with OSVs could potentially offset any energetic benefits that bison would achieve in on-road travel (Bjornlie and Garrott 2001). There are strong indications that historic population growth and range expansion in the central bison herd was driven primarily by biotic factors as opposed to the groomed roads (Coughenour 2005; Gates et al. 2005; Fuller et al. 2007a and b; and Bruggeman 2008a, b, and c). This is very similar to what occurred in one of the few other places where a free-ranging population of bison was observed during expansion, the Mackenzie Bison Sanctuary in the Northwest Territories. After people introduced bison to this area in 1963, bison range expansion was found to be proportionate to their population growth (Larter and Gates 1990), just as several scientists argue has occurred in Yellowstone (Meagher 1993, 1998; Taper et al. 2000; Coughenour 2005, Gates et

al. 2005, Fuller 2006). In summary, many authors note that while individual bison may experience temporary adverse effects due to interactions with people, the animals appear not to be harmed overall and their population as a whole is thriving (Hardy 2001, Bruggeman 2006, Borkowski et al. 2006, White et al. 2006). Several lines of evidence suggest road grooming has not changed population growth of bison relative to what may have been realized in the absence of road grooming (Gates et al. 2005), or that if growth rates were affected, bison populations would have achieved current population levels eventually on their own (Coughenour 2005).

This understanding differs from the Meagher hypothesis (summarized above). The Meagher hypothesis was never rigorously tested to evaluate support in the data, and cannot be today because detailed information on bison travel patterns and pathways from marked or radio-collared bison was not collected during the period of major range expansion by bison (the 1980s and early 1990s) and the potential influence of groomed roads was not experimentally tested at that time. The only data available are akin to snapshots in time of bison distributions and trails, taken from aerial surveys and opportunistic ground observations, which collectively are insufficient for inferring specific movement patterns or evaluating the mechanism(s) causing observed changes in distribution. Bison now use travel corridors along portions of roads that connect these foraging areas and, as a result, these travel corridors may persist whether or not roads are groomed (Gates et al. 2005, Bruggeman 2006). It is unrealistic and unattainable to design studies now that can retrospectively answer the question of whether road grooming has led to fundamental changes in the Yellowstone bison population and distribution. For that reason, recent bison research efforts have focused on gaining insights into how road grooming and other factors currently affect bison travel.

Overall, the best available evidence regarding road grooming and bison distribution and demography suggests that (1) observed changes in bison distribution were likely consequences of natural population growth and range expansion that would have occurred with or without snow-packed roads (Bjornlie and Garrott 2001, Coughenour 2005, Gates et al. 2005, Bruggeman 2006); (2) road grooming did not change the population growth rates of bison relative to what may have been realized in the absence of road grooming (Gates et al. 2005, Bruggeman et al. 2006, Fuller 2006, Wagner 2006); (3) there was no evidence that bison preferentially used groomed roads during winter (Bjornlie and Garrott 2001, Bruggeman et al. 2006); (4) road segments used for travel corridors appeared to be overlaid on what were likely natural travel pathways (Gates et al. 2005, Bruggeman 2006); (5) bison use of travel corridors that include certain road segments would likely persist whether or not roads were groomed (Gates et al. 2005, Bruggeman 2006); and (6) bison and elk behaviorally responded to oversnow vehicles and associated human activities, but human disturbance was not a primary factor influencing their distribution (Bruggeman 2006, Borkowski et al. 2006, White et al. 2006). These findings were made carefully and with considerable objectivity using all the data available and the collective ecological knowledge represented in the scientific literature.

Obvious in this discussion is again the difference between effects on individuals and effects on a wildlife population. As stated previously, the NPS remains concerned about effects on individual bison and seeks to minimize the effects upon them as individuals. It is clear, though, that an increasing consensus exists among wildlife biologists that Yellowstone's bison population is healthy and affected primarily by natural forces, not by human activity. Such an interpretation is consistent with the North American Wildlife Conservation model, which is predicated on wildlife resources being managed in such a way that their populations will be sustained forever. Thus, some individual effects may be tolerable while effects on a population may be quite different or nonexistent.

For example, some bison individuals are clearly disturbed, but that percentage remains minor—less than 10% for the species analyzed—and their populations are thriving and abundant (even increasing without regard to oversnow vehicle numbers). Debate continues as to whether bison distribution in Yellowstone has been affected by winter use and associated road grooming—but their numbers, even after harsh winters such as 2007-08, are abundant (the growth rate of Yellowstone's bison population fluctuates over time, but increases 10-13% per year on average). Further, the NPS has developed various types of study designs and statistical approaches to evaluate three overriding uncertainties: 1) what is the influence of snow and terrain on bison movements; 2) what are the drivers of bison migration, re-distribution, and demography; and 3) what are the effects of road grooming on bison use of travel corridors?

Studies addressing another aspect of the controversy regarding winter recreation in Yellowstone, the behavioral responses of bison and elk to snowmobiles and snowcoaches, indicated these species behaviorally responded to oversnow vehicles and associated human activities with increased vigilance, travel, and occasionally flight or defense (Borkowski et al. 2006, White et al. 2006), but at relatively low levels. However, responses were less frequent and of lower intensity compared to other areas, suggesting there is a certain level of habituation to oversnow vehicles. There was some evidence bison and elk were displaced approximately 60 meters away from roads with historic oversnow vehicle numbers, most of which was unguided (Aune 1981, Hardy 2001). However, human disturbance did not appear to be a primary factor influencing their distribution and movements, suggesting behavioral responses and apparent avoidance of humans in the vicinity of the road were apparently short-term changes that were later reversed. Factors influencing resource availability—including snow pack, population density, and drought—provided the primary impetus for variability in the distribution, movements, and foraging behavior of bison during winter (Bruggeman 2006). Similarly, Messer (2003) reported the distribution of elk in central Yellowstone during winter was primarily influenced by snow mass and heterogeneity.

The best available evidence supports the hypothesis that *individual* bison (and other wildlife) are sometimes disturbed, but monitoring has not detected any moderate or greater adverse effects to natural abundances, diversities, dynamics, distributions, habitats, and behaviors of populations.

Regarding bison ecology and management in GTNP, the bison population of the Jackson Hole area has consistently grown since 1990, increasing at annual rates between 10-14%. Elk population estimates for the National Elk Refuge from 1999 to 2004 have been approximately 20% above U.S. Fish and Wildlife Service (USFWS) objectives (NPS 2007b). Hunts have been utilized to decrease bison and elk numbers and maintain prescribed population goals in the Jackson Hole area. The US Fish and Wildlife Service (National Elk Refuge) and the National Park Service (Grand Teton National Park) have released a joint Bison and Elk Management Plan and EIS (NPS 2007b). The primary purpose of that document is to address supplemental feeding programs and other management alternatives for these populations. Although the report does not address winter recreation impacts, the ecology, management history, and current status of the GTNP bison herd are thoroughly discussed on pages 144-150. This discussion represents the most current information on GTNP bison and is hereby incorporated by reference.

Like bison, elk were once widespread in North America. Elk are today the most abundant ungulate species in the GYA with an estimated 50,000 to 60,000 elk in eight to ten separate herds (USFWS 1994). The northern YNP elk herd, the largest in the GYA, summers throughout the park and surrounding mountains and winters primarily in the Northern Range area between the Northeast Entrance and Gardiner, Montana, and continuing about twenty miles down the

Yellowstone River Valley (to the northwest of Gardiner). Other elk herds that summer in the park include the Madison-Firehole, Gallatin-Madison, and Gallatin Range herds, which occur primarily on the west sides of YNP. East of YNP are the Clark's Fork, North Fork-Shoshone, and Carter Mountain herds, and south are the Jackson Hole, Targhee, and Sand Creek herds. Some of the Jackson Hole herd summers in YNP's southern portions (Clark 1999).

YNP's elk population has fluctuated between 15,000 and 30,000 since 1980. Recently, numbers of elk in the northern herd have dropped substantially, with the likely causes being predation by grizzly bears and wolves, moderate human harvests of antler-less elk, substantial winter-kill in 1997, and possible drought-related effects on pregnancy and survival (Vucetich et al. 2005, White and Garrott 2005, Eberhardt et al. 2007). However, the elk herd remains abundant.

Like bison, the non-migratory central Yellowstone elk herd has been exposed to some of the highest OSV levels in the parks, yet that OSV use has had little detectable effect upon the elk population. For example, from 1968 to 2004, population estimates for the central herd elk fluctuated around a dynamic equilibrium of approximately 500 elk (Garrott et al. 2005) (during this period the number of winter visitors grew from about 5,000 to over 100,000). The annual survival of adult female elk in this population exceeded 90% and calf:cow ratios indicated healthy recruitment prior to wolf recolonization of the Madison-Firehole-Gibbon drainages in 1998 (Garrott et al. 2003).

Elevation, topography, weather, vegetation, and escape cover determine elk habitat. Elk generally forage on grasses followed in preference by browse species and conifers (Clark 1999). Summer range is extensive and reflects vegetative productivity. Winter range is more limited and is determined by lower elevation and snow depth. Thermal areas with snow-free vegetation or shallow snow are important winter habitats for elk along the Madison, Firehole, and Gibbon Rivers (NPS 1990), a connection that has long been noted (Craighead et al. 1973). Researchers continue to note the importance of thermal areas for the central elk herd in particular. Over-winter survival depends heavily on thermal areas that reduce snow accumulations (Ables and Ables 1987).

Because of natural mortality, elk, like bison, play an important role in the ecological processes of the YNP area. Over 90% of the diet of most GYA wolves consists of elk, and grizzly bears are influential predators of young elk (Swensen et al. 1986; Green et al. 1997; Smith et al. 1998; Barber et al. 2005).

As with bison, members of the public have expressed concern about the effects that winter recreation may have upon YNP's elk, although there is less concern about the effects of winter recreation upon elk distribution, probably because elk range has remained stable during the period in which winter recreation became prevalent in YNP. Studies show that elk do not use the groomed roadways as travel corridors to the extent that bison do. Like bison, however, while *individual* elk appear to be occasionally disturbed by oversnow vehicle travel, the elk *population* has shown no discernible decrease due to human recreational use or groomed roadway OSV travel (Hardy 2001; Bjornlie 2000; White et al. 2006).

Regarding elk ecology and distribution in GTNP, the Draft Bison and Elk Management Plan and EIS referred to earlier contain a detailed discussion of the ecology, management history, and current status of the Jackson Hole elk (see pages 118-143 of that document). Elk in the Jackson Hole area utilize state feed grounds, private land, the National Elk Refuge, US Forest Service lands, and GTNP. This document represents the most current information on elk in GTNP and is hereby incorporated by reference.

Habituation, which may be present in both bison and elk, occurs when an animal learns to refrain from responding to repeated stimuli that are not biologically meaningful (Eibl-Eibesfeldt 1970). Wildlife may become conditioned to human activity when the activity is controlled, predictable, and not harmful to the animals (Schultz and Bailey 1978; Thompson and Henderson 1998). Several studies in YNP suggested bison and elk habituate to winter recreation activities to some extent, especially during winters with greater visitation (Aune 1981; Hardy 2001; Borkowski et al. 2006). However, animals still responded to closer-proximity interactions and/or unpredictable disturbances. Evidence of habituation on daily and seasonal time scales has been reported in elk, bison, and white-tailed deer studies, and suggests that regular, predictable activity patterns by recreationists may reduce the potential for adverse effects to wildlife (Richens and Lavigne 1978; Hardy 2001). For instance, the estimated odds of no response relative to a vigilance response by bison increased 1.04 times with each 1000 OSV increase in the cumulative OSV numbers for a winter (White et al. 2006). Elk, however, seem to show the opposite trend: the estimated odds of a vigilance response relative to no response increased 1.03 times with each 1000 OSV increase in the cumulative OSV numbers.

Wildlife monitoring data for 2002-2003 and 2003-2004 show that 80% and 79% of documented active responses by bison and elk were caused by snowmobiles and approximately 20% by snowcoaches, which were 6% and 17% of the observed interactions for those years. However, the odds of bison and elk actively responding to OSVs were greater if a snowcoach was present. This suggests that when snowcoaches are present at an interaction with ungulates, they might elicit a higher level of behavioral response than snowmobiles. The estimated odds of an active response by bison increased 1.5 times for each additional snowcoach, higher than the 1.1 times increase when multiple snowmobiles are present (White et al. 2005; White et al. 2006; Borkowski et al. 2006).

Human activities that result in displacement of animals from parts of their home range may be considered a form of habitat fragmentation. For example, increased human access into elk winter range by roads may reduce the overall scale and effectiveness of elk habitat and lead to increased harassment and energetic stress (Picton 1999). Aune (1981) noted that elk were displaced within 60 meters from trails and roads and that wildlife developed crepuscular patterns in response to winter recreation activity in Yellowstone's Madison, Firehole, and Gibbon River valleys. Hardy (2001) reported that elk in the same area may have been displaced from suitable roadside habitat along the busiest winter road in the park (West Yellowstone to Old Faithful) in part due to high volumes of OSVs. However, Hardy (2001: viii) also stated that "[d]espite varying responses to increasing winter visitation since the late 1970s, bison and elk winter in the same area each year." Thus, displacement observed in these studies was relatively localized and did not translate to large-scale patterns of habitat avoidance. During controlled experiments at the Starkey Experimental Forest and Range in Oregon, elk appeared to make short-term changes in distribution when responding to simulated recreational ATV activity, possibly selecting for refuge areas not viewable from roads, but appeared to return to their pre-disturbance locations when the disturbance ceased (Preisler et al. 2006). In the context of a severe winter, however, Dorrance et al. (1975) and Aune (1981) point out that even short-term habitat displacement can be detrimental to wildlife survival.

Consequently, White et al. (2006) concluded that human disturbance is not the primary factor influencing the distribution and movements of elk and bison in the parks in winter. Specifically regarding central Yellowstone elk and bison distribution, snowpack characteristics (such as mass and heterogeneity) and the factors influencing resource availability (snow pack, population density, and drought) are the primary influences upon herd distribution,

movements, and foraging behavior in winter (Cheville et al. 1998; Bjornlie 2000; Kurz et al. 2000; Bjornlie and Garrott 2001; Gates et al. 2005; White et al. 2005; Fuller et al. 2007b; Bruggeman 2006; Wagner 2006).

Existing Condition: Threatened and Endangered Species

*Canada Lynx (*Lynx canadensis*)*

A study of lynx in YNP was conducted from 2001-2004, representing the most area-specific lynx data available to date (Murphy et al. 2006; Murphy et al. 2005). Three lynx were detected using DNA methods, all of which were east of Yellowstone Lake. This area also had the highest and second highest indices of snowshoe hares and red squirrel, respectively, which form a large percentage of lynx diets (Koehler and Aubry 1994; Sunquist and Sunquist 2002). The authors note that lynx in other areas of the park could have escaped detection, but state that ". . . lynx are apparently limited to the East Sector . . ." Lynx have not been recently detected during surveys of GTNP (Pyare 2001).

Lynx can be sensitive to roads traversing their habitat, although traffic volumes on such roads must generally exceed 2,000 to 3,000 vehicles per day (Apps 2000). They are also sensitive to high road densities, may be killed by traffic on roads, and may be affected by human facilitation of access to their habitat for other competing predators (or predators which may prey upon them) (Ruediger et al. 2000). Lynx have been struck on 2- and 4-lane roads in Colorado, Canada, and Alaska (Staples 1995, Gibeau and Huer 1996, Halfpenny et al. 1999, Murphy et al. 2006). However, lynx activity in relative proximity to roads does not necessarily translate into increased mortality risk for lynx. A Canada lynx translocated from British Columbia to Colorado in 2003 successfully crossed major highways, including I-90 near Livingston, Montana, while en route back to Canada during 2004 (T. Shenk, pers. comm.) and there have been no confirmed strikes in the GYA through 2003 (Halfpenny et al. 1999; Murphy et al. 2006).

*Gray Wolf (*Canis lupus*)*

Although wolves within the Yellowstone area are classified as a nonessential, experimental population, they are managed within the parks as a threatened population. Trends of wolf abundance in the parks have increased since their reintroduction to YNP in 1995, and wolves began to appear in GTNP in 1997. Wolf numbers continued to increase until 2003, when density-dependent natural factors unrelated to OSV use, possibly including disease, caused declines in YNP. Wolves occur throughout the parks, currently numbering about 171 in YNP in 11 packs with about 350 distributed throughout the GYA. Wolf densities are highest in areas frequented by ungulates in the winter, such as Yellowstone's northern range, where their densities are some of the highest in the world. During winter, the packs of YNP's northern range are exposed to more human activity than any other wolves in the parks, although OSV use does not occur in that area of the park. The most visible pack on the northern range for several years, the Lamar Peak Pack, reached a high of 31 wolves in 2001.

Winter road monitoring crews have observed wolves only rarely in six winters of monitoring (never more than eight times per winter), with a total of just twelve sightings involving OSV-wolf interactions. Wolf tracks were frequently seen on the roads by winter wildlife monitoring crews and collared wolves were known to be in the Madison, Firehole and Gibbon drainages during road surveys (signals are monitored by NPS staff and MSU researchers). Wolves have also been documented traveling and making nocturnal kills during winter in developed areas of YNP. Their distribution does not seem to be affected by OSV use in the parks (Smith et al. 2005, Smith 2006). Wolves den in April, after the winter use season in the parks has ended.

Creel and others, in a study of wolves in Yellowstone, Voyageurs, and Isle Royale national parks, found that increased stress hormone levels, and therefore physiological stress, were correlated to OSV usage on short and annual scales. Despite the difficulties in quantifying physiological stress, the authors noted that, even given the known detrimental effects of elevated stress hormone levels, they found "no evidence that current levels of snowmobile activity are affecting the population dynamics of [wolves] in these locations" (Creel et al. 2002). Once again, it is clear that biologists note a difference between individual and population disturbance and see little if any population disturbance.

Existing Condition: Other Species of Concern

*Bald Eagle (*Haliacetus leucocephalus*)*

Since their original listing as an endangered species in 1967, bald eagles have made a remarkable comeback nationwide, and were removed from the ESA in August 2007. They occur throughout the parks, most commonly near unfrozen rivers or lakeshores. The parks have a substantial resident population of eagles. Resident eagles may migrate short distances in the parks in winter to be near open water and their population expands with the addition of migratory eagles (an increase of up to 45% in some years). Nest building by bald eagles occurs between October and April, with actual nesting beginning in mid February. Incubation occurs for 35 days with hatching taking place in late March. Most nests are near bodies of water, in large trees (Stangl 1999; Swensen et al. 1986; Alt 1980). In 2005, YNP had 34 nesting pairs of bald eagles. In 2006, adult bald eagles numbered 24 in GTNP, and there were an unknown number of fledglings born during the summer in nine active nests. Grand Teton has twelve bald eagle territories (Terry McEneaney and Kerry Murphy personal communication with M. Yochim 2006).

Based on the wildlife monitoring NPS has performed in YNP in the last several years, bald eagle responses to OSVs and human activity there were categorized as 17% "no response," 64% "look/resume," 9% "attention/alarm," and 10% being either "travel" or "flight." Last winter, responses were substantially lower, with 59% being "no visible response," 23% being "look-resume," 2.3% being "alarm-attention," and 16% being "flight." Biologists, after noting that the majority of these sightings were at a prominent nesting site on the West Entrance Road, attributed the more recent lower response rate to two factors: 1) in the last two winters, eagles nested lower in the nest and were not as visible to travelers; and 2) a focused effort by NPS employees to educate guides about the potential disturbance they may be having on the eagles meant guides were more sensitive to their effects on the eagles (McClure and Davis 2008; Davis 2007).

Similar to other species, the estimated odds of behavioral responses by bald eagles interact with covariates such as distance from road, interaction time, human behavior and habitat. The odds of observing no response relative to a movement response were 4 times greater for each 100-meter increase in distance from the road (with a threshold value of 250m). The odds of observing a vigilance response were 60 times greater for each 1-minute increase in interaction time. The odds of a movement response were 5 times greater when humans approached on foot. In terms of habitat, the odds of a vigilance response relative to no response were 54 times greater when eagles were in burned forest as opposed to meadow habitat. The estimated odds of observing a movement response compared to no response by bald eagles during 2003 to 2006 were 1.3 times greater for each additional snowmobile and 4.2 times greater for each additional snowcoach (White et al. 2006; White et al. 2005).

Some of the eagle nesting period coincides with the oversnow recreational season in the parks, creating a risk that displaced birds might have less foraging time and be less successful raising

offspring. However, nesting success and numbers of fledgling bald eagles in YNP increased during a period of intense OSV use (1987 to 2005) and were not correlated with cumulative OSV traffic. Additionally, the pair of bald eagles nesting within 55 meters of the heavily-used West Entrance Road of YNP successfully fledged young eaglets.

Grizzly Bears (*Ursus arctos horribilis*)

Grizzly Bears are found throughout YNP, most of GTNP, and the entire Parkway. Currently, biologists estimate their population to be between 431 and 588 in the Yellowstone ecosystem. Because their population has been increasing for at least 15 years, along with their range, the USFWS removed them from the endangered species list in April 2007. During the period of that increase, winter OSV visitation fluctuated between 70,000 and 100,000 visitors (the latter being the maximum visitation seen in the parks in winter).

While bears hibernate in winter, they could be disturbed during hibernation and their late fall and early spring activities by winter use. In fall, grizzlies are in hyperphagia, an annual life phase in which they gorge themselves on any and all available foods in preparation for hibernation, but especially whitebark pine nuts, if they are available. By the end of November, about 90% of all grizzlies are denned. Dens are often located on north slopes between 6,500 and 10,000 feet (averaging 8,100 feet), usually near whitebark pine and/or subalpine fir (McNamee 1984; Judd et al. 1986). In spring, boars are the first to emerge from hibernation, sometimes as early as mid-February. Subadults and cubless sows are next, and sows with cubs are the last to emerge, usually by mid-April. Ungulate carrion (especially elk and bison) are the most important spring foods for bears, with lesser amounts of early spring vegetation (such as that found in thermal areas) and over-wintered whitebark pine nuts if they are available (Mattson et al. 1991; Mattson et al. 1992).

Some concern has been expressed that grizzly bears may be adversely affected by the removal of bison carcasses from the ecosystem due to brucellosis risk management actions occurring at the park boundaries. However, it appears that such removal has little if any effect upon the bear population. As mentioned above, grizzlies in the Yellowstone area were recently removed from the threatened and endangered list of the Endangered Species Act. Second, even in the absence of road grooming a substantial number of bison would be removed annually, as modeled in the Gates study. Finally, other recent studies have found that one of the most important food sources for Greater Yellowstone grizzlies is whitebark pine nuts (Felicetti et al 2003).

Because grizzlies are in hibernation in the winter and because most of their dens are away from the parks' road systems where all OSV use occurs, winter recreation has little potential to disturb them. Wildlife-proof garbage holding facilities for interior locations (including Old Faithful Snowlodge) are provided as part of the regularly-occurring park operations. Moreover, the grizzly bear population has been increasing even during the period of peak winter visitation, confirming that winter recreation, under any of the rules governing winter use in the last thirty years, has disturbed them little, if at all. Consequently, the discussion of the effects of winter use upon grizzly bears is not carried forward.

Wolverines (*Gulo gulo*)

The wolverine is an uncommon, medium-size (6–18 kg) carnivore that is circumpolar in distribution and one of the least understood mammals in the world. In fact, all current understanding of wolverines is based upon less than twenty North American field studies, only three of which have occurred in the 48 contiguous United States. From this extremely limited information, scientists believe that wolverines typically inhabit remote areas north of the 40th

parallel, with the most southerly and easterly breeding population likely in the GYA. In the contiguous 48 United States, they seem to inhabit boreal forest, montane forest, and alpine habitats. They seem especially attracted to rocky areas and talus slopes at or near timberline. They have extremely large ranges (100–1500 km^2) and travel very long distances; daily movements exceeding 35 km are not unusual. They typically exist at very low densities (0.1–2.5 individuals per 100 km^2). In the western portion of the GYA, for example, average home ranges of wolverine were 700 km^2 for adult females and 1300 km^2 for males. Sub-adult animals also travel long distances when leaving their natal territory. Dispersal movements in excess of 200 km have been documented. Wolverines eat mammal carrion, ungulates such as mountain goats (*Oreamnos americana*), and small and mid-size prey such as mice (*Peromyscus* sp.), voles (*Microtus* sp.), snowshoe hares (*Lepus americanus*), and porcupines (*Erethizon dorsatum*). They den in late winter, often in rocky areas (Copeland and Murphy 2005, Inman et al. 2003, Copeland 1996, Banci and Harestad 1988; Banci and Harestad 1990; Gardner et al. 1986, Magoun and Copeland 1998; Magoun and Valkenburg 1983; and Hornocker and Hash 1981).

Reflecting the state of general knowledge about wolverines, very little is known about the animal in the parks or surrounding area. They are believed to be widely distributed, but at low densities, in mountainous areas of the GYA. The YNP database includes 182 sightings (1887–2004) of wolverines or their tracks, although these sightings are of varying qualities. Between 1990 and 2005, researchers saw one wolverine and documented five tracks in the park or vicinity.

Prompted by elevated public concern about the welfare of the wolverine, the NPS and USFS began the Absaroka-Beartooth Wolverine Project in January 2006. The project intends to clarify the wolverine's dependence on habitats in YNP and surrounding National Forest lands by studying wolverine distribution and movements, habitat and food associations, and population indices such as survival rates, birth rates, and dispersal movements. The project also hopes to clarify the wolverine's relationship with other carnivores in the Yellowstone ecosystem.

Two wolverines were trapped and instrumented in the winter of 2005-2006, one of which was near Sylvan Pass (Wolverine Project Update, spring 2006). This point on the East Entrance Road is the highest road in the parks currently open to OSV use (about 8500 feet). Therefore, the closest OSV traffic to possible wolverine denning habitat (which is often rocky terrain above 8000 feet) occurs at the pass (Landa et al. 1998; Banci and Harestad 1990). It is also the closest OSV route to recent, confirmed wolverine presence in the parks.

Banci and Harestad (1990) suggested that adequate year-round food supplies (especially ungulate carrion) may be more important to wolverine than particular types of topography or plant associations. Sylvan Pass is not considered highly productive given its high elevation and snow cover; this could result in the vicinity near Sylvan Pass being utilized less than surrounding areas that support elk and provide winter-kill resources. The less often that wolverines utilize the landscape in proximity to the pass itself, the less they would be subject to impacts from OSV use.

Human disturbance has been indicated as the cause of den abandonment for wolverines (Copeland 1996; Myberget 1968; Pullianian 1968). However, Magoun and Copeland (1998) indicated that snow melt may be a contributing factor in vacating dens, as female wolverines in arctic Alaska did not appear disturbed by human activity.

*Trumpeter Swans (***Cygnus buccinator***)*

YNP has both a resident and a migratory trumpeter swan population. About 14 swans are resident in the park, with autumn migratory populations numbering as high as 500. Resident

trumpeter swans display strong fidelity to breeding areas and nest sites, and winter habitat is generally associated with areas of ice-free, open water. Trumpeters are long-lived and slow to reproduce. Nesting attempts in YNP have ranged from two to ten annually. In 2006, three nest attempts were made, compared to three in 2005, four in 2004, and three in 2003. Swan populations in the parks may be dependent on immigration from the Centennial Valley to the west (McEneaney 2006; Olliff et al. 1999).

Swan presence in the parks decreases as winter weather reduces areas of open water. The nesting period for these birds does not occur until OSV traffic has ceased. A site located along the Madison River, less than 100 meters from YNP's heavily used West Entrance Road, has been a traditional swan nesting area for decades and at least 23 cygnets have fledged from this site since 1983, making it one of the more productive nesting areas in YNP.

Based upon the winter wildlife monitoring NPS has performed in YNP from 2002-2006, trumpeter swan responses to OSVs were characterized as 57% "no response," 21% "look/resume," 12% "attention/alarm," 9% "travel," and 1% "flight" (White et al. 2006; Borkowski 2006). In the last two winters, visible swan response rates have dropped in intensity, averaging 90% "no visible response," 5% "look-resume," 3% "travel," and 2% "alarm-attention" last winter (McClure and Davis 2008). Similar to other species, the estimated odds of behavioral responses by swans interacted with covariates such as distance to road, interaction time, and human behavior. For example, the odds of observing no response relative to a movement response were eight times greater for each 100-meter increase in distance from the road. Each 1-minute increase in interaction time increased the odds of a movement response relative to no response by 1.2 times. The odds of observing a movement response from swans were three times greater when humans approached on foot. Finally, the estimated odds of observing a movement response compared to no response by trumpeter swans during the same period were 1.1 times greater for each additional snowmobile (White et al. 2006; Borkowski 2006).

Resident populations of swans are considered vulnerable in YNP and the GYA. The number of resident adult/subadult and cygnet trumpeter swans in YNP has decreased between 1961 and 2005. Swans have decreased regionally throughout the GYA during the past several decades, including previously productive areas such as Montana's Centennial Valley. Swans in the GYA are especially vulnerable to population declines due to their low abundance, slow reproduction, and predation from grizzly bears and bald eagles. These factors also indicate that any improvements to trumpeter swan numbers in the parks will necessarily be slow (McEneaney 2006; Olliff et al. 1999).

While decreases in reproductive rates have been detected in other birds exposed to increased recreational activity, it is unlikely that poor production across the GYA has resulted from OSV use in YNP. Swans generally return to their breeding territories between February and late May, with young hatching in late June when OSV traffic is no longer a presence in the parks (Stalmaster and Kaiser 1998; Steidl and Anthony 2000; Gonza´lez et al. 2006; Olliff et al. 1999).

Coyotes and Ravens (*Canis latrans *and* Corvus corax*)

Coyotes are abundant, successful and highly adaptable predators in the GYA. They are common in all habitats below 8000 feet, and can utilize higher elevations seasonally (Gehman et al. 1997). Before wolf reintroduction, it was found that coyote densities on Yellowstone's Northern Range ranged as high as 1 animal/ km^2 in open grasslands and shrub habitats. In the years immediately following wolf reintroduction, coyote numbers in the Lamar Valley declined by as much as 33% (Crabtree and Sheldon 1999). In 2003, Switalski (2003) found that coyotes in the Lamar Valley

responded by adapting their activity budgets to increase vigilance behavior and spent less time resting when they were in wolf territories, compared to when they were outside wolf territories.

Coyote behavior differs from many other species in that they sometimes actively seek out interactions with winter recreationists, primarily in an attempt to obtain food. Coyotes are of interest in the winter use debate precisely because of this kind of behavioral adaptability.

Prior to the implementation of mandatory guiding, some visitors responded to coyote begging behavior by providing food, reinforcing the animal's tendency to approach humans in an effort to obtain food. The advent of mandatory guiding in YNP has mostly eliminated this problem, as guides are trained to prevent their clients from encouraging coyote begging behavior. Coyotes have been considerably less likely to seek out or receive human food since 2003 (Taber 2006).

Ravens are a species that also seek out human food. Ravens do not so much beg food from people as seek to obtain food that humans have left in an unguarded situation. Prior to the institution of mandatory guiding, ravens typically found food that snowmobilers had left in the storage compartment under snowmobile seats. The advent of mandatory guiding has virtually eliminated this problem wildlife behavior, as guides are careful to prevent their clients from leaving food in the compartments while away from their machines (Taber 2006).

Other Species

Moose (Alces alces)

In YNP, moose occur at low densities. Although no population estimates exist for them, recent studies indicate a population decline in areas where landscape-level fires (including the 1988 fires) have affected old-growth lodgepole pine winter range. Potential changes in deciduous vegetation, especially willows (Salix spp.) in riparian areas may also affect moose winter foraging and population levels (Tyers and Irby 1995). Future population trends are uncertain and may vary due to habitat conditions, exposure to predation, and human influences (Tyers 1999).

In GTNP, moose were rare or absent before about 1912, but were numerous by 1950. During the mid-l960s, 200 to 250 moose were year-round residents of the valley areas in the park and the adjacent Buffalo Valley. This segment of the Jackson moose population increased from 700 to 900 during winter when moose migrated onto winter range from other areas inside and outside the park. The parkwide population during summer is unknown, but most moose that summer within the park probably remain for the winter (NPS 1995).

Moose that spend the summer at high elevations move downslope to river bottoms and sagebrush flats in the winter, where they are abundant and highly visible. Areas that provide important winter habitat include the Willow Flat, Hermitage Point area, Buffalo Valley, and the Snake and Gros Ventre River corridors. All or portions of these areas are closed to winter use to protect wintering moose and other wildlife.

Moose are widespread in the parks and in the northern Rockies. Additionally, there is no evidence that their population or distribution has been affected by winter recreation. Consequently, the discussion of impacts upon them is not carried forward.

Bighorn Sheep (Ovis canadensis)

Bighorn sheep were historically found throughout the western mountains of North America. However, populations have dramatically declined throughout their range. These declines are associated with competition with livestock, introduction of disease, hunting, and loss of habitat

during settlement of the West. In YNP, the bighorn sheep population ranges from 240 to 325 and winter ranges are located exclusively in the northern part of the park (Legg 1998).

In GTNP, bighorn sheep are found in isolated bands at high elevations along the western park boundary and among the major peaks.

Because there are no OSV routes through bighorn sheep winter range, the discussion of impacts upon bighorn sheep is not carried forward.

Reptiles, Amphibians, and Fish

Winter recreation does not appear to have any direct impacts to reptiles, amphibians, fish, aquatic invertebrates, and other aquatic resources. Water pollution caused by toxins in the snowpack was a concern historically, but has been dismissed as an impact topic due to the reduced emissions from BAT snowmobiles (see Water Quality under Topics Dismissed from Further Analysis). For that reason and because these species hibernate or are inactive in winter, the discussion of impacts upon them is not carried forward.

Soundscapes

The affected environment for impacts to the natural soundscape is generally limited to activities that occur within the parks, as discussed below.

Regulatory and Policy Overview

An important part of the NPS mission is to preserve or restore the natural soundscapes associated with units of the National Park System. The 2006 NPS Management Policies defines the "natural ambient sound level" as "the environment of sound that exists in the absence of human-caused noise," and considers this to be the "baseline condition, and the standard against which current conditions in a soundscape will be measured and evaluated" (NPS 2006: 8.2.3) (however, in *Environmental Consequences,* comparisons are made against existing ambient conditions because the monitoring information upon which analysis was based included all ambient sounds—such as other human-caused sounds like exhaust fans and voices—some of which obscured the sound of OSVs). Further, the NPS "will restore to the natural condition wherever possible those park soundscapes that have become degraded by unnatural sounds (noise), and will protect natural soundscapes from unacceptable impacts" (NPS 2006: 4.9). Although "park visitors also expect sounds … associated with people visiting their parks (such as children laughing, park interpretive talks, motors in cars and motorboats)", NPS's 2006 Management Policies direct that "the Service will take action to prevent or minimize those noises that adversely affect the visitor experience or that exceed levels that are acceptable to or appropriate for visitor uses of parks" (NPS 2006: 8.2.2).

The NPS Organic Act of 1916, as amended, was clearly promulgated before the advent of oversnow vehicles, air tour overflights, and other motorized recreational vehicles or pursuits that have become commonly used by the public. The act was written and enacted in an environment in which it was clear that the American people wanted places to go that were undisturbed and natural and which offered a retreat from the rigors and stresses of everyday life. Consistent with the spirit of the Organic Act, a variety of other laws have since been enacted to address the specific issue of sound or noise in the national parks, beginning with the Grand Canyon National Park Enlargement Act of 1975, which explicitly recognized "natural quiet as a value or resource in its own right to be protected from significant adverse effect." Natural quiet is construed to mean natural sound conditions, which the NPS uses as one baseline for

determining impacts in an analysis such as this. The law requires that the NPS and FAA find a way to manage air tours in a way that substantially restores natural quiet to the park. With overflights continuing to have significant adverse effects on natural quiet and visitor experience in the parks, Congress passed the National Parks Overflight Act of 1987, directing the NPS (and the USFS) to study the impacts of such flights. The resultant NPS study clearly expressed the existing and potential impacts from a variety of sound sources on the "natural quiet" or natural soundscape resource of the parks. Largely resulting from the Report to Congress mandated by the Overflights Act, Congress passed the Air Tour Management Act of 2000. The ATMA requires the NPS and the FAA to study and develop air tour management plans for each park with air tours.

Given the legislative history and the references throughout NPS regulations and management policies, inappropriate sound or noise is clearly an issue to be addressed when considering a proposal for use and enjoyment of the national parks. Natural quiet, or natural sound conditions that would prevail without human presence, is an appropriate baseline from which to gauge the impacts of human use. It is within the purview of an NPS decision-maker, by law and policy, to determine the allowable departure from natural sound conditions that would be experienced in providing for human enjoyment of a park.

New Research and Monitoring

Systematic soundscapes monitoring has been conducted since the winter of 2003-2004 for YNP and GTNP. This effort is the basis for characterizing existing soundscape conditions herein. The primary purpose of acoustical monitoring has been to measure the impact of snowmobile and snowcoach sound on the parks' natural soundscape. The reader is referred to recent monitoring reports (Burson 2008a, 2007, 2006, 2005, and 2004) for more detailed and additional information on park soundscapes. Two recent short-term studies (Ambrose et al. 2006, and reproduced in the appendix of the 2006 monitoring report, and another effort discussed in Burson 2008a) used specialized low noise instrumentation to determine how low sound levels can be in Yellowstone; both studies found very, very quiet conditions at times (see the next section for more discussion of these studies). Often, the lowest minimum sound levels were below the range (noise floor) of the standard instrumentation for many hours of the day in the monitoring studies. Including these efforts, the best available information has been used to describe the natural ambient soundscape as the basis for assessing relative impacts of OSVs. The monitoring reports referenced above are available on the YNP website, http://www.nps.gov/yell/parkmgmt/winterusetechnicaldocuments.htm.

Prior to 2003, much more limited monitoring occurred on the soundscapes of Yellowstone and Grand Teton, thus it is difficult to draw comparisons from existing conditions to historic conditions based on monitoring. The following section describes the existing soundscapes of the parks, based on monitoring from the last several winters.

Existing Soundscape Condition

During the winter, the natural soundscapes of the parks could generally be described as either quiet or windy, but in fact are highly variable in both space and time. Sound-producing physical processes such as geothermal activity, wind and water, and especially biological processes such as animal vocalization depend heavily on location and time of day.

Natural soundscapes vary from the high peaks of the Teton Range to the banks of cascading rivers and streams to the middle of Yellowstone Lake. Weather conditions can be calm, but are often windy, especially in the afternoons. Howling wind and blowing snow of blizzards during

the winter can dominate the natural soundscape. Rushing streams, waterfalls, and rivers create a constant high to moderate sound level that masks nearby natural sounds in those areas. Geothermal areas have intermittent gurgling, hissing, rushing, and eruptive sounds. Croaking ravens are a regular daytime companion; soft calls from chickadees and other small passerines mingle with the harsh notes of nutcrackers and magpies. Gray Jay vocalizations contrast with red squirrel chatter in forested areas. Sounds associated with branches and trees rubbing against each other and popping sounds from wood freezing and thawing during very cold periods are commonly audible within the forested areas of the parks. Near larger bodies of water, the groaning and popping sounds of frozen lake waters accompany temperature fluctuations. The depth of night and early morning are often silent, broken only by the hoot of a distant owl or the howls of wolves.

Sound is measured in decibels, with A-weighted decibels or dBA expressing the relative sound level as perceived by the human ear. For this measure, sounds at low and high frequencies are reduced, compared with unweighted decibels (dB), where no correction is made for acoustic frequency. The decibel scale is logarithmic, meaning a 10 dBA increase in sound source level represents a tenfold increase in sound energy and causes an approximate tenfold increase in the area in which it can be heard. Table 3-2 provides a listing of common sounds and includes some actual sounds monitored in the parks. The threshold of healthy human hearing is near 0 dBA.

Table 3-2: Decibel Levels of Commonly Known Sound Sources[1]

Sound	Noise Level (dBA)	Effect
Jet Engines (near)	140	
Shotgun firing	130	Threshold of pain begins around 125 dB
Jet takeoff (100-200 ft.)	130	
Rock concerts (varies)	110-140	
Oxygen torch	121	
Discotheque, Boom Box	120	Threshold of sensation begins around 120 dB
Thunderclap (near)	120	
Stereo (over 100 watts)	110-125	
Symphony orchestra, chainsaw	110	Regular exposure to sound over 100 dB of more than one minute risks permanent hearing loss.
Turbo-prop aircraft (200 ft.)	110	
Pneumatic drill, jackhammer	110	
Jet flyover (1000 ft.)	103	
Electric furnace area	100	No more than 15 minutes of unprotected exposure recommended for sounds between 90–100 dB
Garbage truck, cement mixer	100	
Farm tractor	98	
Newspaper press	97	
Subway, motorcycle (at 25 ft.)	88	Very annoying

[1] Table adapted from the National Institute on Deafness and Other Communication Disorders at http://www.nidcd.nih.gov/health/hearing/ruler.asp

Lawnmower, food blender	85-90	85 dB is the level at which hearing damage (8 hrs.) begins
Recreational vehicles, TV	70-90	
Diesel truck (40 mph at 50 ft.)	84	
Average city traffic, garbage disposal, Motorcycle with modified exhaust (45 mph at 100 ft.)	80	Annoying; interferes with conversation; constant exposure may cause damage
Dishwasher, washing machine	75-78	
Vacuum cleaner, hair dryer, 2-stroke snowmobile (30mph at 50 ft.)	70	Intrusive; interferes with telephone conversation
4-stroke snowmobile (30 mph at 50 ft.), Automobile (45 mph at 100 ft.)	60	
Quiet office, conversation, croaking raven flyover (at 100 ft.)	50-60	Comfortable hearing levels are under 60 dB
Refrigerator humming, Snake River (at 100 ft.)	40	
Whisper, broadcasting studio, Snake River (at 300 ft.)	30	Very quiet
Rustling leaves	20	Just audible
Normal breathing	10	
Yellowstone winter backcountry	0	Threshold of hearing

Some of the quietest sound levels measured in natural environments have been recently documented during the winter in YNP (Ambrose et al. 2006; Burson 2008a). In 2006, Ambrose et al. documented very low sound levels (below 6.5 dBA) on and near Sylvan Lake on the Fishing Bridge to East Entrance Road during February 2006. Two short-term studies the following February documented sound levels: as low as 0.7 dBA near Craig Pass in Yellowstone and 6.5 dBA at the base of the Teton Range in Grand Teton (Burson 2008b). Clearly, the soundscapes of the parks can be extremely quiet at times—at the very threshold of human hearing.

Winter soundscapes in the absence of non-natural sounds can be particularly quiet, much more so than summertime, for two primary reasons. First, there is more natural sound in spring, summer, and fall. Insects and migratory birds are present in these seasons; they create a chorus of natural sound (with birds, especially around dawn). Deciduous trees are leafed out, creating a rustling whenever wind blows. Creeks and rivers are flowing more vigorously and are not frozen or entrenched within walls of snow. In late summer and fall, bison are bellowing and elk bugling. Second, winter has a widespread sound absorption material present in the form of snow on both trees and the ground. However, non-natural sounds, when present, propagate sound farther in the cold, dense air and during the common temperature inversions of winter than they do in the warm, thinner air of summer (Burson 2008b).

Compared to summer, human activity in winter can be reduced as well, at least in those areas of the parks less accessible in winter than in summer. Human-generated sounds, including non-motorized activities like skiing, are superimposed upon the natural soundscapes. Motorized winter-use related sounds are loudest and most common near developed areas and travel corridors.

Snow-covered groomed roads share many of the same acoustic properties of plowed roads. The percent time that vehicles are audible depends in part upon their numbers on any given day. Vehicle type and speed largely determine the maximum sound levels. Grooming machines are generally the loudest, but relatively infrequent, producers of sounds on groomed routes. They

generally operate during the evening and the night when other OSVs are usually not present. Plowing activity can occur anytime during the day or night, but wheeled traffic occurs primarily during the daylight and early evening hours.

More specifically, sounds from road activity can easily propagate over one mile and much farther depending on the type of vehicle and the weather conditions. Sound levels are highest immediately adjacent to the road, but the percent time audible is often as high farther from the road corridor due to the additive effects of multiple vehicles separated along the travel corridor. In recent winters, all types of OSVs (recreational snowmobiles and snowcoaches and NPS, concession, and contractor administrative snowmobiles and snowcoaches) were often audible over 50% of the 8 am to 4 pm period along the busiest corridor (West Yellowstone to Old Faithful) and between 25% and 40% along the next busiest route (Flagg Ranch to Old Faithful) (Burson 2008a). On less traveled corridors, OSVs were generally audible less than 25% of the day. Maximum sound levels are often over 70 dBA immediately adjacent to the travel corridor, 40 dBA at 1000 feet, and still audible but below natural ambient levels at one mile and beyond.

Developed areas include warming huts (only operated during the day), entrance stations or departure locations such as Flagg Ranch, and destination locations such as West Thumb and Old Faithful. The soundscapes of these areas vary from intermittent OSV sounds and human voices to constant utility sounds from exhaust fans and heating systems. The largest developed area, Old Faithful, has many facilities for staff and winter visitors. In addition to visitors arriving and departing on OSVs there are many administrative OSVs in use. The lowest sound levels in these locations depend on the proximity to the utility sounds of these facilities; the highest sound levels depend on the distance from the OSV routes. All types of OSVs were audible between 60-70% of the period 8 a.m. to 4 p.m. during the last several winter seasons at Old Faithful near visitor facilities. The average percent time audible of OSVs was about 30% during the day for the winters of 2004-05 and 2005-06 along the boardwalk in the transition zone beyond Old Faithful Geyser in the Upper Geyser Basin. This compares to about 50-60% over the same two winters within the developed area of West Thumb Geyser Basin, where visitor facilities consist of just one or two buildings that are closer to the nearby groomed travel corridors. Within Grand Teton OSV sounds are greatest at Flagg Ranch, the launching area for snowcoach and snowmobile trips into Yellowstone. During 8 am to 4 pm OSVs were audible an average of 28% of the time during the winter of 2003-2004. At the next busiest area, OSV on Jackson Lake used by anglers were audible for less than 4% of the day.

The natural soundscape is often uninterrupted in park backcountry areas beyond the effects of travel corridors and developed areas. Although human-caused sounds may extend beyond four miles, areas beyond two miles usually have very low sound levels of OSV sounds and only during certain atmospheric conditions. For example, monitoring at Shoshone Geyser Basin, over 5 miles from the nearest road, last winter found OSVs audible anywhere from 0% to 47% of the day, averaging 18% of the day (at that distance, it was impossible to discern whether snowmobiles, snowcoaches, or both were responsible for the sound). Conversely, at the Lone Star geyser area, one mile from the nearest road, audibility levels were much lower than Shoshone Geyser Basin (only 3-4% audible), illustrating that terrain and local geyser activity can influence a site's soundscape dramatically (Burson 2008a).

In addition to the sounds related to the winter use activity, aircraft sounds are often audible and at sound levels that range from very quiet to levels that mask other sounds. High commercial jets, research flights of low flying propeller planes, sounds of corporate and general aviation aircraft and medical rescue helicopters are audible from less than 10% of the day to over 20% depending on the location. At the Fern Lake backcountry monitoring site in Yellowstone,

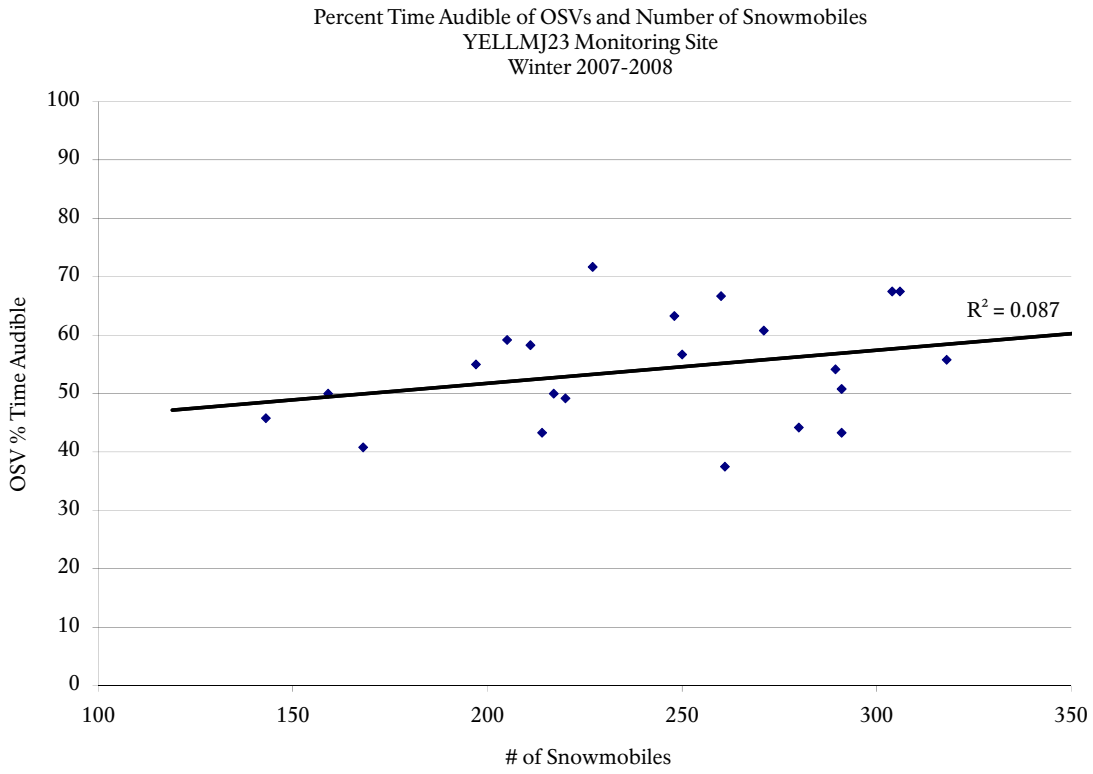
aircraft noise was audible 5-10% of the day. In GTNP, the percent time audible and sound levels generally increase at locations closer to the Jackson Hole Airport.

Detailed Monitoring Data for Old Faithful and Madison Junction

The acoustic data set collected pursuant to the winter use planning efforts is one of the most extensive such sets for national parks in existence. These data illustrate that the parks' soundscapes are highly variable over time, both in minutes and seasons. Current soundscape statistics do not fully explain this inherent variability. For example, as Figure 3-1 below indicates, total recreational snowmobile entrance counts explain only a small portion of the variance in OSV audibility at the Madison Junction monitoring site: less than 9% (of course, OSV presence must determine audibility to some degree). The R-squared value on the chart is the explanatory value of the correlation plotted on the graph. If the plotted values were a perfectly straight line, then the R-squared value would be 1.0, indicating that the line explained all variance in the values—there was a perfect correlation between the X and Y values on the chart. The more scattered the values on the graph, the lower the R-squared value and the poorer the explanatory relationship between the values on the X and Y axes of the graph.

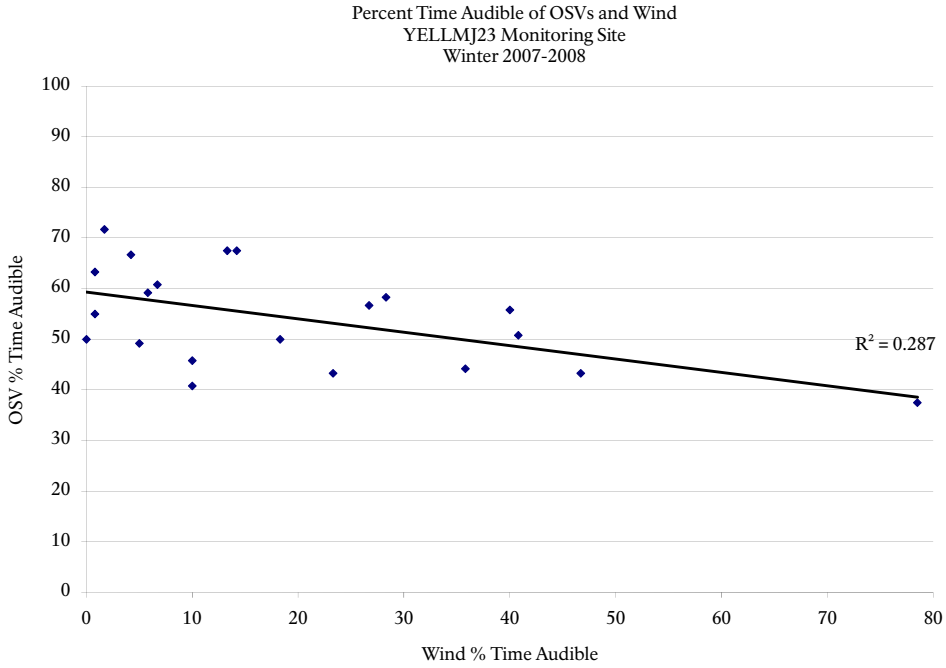
This counter-intuitive finding has several explanations. The exact number of oversnow vehicles passing this monitoring site is not known; only entrance station totals of recreational vehicles are available. Not all the snowmobiles entering the park pass this site; the percentage on any given day that do may vary substantially. Also, the number of snowcoaches, while substantially fewer than the number of snowmobiles, varies daily and contributes varying amounts of OSV sound to audibility. Administrative access contributes about 21% the percent time audible along travel corridor sites such as Madison Junction, thus contributing to the lack of relation between recreational snowmobile use and audibility. Many other variables may act to mask OSV audibility, including wind, wildlife sounds, the sound of the Madison River, humans talking, etc. OSVs vary in how they are grouped and how they pass the monitoring site. As OSV numbers increase, group size may increase rather than number of groups. Some days may find most OSVs tightly clustered together, where other days may find them more spread out. The former condition would decrease audibility; the latter, increase it (both under typical conditions). Number of groups has a larger influence on OSV audibility than does number of OSVs.

Figure 3-1. The daily number of parkwide recreational snowmobiles entering Yellowstone and OSV audibility at Madison Junction 2.3 monitoring site.



Interestingly, the presence or absence of wind at this site plays a greater role in determining OSV audibility, as Figure 3-2 below indicates. Other factors, described above, influence audibility, though correlations for others are not known.

Figure 3-2: The percent time wind and OSVs are audible at Madison Junction 2.3 monitoring site.



Audibility can also be viewed in different ways. For the last four planning efforts in the parks, audibility has been measured by the percent of time between 8:00 a.m. and 4:00 p.m. in which OSVs are audible at a given point. The focus of previous travel corridor analyses has been on a monitoring site near Madison Junction (see the section below, for example). The busiest travel corridor in winter, monitoring there revealed that OSVs were audible about 54% of the 8-hour day (using those days with 318 and fewer parkwide recreational snowmobiles per day entering all four oversnow entrances). When the period of analysis is expanded to coincide with the 7:00 a.m. to 9:00 p.m. time frame when the roads are open to the public, OSV audibility at this site drops to an average of 45% (with 318 and fewer parkwide recreational snowmobiles per day). If one restricts the period of analysis to the busiest hour of the day, 9:00 a.m. to 10:00 a.m., audibility rises to 81%; it falls to 31% during the slow noon hour. Another road corridor monitoring site, Grant Village/Lewis Lake (on the South Entrance Road), averaged 37% from 8:00 a.m. to 4:00 p.m. (calculated with 557 and fewer parkwide recreational snowmobiles). When audibility is averaged across all road corridor monitoring sites, a figure of 43% results (for 318 and fewer parkwide recreational snowmobiles). This exercise illustrates that one's selection of monitoring site(s), OSV numbers, and periods of analysis can greatly influence the final figure for percent time audible. Table 3-3 illustrates the range of audibility figures, depending on one's selection of monitoring site(s) and periods of analysis.

Table 3-3: Audibility is partly a function of monitoring site and period of analysis.

Site(s)	Period of Analysis	Audibility
Madison Junction	12:00 noon to 1:00 p.m.	31%
Madison Junction	7:00 a.m. to 9:00 p.m.	45%
Madison Junction	8:00 a.m. to 4:00 p.m.	54%
Madison Junction	9:00 a.m. to 10:00 a.m.	81%
Grant Village/Lewis Lake	8:00 a.m. to 4:00 p.m.	37%
All travel corridor monitoring sites in Yellowstone	8:00 a.m. to 4:00 p.m.	43%

Although sounds from OSVs are audible within a relatively small portion of the parks' total acreage, they are concentrated to a large degree around travel corridors and park attractions and affect the areas most accessible to the vast majority of park visitors. Most areas used by winter visitors seeking solitude and quiet are within two miles of travel corridors. Remote backcountry areas that are largely free of non-natural sounds are beyond the reach of most visitors because of the distances involved and the arduous nature of winter backcountry travel. For these reasons, the following discussion will focus on developed area and road corridor soundscapes (as noted above, though, backcountry areas have variable audibility, and as the soundscapes discussion in *Environmental Consequences* will make clear, the NPS seeks to protect backcountry soundscapes and those in the frontcountry).

During the 2007-2008 winter use season, the focus for acoustic monitoring was on three Yellowstone sites representative of high-use developed areas and travel corridors: Old Faithful Weather Station, a point 2.3 miles west of Madison Junction, and the Grant Village/Lewis Lake point (one mile north of the Heart Lake Trailhead). Short-term monitoring was also conducted at three sites representative of transition zones and backcountry areas: Shoshone Geyser Basin (discussed above), on the Delacy Creek Trail, and on the Mary Mountain Trail.

At the three developed area and travel corridor sites, acoustic measurements were collected from December 19, 2007 to March 9, 2008 (the entire winter use season) to monitor the natural soundscape. The average parkwide daily use by OSVs at these monitoring sites during the season was about 294 snowmobiles and 35 snowcoaches. Results for Old Faithful Weather Station (Figures 3-3 and 3-4) and near Madison Junction (Figures 3-5 and 3-6) are provided and discussed in more detail below to illustrate data for each management zone. Acoustic data from previous years may be found in the soundscape monitoring reports on the NPS website for comparison (see http://www.nps.gov/yell/parkmgmt/winterusetechnicaldocuments.htm).

Although on average snowmobiles were audible for more time than snowcoaches, snowcoaches in general had higher sound levels, especially at higher speeds. The overall impact on the natural soundscape from OSVs was similar to previous winter seasons. The number of OSVs that entered the park last winter was similar to that from the previous winter. Consistent with acoustic data collected during previous winter seasons, the sound level and the percent time OSVs were audible remained substantially lower than during the 2002-03 winter use season, the last season in which non-BAT snowmobiles were permitted in Yellowstone (those machines had on average 5 dBA higher sound levels than do BAT snowmobiles). Besides the change from two-

to four-stroke engine technology, the reduced sound and audibility levels were also explained by fewer snowmobiles than during 2002-03 and the guided group requirements.

Soundscapes sound level monitoring data include all sources of sound while audibility monitoring data include all sources of OSV sounds; these are measured and compared against the goals identified in the 2007 FEIS. One contribution to the overall impact on the natural soundscape is administrative OSV travel. Importantly, and as described below, monitoring results indicate that administrative vehicles clearly contribute to soundscapes impacts: although administrative snowmobiles operated by NPS, concession, and contractor employees comprise 6-17% of the individual snowmobiles, they are heard 29% of the time during an 8 a.m. to 4 p.m. period (Burson 2008a). Many are operated individually, rather than in groups, and they include some non-BAT administrative snowmobiles (as many as 99 in 2004, although that number has likely dropped by as much as 50%).

Conditions in the Old Faithful Area

Acoustic data were collected at the Old Faithful Weather Station site in 2007-2008 for the fifth winter. The monitoring site is adjacent to the west parking lot used by all snowmobiles and snowcoaches entering and leaving the Old Faithful area. It is also close to both the Ranger Station and Snow Lodge, both of which produce mechanical sounds 24 hours per day. Old Faithful Geyser is approximately 2600 feet from the monitoring site. For these reasons, the site is not representative of what a visitor might hear while enjoying the geyser. Instead, it is more representative of what a visitor might hear at a moderately-sized or large resort. The monitoring data described below for the Upper Basin site or the West Thumb developed area are more representative of what a visitor walking one of the boardwalks at Old Faithful or observing the geyser would hear.

Within the developed area at Old Faithful, the average daily percent time audible for snowmobiles and snowcoaches was 68% (Fig. 3-5). OSVs were audible on a daily (8:00 a.m. to 4:00 p.m.) basis consistently between 60% and 80% of the time; Figure 3-4 illustrates the typical audibility by hour. For the last four winters, average OSV audibility at Old Faithful has varied only from 67% to 69%, consistently remaining below the audibility threshold from the FEIS for developed areas (though 2 of the 27 days analyzed last winter did exceed this 75% threshold). Contractors accounted for 9% of the total number of groups and 4% of the total number of snowmobiles audible in the Old Faithful area during observations over the last four winters. The wind bars in Figures 3-3 to 3-6 indicate the percent time wind is audible.

Figure 3-3. The percent time audible for snowmobiles and snowcoaches, and wind by date at Old Faithful Weather Station, Yellowstone National Park from 8 a.m. to 4 p.m., 19 December 2007 to 8 March 2008.

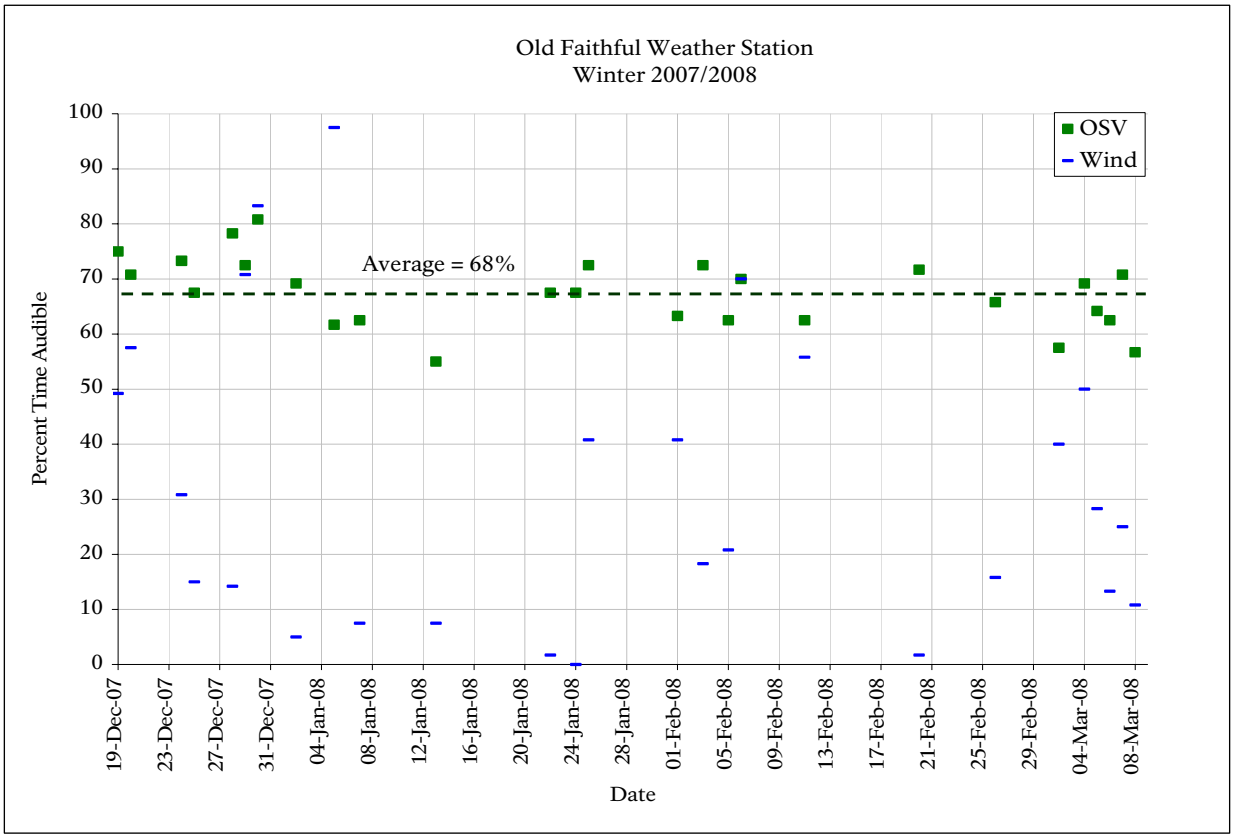
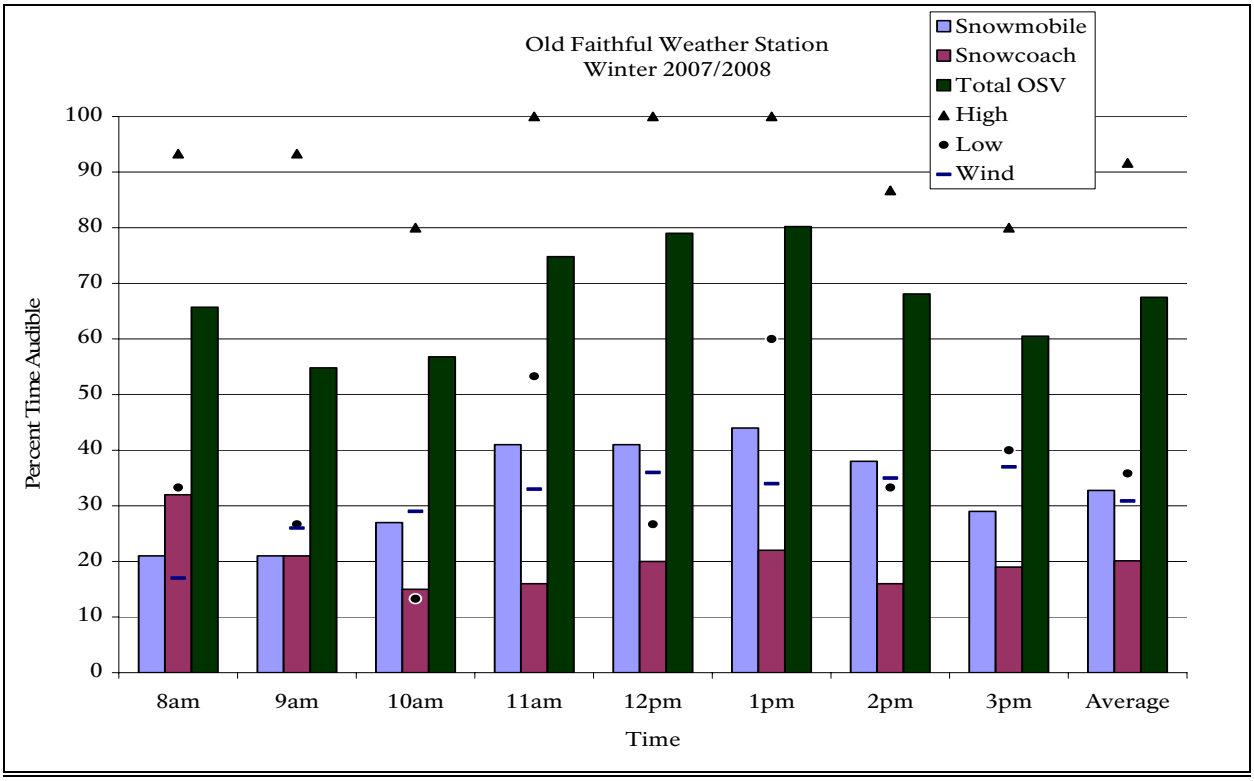


Figure 3-4. The average percent time audible by hour (8 am-4 pm) of snowmobiles (left light blue bar), snowcoaches (middle maroon bar), and combined category (right dark green bar), and high and low OSV values at Old Faithful Weather Station, Yellowstone National Park from 8 a.m. to 4 p.m., 19 December 2007 to 8 March 2008.



Note: Original figure is in color; printing costs precluded use of color. The reader may obtain the color version at http://www.nps.gov/yell/parkmgmt/winterusetechnicaldocuments.htm.

In the winters of 2004-05 and 2005-06, acoustic data were also collected at a location in the developed area of the Old Faithful Upper Basin. This monitor was located adjacent to a boardwalk within a popular thermal area about 1800 feet (1/3 mile) from the nearest motorized route. The data from this site provide a useful comparison to data collected at the Old Faithful Weather Station (about 2600 feet (1/2 mile) away, and much closer to vehicular traffic and visitor buildings). At the Upper Basin site, the sounds of wind and thermal features such as nearby geysers and steam vents often masked distant sound of OSVs. The percent time OSVs were audible at the Upper Basin was 35% compared to 68% at the Weather Station. OSVs that were audible at the Upper Basin sites were often approaching or departing the Old Faithful area along the roads leading north or south and were not within the developed area itself, where the weather station site records most OSVs traveling to and through the developed area. Clearly, even this small a distance (1/3 mile) can have a substantial effect on audibility. At West Thumb Geyser Basin, audibility of OSVs was between that of the two Old Faithful sites, at about 56%.

Madison Junction to West Yellowstone Travel Corridor

The Madison Junction 2.3 monitoring site was located 100 feet off the West Entrance Road 2.3 miles west of Madison Junction in a travel corridor management zone. Acoustic data were collected over the entire winter use season during 2007-08 (for the third complete winter). Snowmobiles and snowcoaches (including administrative travelers) were audible for an average

of 53% of the time during the winter use season last year (Fig. 3-7), with the percent time audible for 15 (56%) of 27 days analyzed exceeding 50%. Commercially guided snowmobiles account for about 70% of groups and about 94% of individual snowmobiles along travel corridors (Burson 2008a). It is important to remember that about 21% of the audibility at this site is attributable to administrative snowmobiles; when that portion is removed, audibility levels at this site fall to about 46%.

The bimodal distribution (Fig. 3-6) reflects the pulse of OSVs in the morning on the way to Old Faithful and in the afternoon on the way back to West Yellowstone. This figure also shows that many of the OSVs cannot be distinguished as a snowmobile or a snowcoach. This indicates that many OSVs were audible over long distances because those operating nearby can usually be identified.

Figure 3-5. The average percent time audible by date of snowmobiles and snowcoaches, and wind at 2.3 miles (3.7 km) west of Madison Junction along the West Entrance Road Yellowstone National Park, 19 December 2007-8 March 2008.

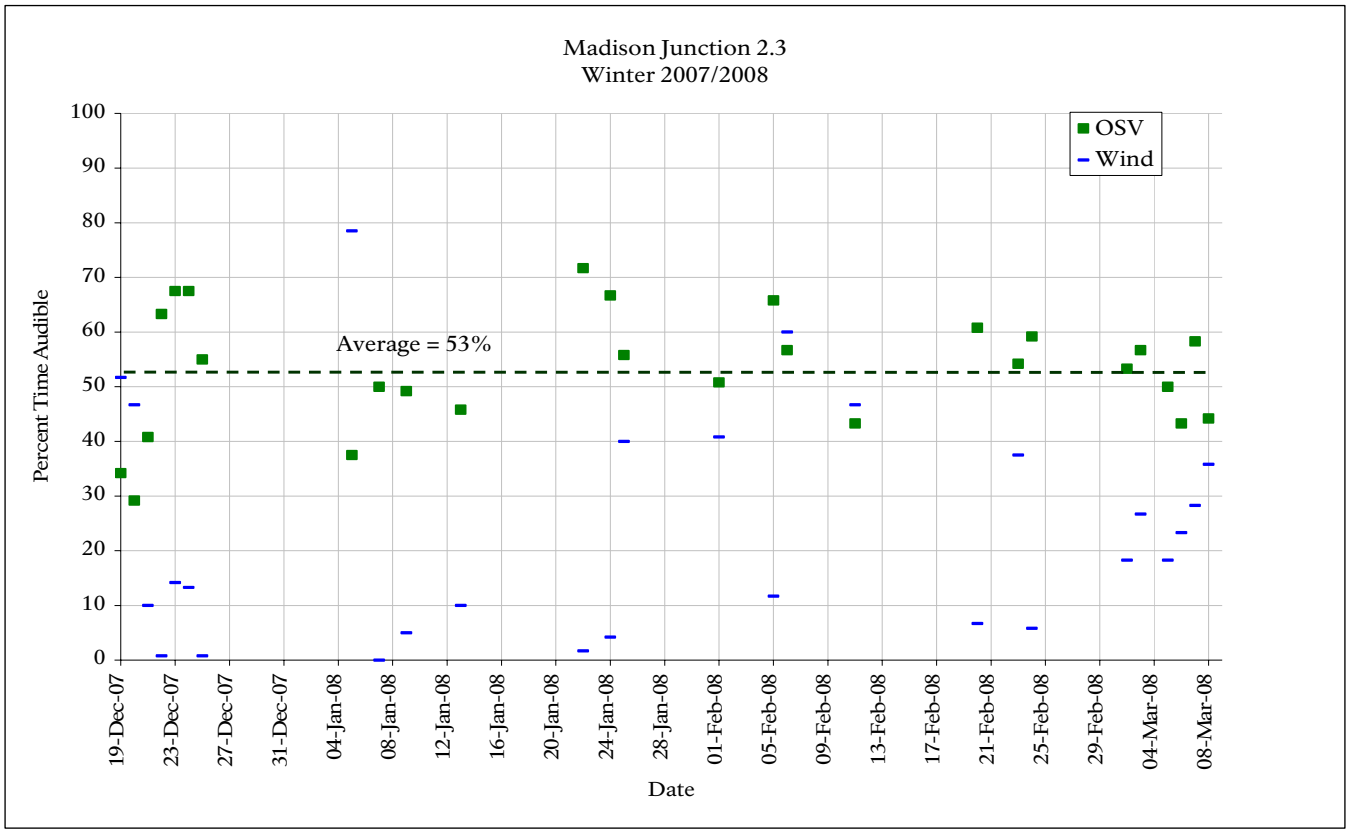
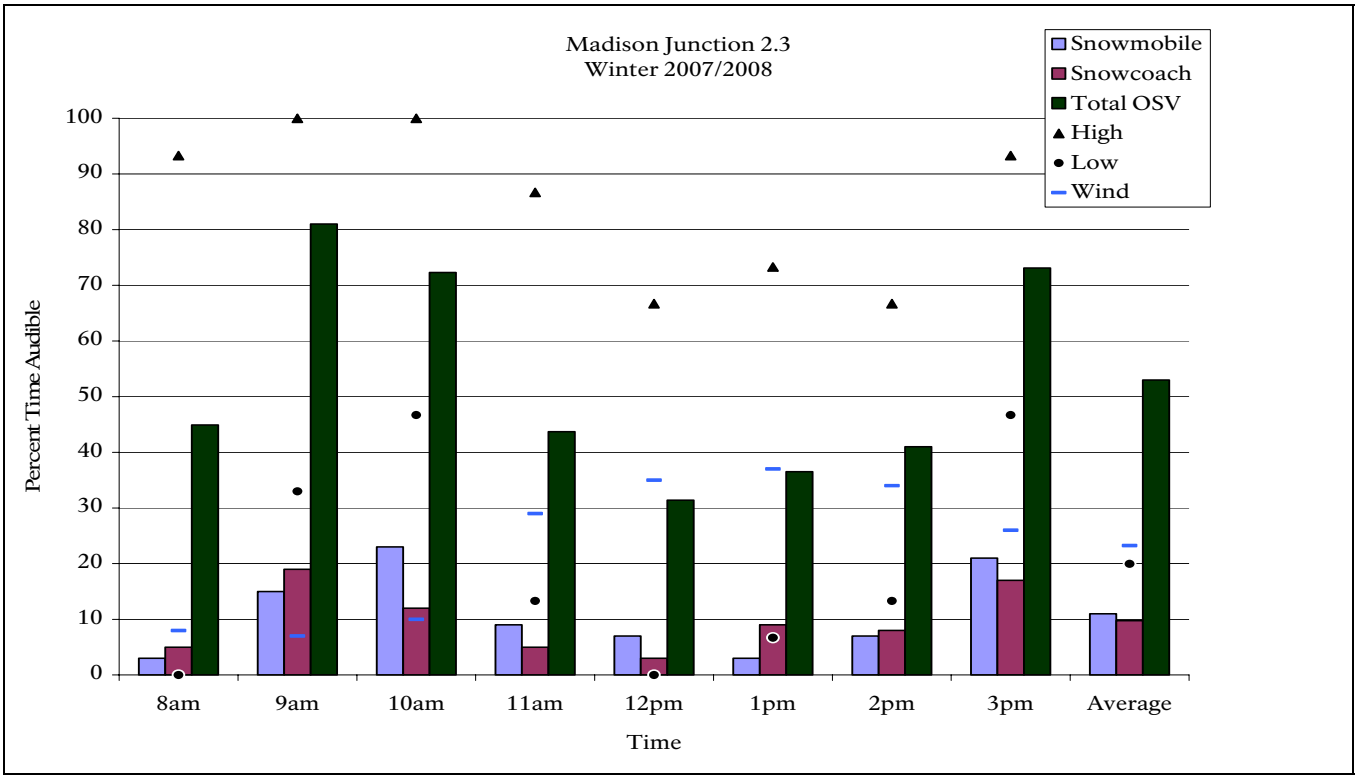


Figure 3-6. The average percent time audible by hour (8 am-4 pm) of snowmobiles and snowcoaches, and high and low OSV values at 2.3 miles (3.7 km) west of Madison Junction along the West Entrance Road Yellowstone National Park, 19 December 2007- 8 March 2008.



Backcountry areas

In the winter of 2006-07, soundscapes monitoring was done (for the entire winter) at Fern Lake, a site about 8 miles from the nearest OSV route. No OSV sounds were audible there all winter; the only non-natural sounds sources were aircraft. Jets and propeller planes were audible on average for 6% of the period 8 a.m. to 4 p.m. during the winter use period. Wind, snowfall, ducks, magpies, ravens, geese, and other birds were frequently audible and several coyotes and wolves were recorded. Overall, the area was consistently very quiet with few loud events; daytime periods had higher sound levels than nights, which had less wind, fewer bird vocalizations, and aircraft (Burson 2008a).

Last winter, sound monitoring was done for one week at Shoshone Geyser Basin, about 5.5 miles from the nearest road. There, the soundscape was defined by wind, geothermal activity, and distant OSV sounds. OSVs were audible as much as 47% of the day, averaging 18% (Burson 2008a). When the administrative component of this audibility is removed, the average audibility drops to about 14%.

Sound Level Analysis

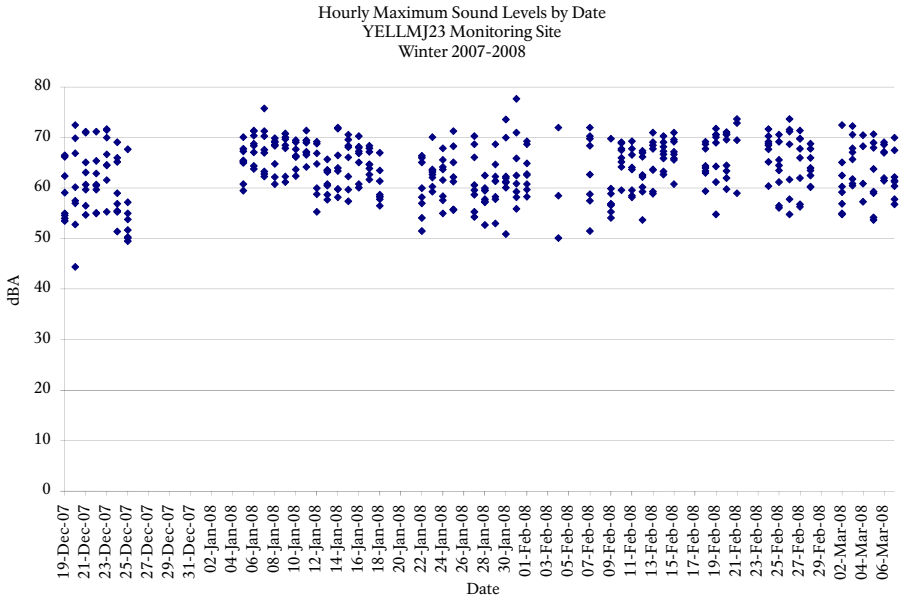
At the Old Faithful Weather Station site, the maximum sound levels were determined by OSVs on all but the windiest days when the wind created spurious readings from microphone overload. The lowest sound levels (measured at 22 dBA) were determined by the nearly constant utility sounds (exhaust and heating fans) from the Snow Lodge and Old Faithful Ranger Station.

In contrast, at the Old Faithful Upper Basin site, both the minimum and maximum sound levels were largely determined by natural thermal activity, gurgling and sputtering at low levels and

erupting geysers at the higher levels. Footsteps on the nearby boardwalk, people's voices, and wind in the trees also contributed to the sound levels documented. Construction activity at the Old Faithful Inn 1,100 feet away also was audible at low sound levels. OSVs were often audible and contributed to the soundscape, but only at intermediate and lower sound levels.

Consistent with previous seasons, the sound levels from OSVs at Madison Junction 2.3 occasionally exceeded the Temporary Plan maximum sound level impact definition threshold (70 dBA) during the hours of the measurement day (8 a.m. to 4 p.m.) in 2007-2008. The total duration of those exceedances averaged less than 1 minute per day, or less than 1% of the eight hour day. The 102 measured exceedances between December 2007 and March 2008 were attributed to the following types of vehicle: 94 snowcoaches, 4 snowmobiles, and 4 groomers. Figure 3-7 displays the hourly sound level peak by date (described in the figure title as "LMax") for all analyzed days of the 2007-08 season. Exceedances of 70 dBA violate the NPS's adaptive management threshold; most of these exceedances were due to high-stack Bombardiers.

Figure 3-7: Daily hourly maximum sound levels at Madison Junction 2.3.



The Grant Village/Lewis Lake monitoring site had more loud events than the Madison site. The majority of these maximum sound levels were from snowcoaches. Snowcoaches traveled at maximum cruising speeds passed this monitoring site, thereby generating higher sound levels. Of 233 exceedances, 216 were snowcoaches (96%), 15 snowmobiles (6%) and 2 groomers (1%). At night, this site was extremely quiet, but by day wind increased the natural sound levels.

Grand Teton National Park and the Parkway

Soundscapes monitoring data were also collected for Grand Teton National Park and the Parkway over the last several winters. Aside from the snowmobile and snowcoach tours departing Flagg Ranch for trips into Yellowstone, oversnow vehicle use in Grand Teton and the

Parkway has consisted of snowmobiles used by ice fishermen on Jackson Lake, snowmobilers traveling between the Targhee National Forest and Flagg Ranch on the Grassy Lake Road, and snowmobilers using the CDST. Since the 2004-2005 winter season, snowmobile use on Jackson Lake has averaged less than three per day (with a peak day of 15 in 2008), use of the CDST has averaged less than 15 snowmobiles per entire season, and use of the Grassy Lake Road averaged 2-3 per day.

Monitoring data was collected for Jackson Lake at several sites in 2005 and 2006. At Catholic Bay, 13 days of data collection in the January – March 2005 period resulted in snowmobiles being audible 0.5% of the time. At Cow Island, 17 days of data in February-March 2005 yielded 3% time audible, and 24 days of data collection over the period December 2005 – March 2006 resulted in less than 1% time audible (a total of 7 snowmobiles were heard). Four days worth of data collection at Colter Bay landing in February-March 2005 resulted in 3% time audible.

For Grassy Lake Road, 14 days of data during January-March 2005 yielded 6% time audible, some of which is believed to be from snowmobiles staging for trips into Yellowstone at Flagg Ranch.

Socioeconomics

The affected environment for socioeconomic impacts includes the parks, as discussed below. In addition, the economy of the GYA is described at three different levels: a state level (Idaho, Montana, and Wyoming), a county level (Fremont County in Idaho, Gallatin and Park Counties in Montana, and Park and Teton Counties in Wyoming), and a community level (Cody, Jackson, and Wapiti, Wyoming, and West Yellowstone, Montana).

Regulatory and Policy Overview

Economic and social values are fully entwined through the regulatory and policy environment of the National Park Service. The context for this discussion, and for public perception of socioeconomic values, lies in the debate about Organic Act purposes of public enjoyment and conservation of park resources and values. Appropriate forms of visitor enjoyment, including those that promote health and personal fitness, emphasize recreation that is consistent with park protection, including interpretation and contemplation of and understanding of the purposes for which a park was established. The NPS is committed to providing appropriate, high quality opportunities for visitors, and will maintain an atmosphere that is open and accessible to every segment of American society (NPS 2006: 8.2).

NPS managers have a strict mandate to protect park resources and values, a responsibility to manage all park uses, and when necessary, an obligation to regulate their amount, kind, time, and place (NPS 2006: 8.1). Appropriate visitor activities (NPS 2006: 8.1.1) are allowable when they have been determined to be consistent with the protective mandate. Any economic values associated with such use are effectively limited to what is appropriate and allowable.

The inevitable disagreements about what is appropriate or allowable are to be addressed by the NPS in seeking cooperative conservation beyond park boundaries (NPS 2006: 1.6) and the process of civic engagement (NPS 2006: 1.7). The former policy grows out of an understanding that parks are integral parts of larger regional environments. In order to protect park resources, the NPS is to work cooperatively with others to anticipate, avoid, and resolve potential conflicts, and address mutual interests in the quality of life for community residents. This includes matters such as compatible economic development and resource and environmental protection.

Cooperative conservation activities are vital in establishing relationships that will benefit the parks and fostering decisions that are sustainable. Civic engagement encourages effective two-way communication with the public, wherein the NPS will learn from the communities it serves while conveying the full meaning and relevance of park resources and values.

The series of policy statements set out in the 2006 NPS Management Policies section 8, Use of the Parks, refines these concepts. Policies set out in section 10, Commercial Visitor Services, are circumscribed by section 8 as they relate to visitor activities (NPS 2006).

Existing and Historic Socioeconomic Condition

Economy of the Greater Yellowstone Area

As discussed above, the affected economic environment is described at three levels (that description relies on IMPLAN modeling; see *Environmental Consequences*, Socioeconomics, for a description of the model). These three levels allow the reader to understand the magnitude of the impacts (both absolutely and relatively) at multiple stages. These were also the levels used in analysis in the previous EIS (NPS 2000b), SEIS (NPS 2003), EA (NPS 2004b), and EIS (NPS 2007a) for winter planning. The four communities at the local scale (Cody, Jackson, Wapiti, and West Yellowstone) provide the reader a representative example of the possible effects at the city or town level. Also, these communities have been previously identified as most likely to be affected by changes in winter use policies.

Visitors also use other gateway communities or areas. For example, skiers and snowboarders at Big Sky, Montana often spend part of their winter trip taking a snowmobile or a snowcoach tour into Yellowstone. Similarly, Livingston, Cooke City, and Gardiner, Montana are important gateway communities to Yellowstone's North and North East Entrances. Dubois, Wyoming is a gateway community to both Yellowstone and Grand Teton. Driggs and other Idaho communities west of Teton Pass are gateways to Grand Teton. Other geographic areas, within the counties or states, but outside the communities can also be affected the winter use alternatives. The effects on these smaller areas may be masked even at the zip code level of analysis that occurs with IMPLAN modeling, but will be represented through qualitative discussions.

Table 3-4 presents the relative sizes of the economies of the six geographic areas analyzed (the three-state area, the five-county area, and the four individual communities). The range of total economic output among these areas ranges from $166 billion annually in the three-state area to $10 million in the Wapiti, Wyoming area. This range suggests that a change in visitor activity that is generally small in the context of the three-state area has the potential to be substantial in the context of the much smaller economy of West Yellowstone. However, as noted below, this does not mean that individuals and businesses in the area have not been affected by changes in visitor activities. Some businesses that relied specifically on snowmobile access have reported being adversely affected. Others have noted that their ability to retain highly qualified, year-round workers has been diminished (Ecosystem Research Group 2006). For comparison, using 1999 IMPLAN data, the estimated total economic output of the three states was $125 billion; five counties, $6.4 billion; Cody, Wyoming, $800 million; Jackson, Wyoming, $1.2 billion; and West Yellowstone, $113 million. From 1999 to 2003, the economies grew by 33%, 48%, and 33%, respectively. Employment in 1999 for the three states was 1,651,000 jobs; five counties, 103,000 jobs; Cody, 11,414 jobs; Jackson, 17,687 jobs; and West Yellowstone, 2,177 jobs. From 1999 to 2003, output grew between 33% and 51%; however, Cody's output only grew 15%. For employment, the various areas grew between 6 and 15%; however, Cody lost about 6% of its jobs between 1999 and 2003.

Table 3-4: Economic Output and Employment Levels for the Greater Yellowstone Area, 2003

Geographic Area	Total 2003 Output [a]	Total 2003 Employment [b]
Three-State	$166,318,000,000	1,750,137
Five-County	$9,547,000,000	115,822
Cody, WY	$917,000,000	10,705
Jackson, WY	$1,860,000,000	20,302
West Yellowstone, MT	$167,000,000	2,333
Wapiti, WY	$10,300,000	112

[a] Includes direct, indirect, and induced output
[b] All jobs, both full and part time. The analysis area at the community level is by zip code, thus the area may not correspond with city limits.

Recent Trends in Park Visitation

This analysis estimates changes in total visits to the three park units in the GYA by people who are from outside the area. The estimated regional economic impacts discussed in *Environmental Consequences* consider impacts to the GYA that are associated with the different winter management alternatives considered, including limits to the use of snowmobiles and snowcoaches within the parks.

Previous estimates of changes in GYA visitation in response to changes in winter use policies relied primarily on visitor surveys to predict future policy impacts (Duffield and Neher 2000; RTI International 2004). The current analysis, however, benefits from several years of data collected during periods of varying winter use visitation levels. These sources of observed data allow the current analysis to incorporate trends in winter economic activity to supplement predictions based on visitor survey responses. Visitation data for the parks is presented in Visitor Access and Use in this chapter.

Recent Trends in the Greater Yellowstone Area Economy

Analyses for previous winter use planning efforts in the parks have predicted that restrictions on some types of winter use (snowmobiles primarily) would be at least partially offset by winter visitors still recreating in the GYA but utilizing other recreational opportunities outside of the parks. As a general example, it was predicted that restricting access to the parks for some uses, such as snowmobiling, could lead to offsetting increases in use of other GYA recreational opportunities, such as snowmobiling in the national forests.

As shown later in this section, however, there have been noteworthy declines in both snowmobile visits and total winter visitation to YNP in the past six years. An examination of key tourism-targeted tax collections in the GYA counties bordering the parks provides information on the degree to which the economies of these counties and communities are economically dependent on park winter visitation.

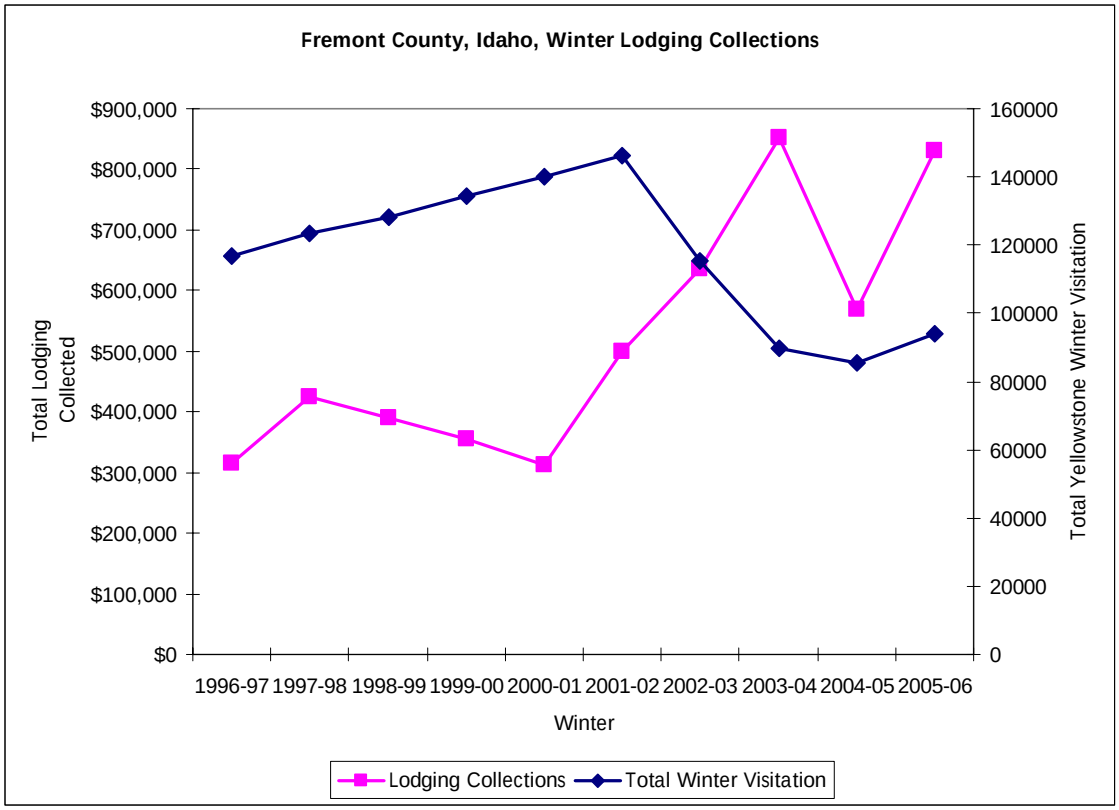
Table 3-5 and Figure 3-8 present winter lodging collections for Fremont County, Idaho. In general, during the period of time when winter visitation to YNP was decreasing (2002-2003 through 2005-2006), winter lodging tax collections in Fremont County trended upwards—opposite of YNP visitation trends. Fremont County winter lodging tax collections in 2005-2006 were over double the level seen in the four years prior to 2002 (and the management changes

that began in 2003). Winter lodging taxes in Fremont County seem to more closely match the statewide 16.7% growth in lodging tax that occurred during the same period (Otter 2007).

Table 3-5: Fremont County, Idaho, Winter Lodging Tax Collections Compared with Yellowstone National Park Winter Visitation, 1996-1997 through 2005-2006 (Idaho State Tax Commission 2006).

	Total Lodging Sales					
Winter Season	Dec	Jan	Feb	Mar	Total for Winter	YNP Winter Visitation (OSV and wheeled)
1996-97	$42,442	$44,183	$83,866	$143,806	$314,297	116,882
1997-98	$204,652	$34,754	$114,365	$71,945	$425,716	123,225
1998-99	$93,591	$55,816	$180,620	$59,299	$389,326	128,057
1999-00	$76,263	$70,473	$112,822	$96,865	$356,423	134,326
2000-01	$80,688	$58,952	$101,676	$71,411	$312,727	139,880
2001-02	$123,261	$76,855	$144,869	$155,416	$500,401	146,425
2002-03	$61,374	$131,383	$239,068	$204,393	$636,218	115,304
2003-04	$246,769	$107,345	$406,135	$92,864	$853,113	89,626
2004-05	$116,323	$4,661	$335,441	$112,605	$569,031	85,224
2005-06	$221,627	$261,024	$236,964	$111,201	$830,816	94,206

Figure 3-8: Comparison of Fremont County, Idaho, Winter Lodging Collections and Yellowstone National Park Winter Visitation, 1996-1997 through 2005-2006



Note: Original figure is in color; printing costs precluded use of color. The reader may obtain the color version at http://www.nps.gov/yell/parkmgmt/winterusetechnicaldocuments.htm.

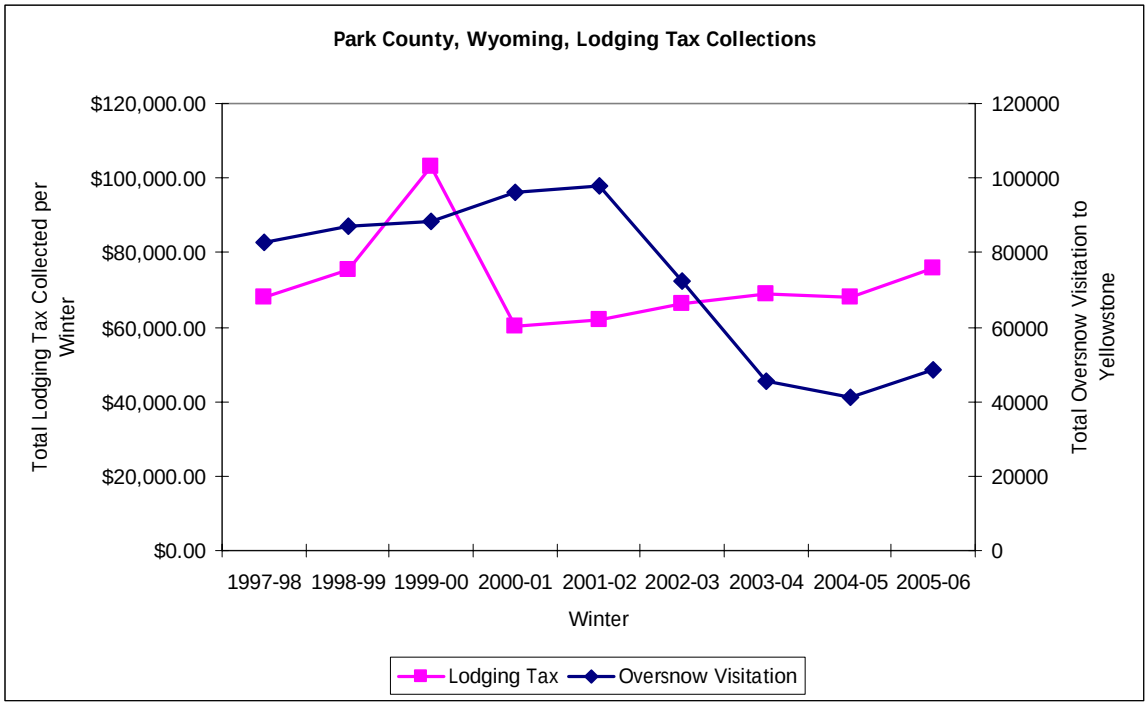
Table 3-6 and Figure 3-9 present similar winter lodging tax collection information for Park County, Wyoming, on the east side of YNP. The main community in Park County is Cody. However, Park County includes the northern portion of YNP, including the Mammoth Hot Springs Hotel, which is open during the winter (Snow Lodge, at Old Faithful, is in Teton County, Wyoming). This table shows both total OSV visitation levels for YNP and total winter lodging tax collections for the county. As is the case in Fremont County, winter lodging tax collections did not follow the decrease in YNP OSV visitation during 2002-2006. The Mammoth Hot Springs Hotel accounts for 41% of the Park County lodging tax in the winter.

Table 3-6: Park County, Wyoming, Winter Lodging Tax Collections, in Tax Year Dollars, Compared with Yellowstone National Park Oversnow Visitation, 1997-1998 through 2005-2006*

Winter Season	Dec	Jan	Feb	Mar	Total for Winter	YNP OSV Visitation
1997-98	$33,155	$8,498	$13,458	$12,965	$68,075	82,731
1998-99	$24,258	$9,523	$12,509	$29,218	$75,509	87,050
1999-00	$59,379	$14,971	$10,617	$18,184	$103,151	88,270
2000-01	$20,467	$9,384	$16,200	$13,955	$60,006	96,156
2001-02	$26,971	$9,477	$12,352	$13,072	$61,872	98,038
2002-03	$27,486	$14,217	$10,417	$14,256	$66,376	72,560
2003-04	$28,765	$12,527	$9,455	$18,090	$68,837	45,535
2004-05	$27,841	$13,210	$13,313	$13,556	$67,919	41,291
2005-06	$20,520	$21,382	$20,532	$13,244	$75,679	48,689

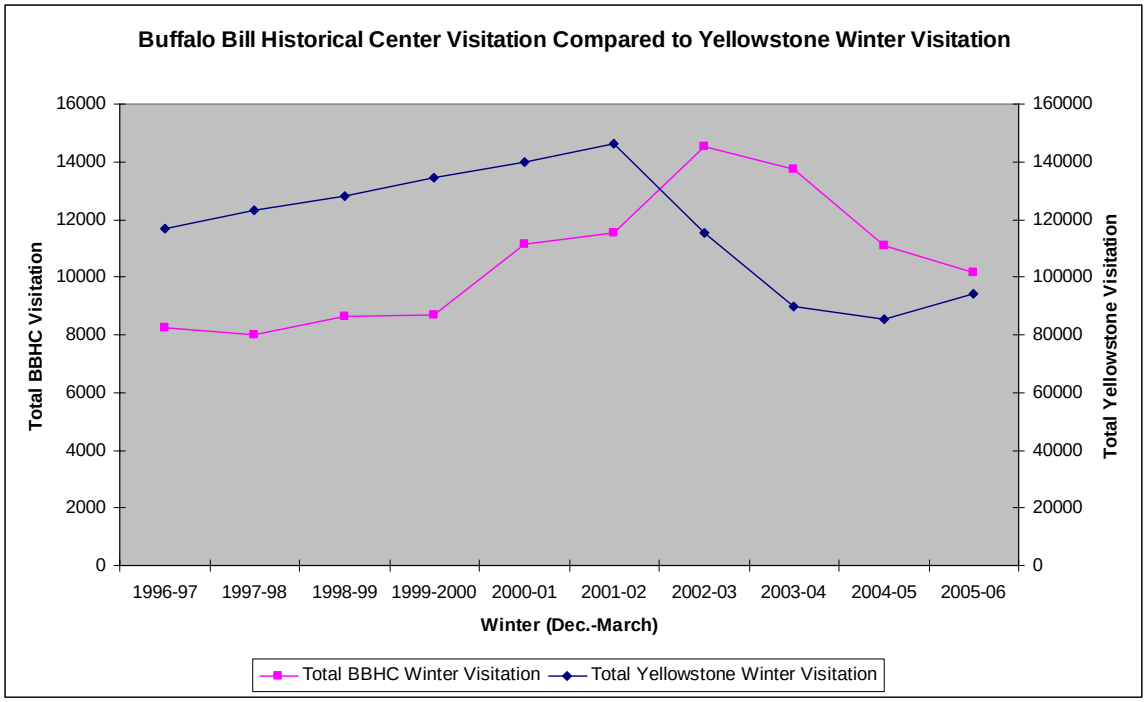
*The report, "Economic Trends in the Winter Season for Park County, Wyoming" by David T. Taylor (Taylor 2007) presents different winter lodging tax information (excluding December and lagged 2-months) for 5 of the 9 years presented above. However, the general lodging tax trends (without regard to inflation – see text below) are the same in both reports.

Figure 3-9: Comparison of Park County, Wyoming, Winter Lodging Tax Collections, and Yellowstone National Park Oversnow Visitation, 1997-1998 through 2005-2006



The recent lodging and tax data for Fremont and Park counties indicate that declines in snowmobile entries into YNP in particular, and in winter visitation in the park in general, have not detectably impacted the overall winter tourist economy in the counties as measured by monthly lodging tax collections. This is despite the fact that the economies of these counties are relatively small. However, one of the stronger relationships between winter use in the parks and a local entity is with the Buffalo Bill Historic Center (BBHC) in Cody, Wyoming. As the following graph (Figure 3-10) indicates, overall Yellowstone winter visitation and BBHC winter visitation seem to move together.

Figure 3-10: Comparison of Buffalo Bill Historic Center (BBHC) winter visitation with and Yellowstone National Park overall winter visitation (wheeled and oversnow), 1996-1997 through 2005-2006



Two other adjoining counties, Gallatin County in Montana (including Bozeman) and Teton County in Wyoming (including Jackson) have relatively large economies where even substantial changes in YNP and GTNP winter visitation would not be detectable. For example, the observed change in visitation at the south entrance in response to the Temporary Winter Use Plan might have an expenditure impact on the order of $4 million per year. By comparison, the five county GYA economy (largely driven by Gallatin and Teton counties) was on the order of $6 billion in 1999 and in 2003 (the most recent IMPLAN data available) had grown to about $9 billion. Similarly, impacts from changes in the parks' winter visitation levels for the three-state economy would not be detectable.

However, the relative size of the county economies does mask likely individual changes that have occurred. Some individual businesses have indicated a considerable reduction in their winter operations. Other employment patterns have changed (all-year work for some employees is no longer available) as a result of changing visitation patterns (Ecosystem Research Group 2006).

Parenthetically, for the north entrance gateway of Gardiner, Montana (Park County), almost all winter use is wheeled vehicle entries. Neither the Temporary Winter Use Plan (NPS 2004b) nor the 2007 FEIS had a noticeable effect on visitation through this entrance. Visitors there are destined for Mammoth Hot Springs and sites such as the Lamar Valley in the park's northern range (which are both in Park County, Wyoming) or other YNP locations or to recreate in and around Cooke City, Montana (which is in Park County, Montana).

Another indicator and change in the winter economy is wildlife viewing in Yellowstone. A 2004-2006 year-round survey looked at the economic effects of wolf watching and wolf presence to Yellowstone visitors. Winter visitors, who constitute about 3.1% of the annual visitation to Yellowstone, contribute about $1.3 million to the 17-county economy just related to wolf presence in Yellowstone. This is about 5.8% of the total annual $22.5 million direct spending impact of wolf watching to the 17-county economy (Duffield, Neher, and Patterson 2006).

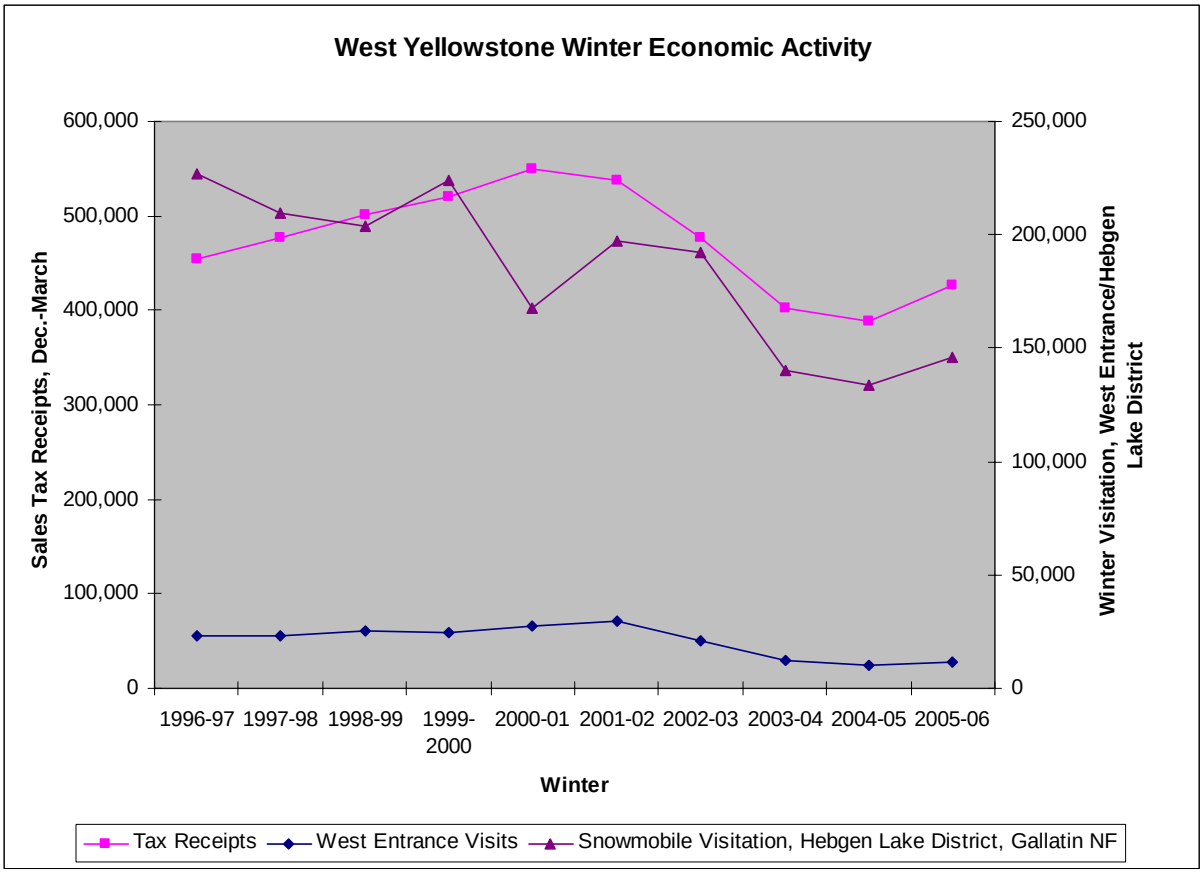
The lodging tax information at the county level in tables 3-5 and 3-6 is as reported by the respective states and does not include an inflation factor. That is, lodging costs typically increase as a result of inflation, thus lodging tax revenue (which is a percent of the cost of lodging) will also increase. When inflation is included, the inflation-adjusted tax revenue may be lower, even though the tax dollars stay the same or increase (Taylor 2007). A variety of inflation estimates exist, such as the national consumer price index (CPI), the core consumer price index (which excludes food and energy), the consumer price index for all urban consumers in the west (CPI-U), the consumer price index for urban wage earners and clerical earners in the west (CPI-W), and Monthly Average Daily Room Rates (U.S. Department of Labor 2007; Taylor 2007). The NPS chooses to present lodging tax information without an inflation adjustment since there are a variety of possible indices, but notes through the reference to Taylor 2007 that such adjustments can be made. Also, another similar report examining tourism in Wyoming (Dean Runyan Associates 2006) and cited by Taylor 2007 does not (except for one table in a 71-page report) take into account inflation.

The remaining major gateway community for YNP and GTNP is West Yellowstone, at the west entrance to YNP. Table 3-7 provides time series data for this entrance, shown graphically in Figure 3-11. Included in the table are winter resort tax collections for the town of West Yellowstone, winter entries through the west entrance to YNP, and winter snowmobile visits to the Hebgen Lake District of the Gallatin National Forest, which abuts the town to the west. Unlike the cases of Park and Fremont Counties, discussed above, it is clear that in response to reductions in winter park visits through the west entrance in 2002-2003 through 2005-2006 and in response to reduced forest visits, resort tax collections also fell. It should be noted that the decline was not in proportion to the decrease in west entrance visits. Specifically, comparing average levels for the four years immediately before and after management changes (2002-2003 through 2005-2006 to the four years immediately preceding this period) shows that while park visitation fell 48.5% on average, winter tax collections only fell 19.7%. However, Montana's statewide lodging tax grew 17% during the same time period. The nearly 20% reduction in tax revenue is more striking in light of the statewide increase and perhaps a better indicator of the relative impact of the recent decrease in winter park visitation on West Yellowstone (Otter 2007).

Table 3-7: West Yellowstone Winter Resort Tax Collections, Hebgen Lake District Snowmobile Use, and Yellowstone West Entrance Winter Visits, 1989-1990 through 2005-2006

Winter Season	West Yellowstone Winter Resort Tax Collections	Gallatin National Forest Hebgen Lake District Snowmobile Use	Yellowstone National Park West Entrance Winter Visits
1996-97	$455,035	226,555	56,212
1997-98	$476,508	209,420	54,859
1998-99	$500,473	203,759	59,928
1999-00	$520,566	223,726	58,154
2000-01	$549,182	167,512	66,302
2001-02	$536,996	197,190	70,371
2002-03	$476,037	191,847	49,703
2003-04	$401,664	139,991	28,880
2004-05	$388,222	133,858	24,510
2005-06	$425,933	146,128	28,243

Figure 3-11: West Yellowstone Winter Resort Tax Collections, Hebgen Lake District Snowmobile Use, and Yellowstone West Entrance Winter Visits, 1996-1997 through 2005-2006



The observed data for West Yellowstone resort tax collections and west entrance visits were used to estimate a linear regression model explaining tax levels as a function of west entrance visits for a time series of the December through March winter months for the 1989-1990 through 2005-2006 winters. This estimated model explains a substantial proportion (73.2%) of the variation in winter resort tax collections. The model indicates a $5.26 increase in tax collections for each west entrance visit. Since the tax rate is 3%, this implies $175.33 of taxable expenditures in West Yellowstone for each park visit. The model also implies that in 1989-1990, some other factor accounted for a substantial share of resort tax collections. This could possibly be snowmobile use on the adjacent national forest lands, as discussed below.

Table 3-7 and Figure 3-11 also present data for snowmobile use on the Hebgen Lake District of the Gallatin National Forest. This district includes many miles of groomed snowmobile trails that are accessible primarily from the West Yellowstone area. What these data show is that in the last three winters, snowmobile use on this national forest area adjacent to West Yellowstone has declined at the same time park visits through the west entrance declined. Causation, though, is complicated by the short time series and a drought and relatively low snow pack in recent years, including the winter of 2004-2005. In any case, these data suggest that restrictions on snowmobile access at the west entrance have not led to noticeable increased use on the adjacent national forest.

National forest snowmobile use data were also obtained for the Ashton/Island Park Ranger District of the Caribou-Targhee National Forest (Davis, Jenkins, and Angell 2006). The ranger district is generally in Fremont County, Idaho. Many of the trails on this district are also accessed by visitors staying at West Yellowstone. The most complete data are for counters at Twin Creek, Red Rock, Flagg Ranch, and Big Springs for 2003 to 2006. Total use for these counters for the winter seasons of 2002-2003 through 2005-2006 was 29,893, 34,412, 40,993, and 39,781, respectively. These data show an increase for the most recent two years, but combined with the Hebgen Lake data there is still a substantial decline in total national forest snowmobile use on these two districts. The increase for the Ashton/Island Park District may be due to better counts of use, and the sense of district staff is that use is actually down. The trailheads on the district most used by snowmobilers staying at West Yellowstone are Big Springs and Twin Creek. Data for these trailheads are summarized in Table 3-8, and show an increase in 2004-2005 and 2005-2006.

Table 3-8: Ashton/Island Park Ranger District Snowmobile Use, Trailheads Used by West Yellowstone Visitors, 2002-2003 through 2005-2006

Winter	Twin Creek Trailhead	Big Springs Trailhead	Total
2002-03	9,991	14,025	24,016
2003-04	10,305	11,589	21,894
2004-05	14,181	20,313	34,494
2005-06	12,093	20,232	32,325
Source: Davis, Jenkins, and Angell 2006.			

Data for selected trailheads in the Bridger-Teton are shown in Table 3-9. The CDST-Togwotee and the Gros Ventre trailheads are most likely to show influences from park winter use management. These data show no clear trend, but use is either approximately stable or slightly down. The best long-term data for the Bridger-Teton are for Grey's River trailhead. The use at this trailhead is shown in Table 3-10 for 1996-1997 to 2004-2005. The trend is up, but this is not likely related to park winter use management, but rather regional population growth, including the Idaho Falls and Salt Lake City areas. The Greater Yellowstone Coordinating Committee has undertaken a winter use monitoring strategy on the six national forests adjoining YNP. One objective of this work was to answer the question of whether restrictions in snowmobile use in national parks result in changes in snowmobile use on national forests. Currently five-year summaries of the findings from monitoring snowmobile use in the GYA are being evaluated. Preliminarily, it appears that use on the forests has not increased in response to changes in park winter use policy, but the interpretation is complicated by recent drought conditions.

Table 3-9: Bridger-Teton National Forest Snowmobile Use, CDST-Togwotee and Gros Ventre Trailheads, 1998-1999 through 2003-2004

Winter Season	CDST-Togwotee Trailheads	Gros Ventre Trailhead	Total
1998-99	186	165	351
1999-00	231	122	353
2000-01	167	152	319
2001-02	165	142	307
2002-03	153	118	271
2003-04	118	230	348
Source: Bridger-Teton National Forest summary of winter use monitoring 1999-2004.			

Table 3-10: Bridger-Teton National Forest Snowmobile Use, Grey's River Trailhead, 1996-1997 through 2004-2005

Winter Season	Gray's River Trailhead
1996-97	7,956
1997-98	9,025
1998-99	8,897
1999-00	no data
2000-01	8,716
2001-02	9,906
2002-03	no data
2003-04	10,066
2004-05	9,230
Source: Susan Marsh, pers. comm. 2006.	

However, a major caveat is that winter visitor surveys on the national forests are not extensive. Additionally, it is possible that changes in park winter use have led to increases in other types of GYA winter use. Relative to total winter recreation in the GYA, the fraction affected by current park winter use policies is rather small. For example, downhill ski use at Big Sky and Jackson Hole Ski Area (not to mention Bridger Bowl, Red Lodge, Snow King, and Grand Targhee) has reached record levels in the last few years. While the key issue for this analysis is the change in GYA winter recreation visits (and expenditures) as a function of park winter use policy, it is difficult to collect reliable aggregate data for these statistics. The most relevant and comprehensive data are visitor use in the parks.

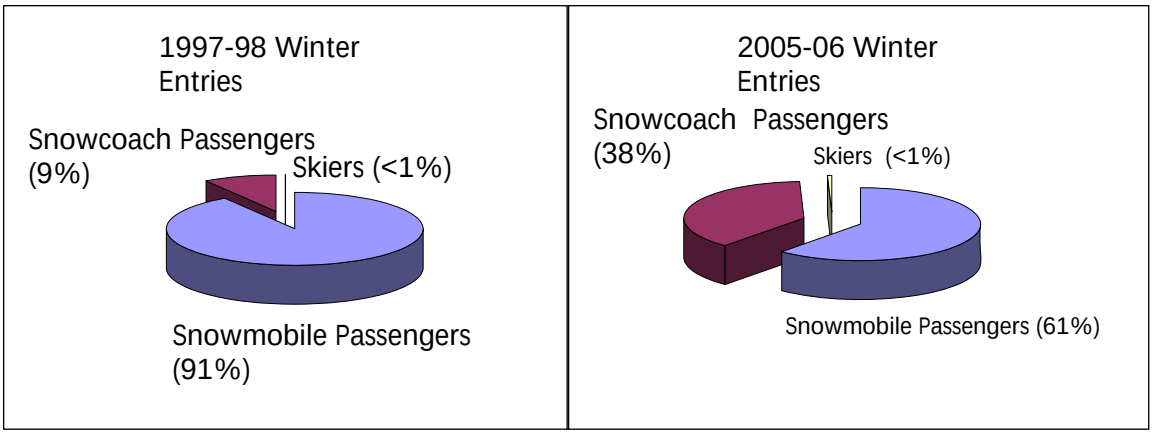
The primary conclusion from Table 3-7 and Figure 3-11 is that even in West Yellowstone, a community located at a park entrance and with an economy heavily dependent on tourism spending, changes in park winter use management may impact local economic activity but the economy is not wholly dependent on winter park snowmobile access. Among other activities, snowmobiling on the adjacent national forests is also important for the West Yellowstone economy.

That hypothesis was tested by estimating a second linear regression model of winter West Yellowstone tax receipts, this time including snowmobile counts in the Hebgen Lake District as an explanatory variable in addition to YNP west entrance winter visits. In this model, both park visits and forest visits are statistically important factors explaining tax receipts. Additionally, this model now accounts for most if not all of the resort tax collections. The results strongly support the hypothesis that, in addition to YNP west entrance visits, snowmobiling on the adjacent national forests is also important for the West Yellowstone economy (Duffield and Neher 2006).

Of the five regional economic areas examined in this analysis, only for the gateway community of West Yellowstone is there a detectable impact on the relevant area's economy from winter use in Yellowstone (and that on the surrounding national forests). These results are consistent with the predicted impacts from the socioeconomic impacts section of the FSEIS (NPS 2003), where the authors noted that measurable impacts from changes in winter use policy in the parks would only be found in the community of West Yellowstone.

Figure 3-12 shows a comparison of the YNP west entrance use distributions for the winter of 1997-1998 (before winter use policy changes), and 2005-06 (after changes). Clearly, the distribution of use between snowmobiles and snowcoaches has changed substantially in the wake of the temporary winter use plan. Prior to these changes, snowmobile visitors made up about 91% of west entrance visits; currently 61% of these visits are by snowmobile. Snowcoach use has increased from 9% of west entrance use to 38%. In 2004-2005, which was a year with low snow pack in the West Yellowstone and Old Faithful areas, snowcoach and snowmobile use were approximately equal.

Figure 3-12: Comparison of West Entrance Use Distribution, 1997-1998 vs. 2005-2006



It is notable that winter access by autos, recreational vehicles and buses, all of which in a normal winter is through the north entrance, has been relatively stable. This seems to indicate that visitors are not substantially substituting access between entrances in response to changes in winter use management. Also, because access through the west, south, and east entrances to YNP is all oversnow under current and historic management, there does not seem to be a shift in access modes between cars and OSVs. To conclude, the main changes with respect to visitor use levels brought about by current park management are the reduction in total snowmobile use and the substitution within motorized oversnow use from snowmobiles to snowcoaches. The latter has steadily increased the last five winters.

Air Quality and Air Quality-Related Values

The affected environment for air quality impacts and air quality-related values is the parks, as discussed below. Additionally, some discussion of air quality and related values for the town of West Yellowstone, Montana is relevant because of its proximity to the west entrance to Yellowstone, and because air quality monitoring data is available from that location.

Regulatory and Policy Overview

YNP and GTNP are classified as Class I areas under the Federal Clean Air Act. This air quality classification is to provide protection against air quality degradation in national parks and wilderness areas. The Clean Air Act defines mandatory Class I areas as national parks over 6,000 acres, wilderness areas over 5,000 acres, and national memorial parks over 5,000 acres designated as of the date of the Act. The Parkway is a Class II area but is managed as a Class I area according to NPS policy. As required by the visibility protection provision of the Clean Air Act, additional procedural requirements apply when a proposed source has the potential to impair visibility in a Class I area (40 CFR 52.27 (d)). See NPS 2006: 4.7.1 Air Quality, included in Appendix A.

Both Wyoming and Montana have, pursuant to the Clean Air Act provisions, adopted air quality standards that are more stringent for some pollutants than provided in the Federal Standards (known as the National Ambient Air Quality Standards). While it is clear that the Clean Air Act delegates jurisdiction for enforcement of air quality standards to conforming states, it is equally clear that the act gives federal land managers the affirmative responsibility to protect air quality and air quality related values (including visibility). The federal land manager, in this case the NPS, has the authority and jurisdiction to administer some provisions of the Clean Air Act,

particularly the non-degradation standard for Class I air, and to manage activities within their jurisdictions that either affect, or have the potential to affect, air quality or associated values.

As required by the Clean Air Act and its amendments, the Environmental Protection Agency has established primary and secondary National Ambient Air Quality Standards (NAAQS) for six major air pollutants: carbon monoxide (CO), nitrogen dioxide (NO2), ozone (O3), particulate matter (PM10 and PM2.5), sulfur dioxide (SO2), and lead. The NAAQS of primary concern for this analysis (CO, PM10 and PM2.5) are shown in Table 3-11.

CO is a colorless, odorless, and poisonous gas produced by incomplete burning of carbon in fuels. When CO enters the bloodstream, it reduces the delivery of oxygen to the body's organs and tissues. Health effects may include impairment of visual perception, manual dexterity, learning ability, and performance of complex tasks; headaches and fatigue; or respiratory failure and death. PM includes dust, dirt, soot, smoke, and liquid droplets from sources such as power plants, vehicles, construction activity, fires, and windblown dust. PM can either be emitted directly from such sources or formed in the atmosphere through secondary reactions or condensation. Health effects from PM emissions include reduced lung function, long-term risk of increased cancer rates, and the development or aggravation of respiratory problems. Hydrocarbons (HCs, which are not regulated by the Clean Air Act but do have other regulatory standards) include air toxics or hazardous air pollutants such as benzene, formaldehyde, and 1,3 butadiene (note that monitoring for particulates captures many hydrocarbons).

The primary standards protect public health, and represent levels at which there are no known major effects on human health. The secondary standards are intended to protect the nation's welfare, and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the environment. Therefore, aside from being national standards, both primary and secondary standards have applicability to air quality in national parks. The secondary standards are directly related to the protection of a wide variety of park resources. For CO, PM10 and PM2.5, the primary and secondary standards are the same. Data from air quality monitoring studies are summarized, relative to the standards, in Tables 3-12 to 3-15, below.

Table 3-11: National Ambient Air Quality Standards

Pollutant	Primary		Secondary	
	PPM (parts per million)	ug/m^3 (micro-grams per cubic meter)	PPM	ug/m^3
Carbon Monoxide (CO)				None
Maximum 8-Hour Concentration[a]	9			
Maximum 1-Hour Concentration[a]	35			
Maximum 1-Hour Concentration (Montana)[a]	23			
Respirable Particulates (PM10)				
Annual Arithmetic Mean[b]		50		Same as Primary
Maximum 24-Hour Concentration[a]		150		

Respirable Particulates (PM2.5) Annual Arithmetic Mean[c] Maximum 24-Hour Concentration[d]		 15 65		Same as Primary

Notes:

[a] Not to be exceeded more than once per year.

[b] To attain this standard, the 3-year average of the weighted annual mean PM10 concentration at each monitor within an area must not exceed 50 ug/m^3.

[c] To attain this standard, the 3-year average of the weighted annual mean PM2.5 concentrations from single or multiple community-oriented monitors must not exceed 15.0 ug/m^3.

[d] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 65 ug/m^3.

PPM = parts per million; ug/m^3 = micrograms per cubic meter

Source: 40 CFR 50—National Primary and Secondary Ambient Air Quality Standards

New Research and Monitoring

A variety of recent air quality research and monitoring contributes to this section. Dr. Gary Bishop and others from the University of Denver conducted winter emissions measurements in YNP that involved the collection of emissions data from in-use snowcoaches and snowmobiles in February 2005 and February 2006. Results from the work indicate that while most snowcoaches have lower emissions per person than two-stroke snowmobiles, the snowcoach fleet could be modernized to reduce unnecessary carbon monoxide (CO) and hydrocarbon (HC) emissions. Vans and coaches with efficient fuel-injected engines and catalytic converters can be nearly as clean as modern wheeled passenger vehicles. This supports both snowmobile BAT and the development of snowcoach BAT (scheduled to be implemented in 2011) (Bishop et al. 2006, Bishop et al. 2007).

Monitoring conducted in YNP by the State of Montana and the NPS Air Resources Division in the past several winters for CO and PM2.5 indicates that concentrations of both pollutants have stabilized at levels well below the national standards—about 20% of the national standards (Ray 2008). Because many hydrocarbons occur as particulates and because monitoring for hydrocarbons is quite complex, monitoring is done instead for particulates (thereby capturing many particulates). The NPS has also done extensive testing for air toxics, which include many hydrocarbons; see the Health and Safety section. Lower ambient concentrations of both pollutants are primarily attributable to the Best Available Technology used in today's snowmobiles as well as the lower numbers of them. Summer traffic with wheeled-vehicles contributes a smaller amount of CO and PM than winter activity by snowmobiles and snowcoaches (Ray 2005; Ray 2006; Ray 2007; Ray 2008).

Existing and Historic Conditions

In recent years, the NPS has conducted winter air quality monitoring in the Old Faithful developed area at YNP. Meteorological, gaseous, and particulate variables were monitored continuously. The Montana Department of Environmental Quality (DEQ) also collects meteorological, gaseous, and particulate data at a monitoring station at the West Entrance to YNP.

Air quality monitors for CO and PM2.5 are located at both the West Entrance and Old Faithful. A long term trend for CO is provided in Figure 3-13 and for PM in Figure 3-14 below; both figures indicate snowmobile numbers as well. Tables 3-12 through 3-15 below provide a summary of the monitoring results for these locations. Since monitoring began in 1998 for CO and in 2002 for PM2.5 at YNP, measured pollutant concentrations have steadily decreased, consistent with the snowmobile technology emission requirements of the last five years and the decrease in number of snowmobile visits. At the West Entrance, the highest measured 8-hour average CO concentrations have gone from a near NAAQS exceedance of 8.9 parts per million (ppm) in the 1998-1999 winter season to 1.6 ppm in 2007-2008 (Ray 2008). At Old Faithful, the highest measured 8-hour average CO concentrations have declined from 1.2 ppm in the 2002-2003 winter season to 0.4 ppm in 2007-2008.

The highest measured 24-hour average PM2.5 concentrations at the West Entrance have declined from 15 micrograms per cubic meter (ug/m^3) in the 2002-2003 winter season to 9.5 ug/m^3 in 2007-2008. At Old Faithful the highest measured 24-hour average PM2.5 concentrations have declined from 37 ug/m^3 in the 2002-2003 winter season to 8.1 micrograms per cubic meter in 2006-2007 (Ray 2007). These monitored maximum values demonstrate a distinct trend of improvement in winter pollutant concentrations in YNP. Since the implementation of BAT requirements for snowmobiles and the reduction in snowmobile numbers, winter air quality in Yellowstone has been pristine.

In addition to snowmobile and snowcoach emissions, an important driver of air quality is meteorological conditions. Days where inversions occur, with little or no wind, tend to facilitate the accumulation of pollution in areas where snowmobiles and snowcoaches congregate, such as the West Entrance. This phenomenon was illustrated on the two days during the 2003–2004 season in which the highest CO concentrations were observed. On December 23, 2003, a 1-hour CO concentration of 6.3 ppm was observed at the West Entrance at 5:00 p.m., with only 143 snowmobiles entering the park's West Entrance on that day. On February 12, 2004, 181 snowmobiles entered the West Entrance, and a 1-hour CO concentration of 3.1 ppm was observed. By contrast, the West Entrance's busiest day during the 2003–2004 season, with 307 snowmobiles, had a maximum 1-hour CO concentration of 1.5 ppm. Such variability—which is still producing peaks well below the NAAQS—is still the norm; the winter of 2007-08 saw a 1-hour CO peak at the West Entrance of 6.1 ppm and 0.9 ppm at Old Faithful.

The winter of 2007-2008 saw an increase in CO at West Entrance; the cause is unclear. Snowmobile numbers were down slightly, while snowcoach numbers were up. A particularly strong inversion may have contributed. Construction activities were going on during the winter at the new station and a propane heater was running nearby, either one of which could have influenced the readings at this site.

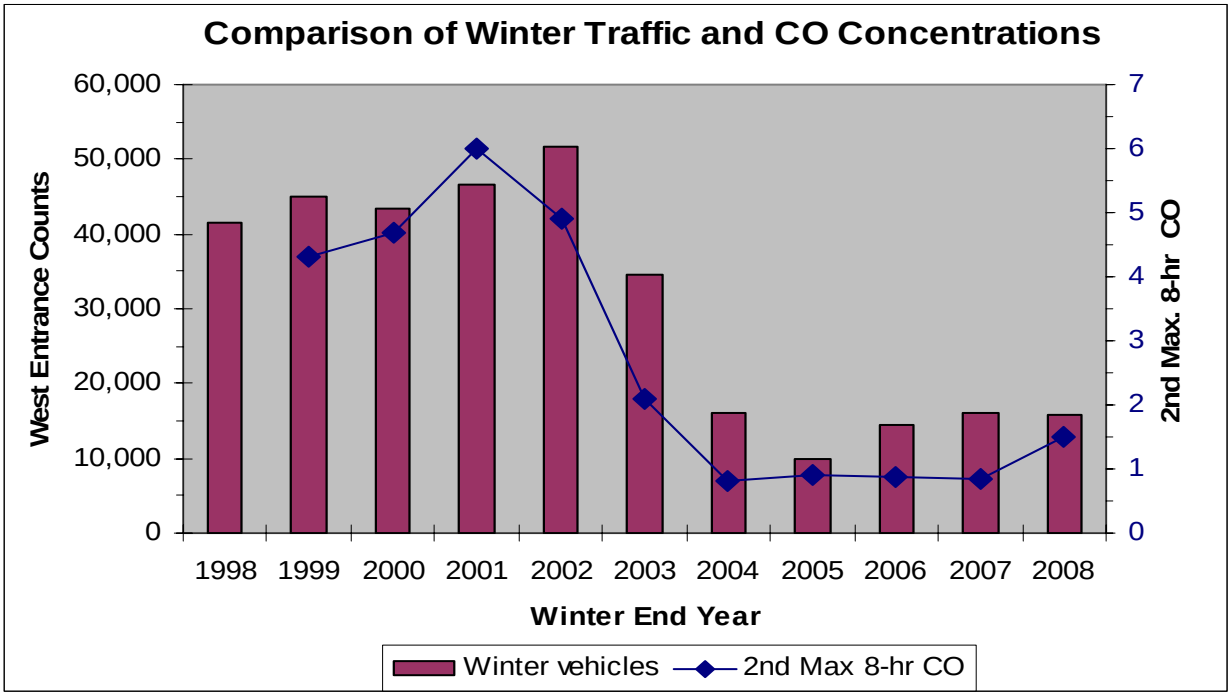
For comparative purposes, spring and fall CO concentration averages are the regional background concentrations of 0.17 ppm, while summer levels are always less than 2 ppm (Coefield 2002; Ray 2008). Other than certain high CO levels measured in fall 2007 and spring 2008 that may have been related to the reconstruction of the park's entrance station adjacent to the West Entrance monitoring site, almost all CO values measured at the West Entrance through March 2008 that exceed 3 ppm are associated with OSV traffic (though such levels are still well below the NAAQS). Higher particulate levels are often observed in summer, but these are a reflection of wildfire smoke blowing into Yellowstone, not the summer traffic (Ray 2008).

Historically, two-stroke snowmobiles were the source of the vehicle emission and health-related complaints in YNP. Two-stroke engines providing a high power/weight ratio were the typical

power plant used in such vehicles. These engines produce relatively high emissions of CO, unburned hydrocarbons (HC), and fine particulate matter (PM2.5) compared to modern automobile engines and they incorporate little pollution control equipment. During the 2003–2004 season, two-stroke snowmobiles were largely replaced in YNP by four-stroke snowmobiles meeting the BAT requirements for HC and CO, which are a 90% reduction in HC and a 70% reduction in CO emissions as compared to two-stroke snowmobiles. Since then, all recreational snowmobiles have had to meet the BAT requirements. This change, combined with an overall reduction in snowmobiles from previous years and use of ethanol-enhanced fuels, has led to the marked reduction in ambient pollution levels. As noted previously, winter air quality in Yellowstone for the past four winters has been excellent.

Impacts on air quality secondarily have impacts on human health and the quality of visitor experience. Such impacts are reflected in analyses under their respective headings.

Figure 3-13: Trends in Second Maximum 8-Hour CO Level and West Entrance Annual Snowmobile Visitation.



Note: Original figure is in color; reproduction costs precluded use of color. The reader may obtain the color version at http://www.nps.gov/yell/parkmgmt/winterusetechnicaldocuments.htm.

Figure 3-14: Trends in the 98th percentile of daily PM2.5 and West Entrance traffic since 1998.

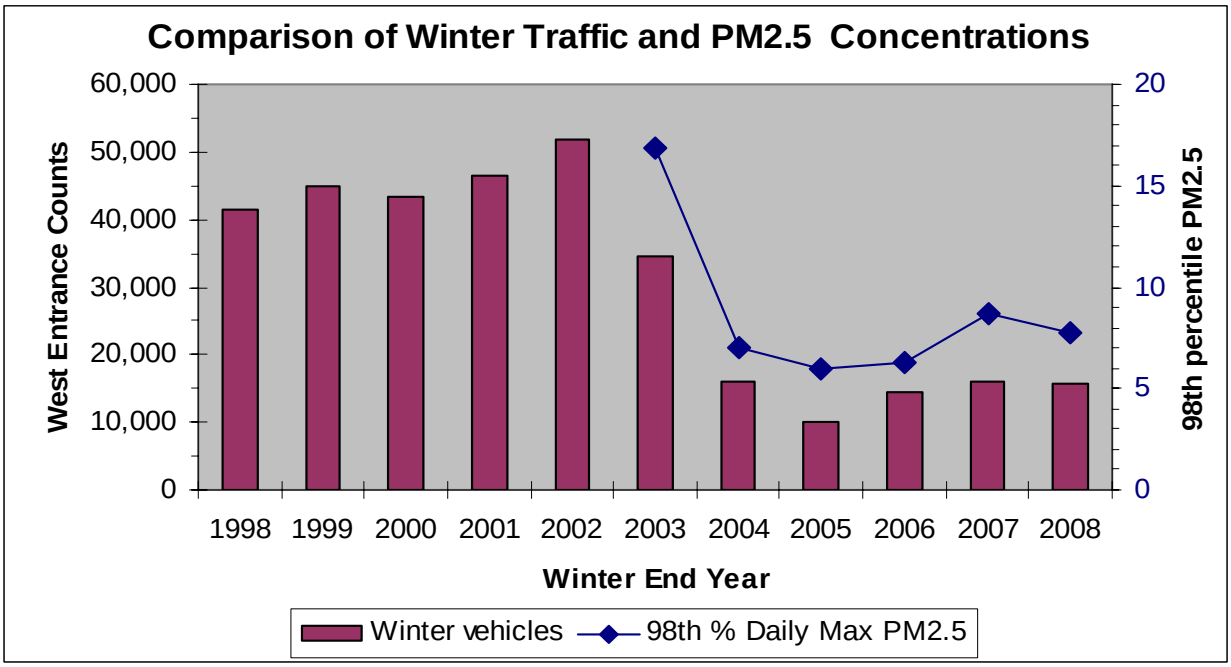


Table 3-12: Carbon Monoxide Concentration, in parts per million (ppm), 2002-2003 through 2007-2008, Old Faithful.

Winter Season Statistic	Winter 2007-08	Winter 2006-07[a]	Winter 2005-06	Winter 2004-05	Winter 2003-04	Winter 2002-03
Max 1-hr	0.9	0.9	1.6	1.6	2.2	2.9
% of Std	2%	3%	4%	4%	6%	8%
Max 8-hr	0.4	0.4	0.5	0.8	0.9	1.2
% of Std	5%	4%	6%	7%	10%	13%
Average	0.19	0.27	0.18	0.12	0.26	0.24
90th percentile	0.24	0.19	0.26	0.29	0.5	0.5

[a] The visitor parking and the monitoring station moved because of construction at Old Faithful (Ray 2007). Standards are provided in Table 3-11: the standard for Max 1-hr is 35 ppm, and for Max 8-hr is 9 ppm.

Table 3-13: Carbon Monoxide Concentration, in parts per million (ppm), 2002-2003 through 2007-2008, West Entrance.

Winter Season Statistic	Winter 2007-08	Winter 2006-07[a]	Winter 2005-06	Winter 2004-05	Winter 2003-04	Winter 2002-03
Max 1-hr	6.1	3.7	2.1	2.8	6.4	8.6
% of Std	17%	11%	6%	8%	18%	25%
Max 8-hr	1.6	0.8	0.9	1.0	1.3	3.3
% of Std	18%	9%	10%	11%	14%	37%
Average	0.23	0.19	0.23	0.24	0.26	0.57
90th percentile	0.4	0.27	0.40	0.43	0.5	1.3

[a] The visitor parking and the monitoring station moved because of construction at Old Faithful (Ray 2007). Standards are provided in Table 3-11: the standard for Max 1-hr is 35 ppm, and for Max 8-hr is 9 ppm.

Table 3-14: PM2.5 in micrograms per cubic meter (ug/m3), 2002-2003 through 2007-2008, Old Faithful

Winter Season Statistic	Winter 2007-08	Winter 2006-07	Winter 2005-06	Winter 2004-05	Winter 2003-04	Winter 2002-03
Max 1-hr	32	20	56	38	151	200
Max Daily (24-hr)	8.1	6.6	9	6	16	37
98th percentile	5.8	6.4	9	9	9	21
% of Std	17%	18%	13%	14%	14%	33%
Average	3.2	3.3	3.5	4.0	4.9	6.9

Source: Ray 2008. Standards are provided in Table 3-11: To attain the PM2.5 standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 65 ug/m^3, the NAAQS standard. Note that the visitor parking and the monitoring station moved because of construction at Old Faithful.

Table 3-15: PM2.5 in micrograms per cubic meter (ug/m3), 2002-2003 through 2007-2008, West Entrance.

Winter Season Statistic	Winter 2007-08	Winter 2006-07	Winter 2005-06	Winter 2004-05	Winter 2003-04	Winter 2002-03
Max 1-hr	44	40	44	21	29	81
Max Daily (24-hr)	9.5	8.8	7	6	8	15
98th percentile	7.8	8.7	6	6	7	17
% of Std	22%	25%	10%	9%	11%	26%
Average	2.6	2.1	1.9	2.9	4.0	8.2

Source: Ray 2008. Standards are provided in Table 3-11: To attain the PM2.5 standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 65 ug/m^3, the NAAQS standard.

Public and Employee Health and Safety

The affected environment for impacts to public and employee health and safety is limited to activities that occur within the parks, as discussed below.

Regulatory and Policy Overview

The Occupational Safety and Health Administration (OSHA) provides limits for air pollution and noise exposure, as presented in this section. Additionally, as noted in footnotes 7-9, other organizations such as The National Institute for Occupational Safety and Health (NIOSH) conduct research on occupational diseases and injuries and recommend standards or guidelines. Also, by policy, the National Park Service is committed to providing the safest possible environment for employees and the general public.

The 2006 NPS Management Policies (NPS 2006: 8.2.5.5) states "the Service will work to identify public health issues . . . in the parks and to conduct park operations in ways that reduce or eliminate these hazards. Park managers will pursue these goals with technical assistance provided under the auspices of a Service-wide public health program." The policies (NPS 2006: 8.2.5.1) also recognize agency limitations for eliminating hazards while continuing to strive to identify and prevent injuries from recognizable threats to the health and safety of persons by applying nationally accepted codes, standards, engineering principles and guidance provided in various Directors' Orders. Further, the NPS will reduce or remove known hazards and apply other appropriate measures including closures, guarding, signing, or other forms of education. In doing so, preferred actions are to be those having the least impact on park resources and values. Finally, the policies (NPS 2006: 4.8.1.3) note that naturally occurring geologic processes, which the NPS is charged to preserve, can be hazardous to humans. Included in such hazards are landslides and avalanches. The NPS must strive to understand and minimize potential impacts to visitors and staff. Superintendents are to examine the feasibility of phasing out, relocating or providing alternative facilities for developments subject to hazardous processes.

In the last ten years, the NPS (both nationally and in Yellowstone) has become very concerned about providing safe work environments for all employees. In part, the agency's concern was heightened after the Occupational Health and Safety Administration (OSHA) found over 600 safety violations in Yellowstone in 1997. Yellowstone's injury rate was two to three times as high as even that of industries known to be risky, such as oil and gas drilling. In response to this problem, Yellowstone partnered with OSHA to improve employee safety. With OSHA's assistance, the NPS has improved workplace safety, an improvement reflected in an overall drop in employee injuries. The NPS remains committed, as does the Department of the Interior, to providing safe work places, with a goal of no lost time accidents for its employees. This was emphasized by Secretary Kempthorne in May 2007 when he said it was no longer "business as usual" for employee health and safety programs in the Department of the Interior (Bomar 2007a; Bomar 2007b; Office of the Secretary 2007; YNP 2005; NPS 2004a; USDI 2000).

New Research and Monitoring

In 2008, employee health and safety monitoring occurred, and the report (actually a memorandum) found no concerns with air pollutants or toxics, but did find a concern with employee exposure to snowmobile noise while riding a snowmobile for a full day (Industrial Hygienist 2008). The author recommended continued monitoring and evaluation of exposure to noise for employees who ride a snowmobile for a significant amount of their work shift.

Additional new work relative to avalanche control in Yellowstone includes a March 2007 report "Avalanche Hazard Assessment and Mitigation" and an August 2007 Operational Risk Management (ORM) Assessment (both of which are available on the winter use website at: http://www.nps.gov/yell/parkmgmt/winterusetechnicaldocuments.htm).

The *Affected Environment* air quality and natural soundscapes sections also include recent monitoring data and analyses.

Existing and Historic Conditions

Although conditions are substantially improved from historic periods of peak snowmobile use in the parks, some health and safety concerns remain. These include personal and occupational exposure to noise and air contaminants and avalanche hazard mitigation. Air quality and soundscapes are monitored in the park throughout the year. Personal exposure has been monitored in both summer and winter during 2005 and 2006 and in winter 2007-08. Information about each of these health and safety issues is addressed here. Avalanche control operations are also reviewed below. Past concerns relative to vehicular traffic, winter driving and difficult road conditions have largely been mitigated with the implementation of commercial guiding and operational processes.

Personal and Occupational Exposure to Contaminants

Air Quality

Numerous occupational air quality studies have been conducted at YNP, focusing on the West Entrance, which is the busiest winter access point to the park. Some of these studies, conducted when unlimited two-stroke machines were allowed, indicated concerns regarding employee health safety and health, particularly on days with atmospheric inversions. Since snowmobiles entering the West Entrance are now primarily Best Available Technology (BAT) with reduced numbers, exposure levels to a variety of chemicals have dropped appreciably.

The major objective of these studies was to evaluate NPS employee exposure to particulate matter, air contaminants, and noise emitted by snowmobiles. The studies were performed

during anticipated peak levels of snowmobile use in an attempt to obtain worst-case measurements during winter use work activities. Most sampling was completed during the busiest winter weekends in the parks (the Martin Luther King three-day weekend and the President's Day three-day weekend). It should be noted that a new West Entrance station was completed in the winter of 2007-2008. The new facility has a modern heating-ventilation system that was intended to assist with the historic exposure issues at the entrance. Thus some of the results obtained prior to this last winter would not be applicable to the current station configuration.

In 1997, personal exposure measurements for carbon monoxide were conducted at the West Entrance (Radtke 1997). The 8-hour, time-weighted average[2] for carbon monoxide was between 2 and 4 parts per million (ppm). The OSHA permissible exposure limit[3] is 50 ppm and the threshold limit value[4] is 25 ppm. The more restrictive 8-hour National Ambient Air Quality Standard[5] is 9 ppm. The study concluded that carbon monoxide did not appear to be an important hazard for employees at the West Entrance.

In 2000, OSHA conducted personal and area sampling for benzene, gasoline, formaldehyde, and carbon monoxide in Yellowstone. They concluded that exposures were below permissible exposure limits and threshold limit values, except for exposure to benzene, formaldehyde, and carbon monoxide which exceeded the NIOSH recommended exposure limit[6] for one employee at the West Entrance express lane.

A 2001 study included personal exposure monitoring for respirable particulate matter, carbon monoxide, and benzene. The study recorded an average benzene level of 0.035 ppm, and an average overexposure of 0.029 ppm to benzene (Kado et al. 2001). The minimum risk level[7] standard for benzene is 0.006 ppm for intermediate-duration inhalation exposures (15-364 days/year).

In 2004, occupational exposures to aldehydes, VOCs, respirable particulate, carbon monoxide, and noise were evaluated. This study concluded that concentrations of all airborne contaminants were well below current standards and recommended exposure limits (IHI Environmental 2004). By this time, the majority of snowmobiles entering Yellowstone were Best Available Technology; since then, all visitor snowmobiles are.

A 2005 study evaluated exposures at the West Entrance for aldehydes, volatile organic compounds, total hydrocarbons, elemental and organic carbon, oxides of nitrogen, carbon monoxide, and respirable particulate matter. All employee exposures to the above air contaminants and noise were below OSHA permissible exposure limits and other recommended exposure limits. During this study, a ventilation survey was performed in kiosks A and B at the West Entrance. The survey showed that both kiosks were under strong positive pressure. At the

[2] TWA- time weighted average, an allowable exposure concentration averaged over a normal 8-hour workday or a 40-hour workweek.
[3] PEL- permissible exposure limit set by OSHA; the concentration of a substance to which most workers can be exposed without adverse effect based on an 8-hour TWA exposure.
[4] TLV- threshold limit value, guideline set by the American Conference of Governmental Industrial Hygienists (ACGIH) referring to airborne concentrations of substances and representing conditions under which nearly all workers may be repeatedly exposed, day after day, without adverse effect.
[5] National Ambient Air Quality Standards (NAAQS) are designed to include protection for sensitive populations including children, asthmatics, and the elderly.
[6] REL- recommended exposure limit set by NIOSH for an 8- or 10-hour time-weighted-average exposure.
[7] MRL- minimal risk level set by The Agency for Toxic Substances and Disease Registry (ATSDR); estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), non-cancerous effects over a specified duration of exposure.

time of the survey both kiosks were achieving slightly over one air exchange per minute with the window open 30 inches (Spear and Stephenson 2005).

Spear, Hart, and Stephenson conducted a similar study in 2006 (Spear et al. 2006). While there were some minor variances, the 2006 report confirmed employee exposures to be below all current standards set by regulatory agencies except for two of thirteen benzene samples. Although these two samples were close to an order of magnitude less than the samples obtained before conversion to BAT snowmobiles in 2004 (see the discussion of 2001 findings above; Kado et al. 2001), they appeared to be above the MRL for chronic-duration (365 days/year) inhalation exposure, 0.003 ppm for benzene, and for intermediate-duration exposure, 0.006 ppm. Taking note of the two samples, the authors explained that these appearances were deceptive: "The benzene samples with concentrations of 0.0072 ppm and 0.0086 ppm are above the intermediate-duration inhalation exposure of 0.006 ppm, but below the acute duration inhalation exposure of 0.009 ppm. However, both of these were short term samples taken to minimize dilution effects and thereby obtain a better idea of potential worst case exposures." In reality, the two samples were not intermediate-duration inhalation or chronic-duration exposure samples, which would have had to exceed 0.006 ppm for fifteen days or 0.003 ppm for 365 dyas/year, respectively, for a problem to be evident. They were short-term samples, and even at that, were far from the PEL of 1.0 ppm. Spear, Hart and Stephenson found no correlation between VOC concentrations and the number of vehicles entering during their 2005 and 2006 studies; there were less than 250 snowmobile entries on the days with higher benzene exposures. They concluded, "both mean concentrations are well below the MRL for benzene" (Spear et al. 2006).

Confirming their finding—that benzene is not a major concern for employee health and safety—was an air toxic assessment performed last winter by the Department of the Interior's Office of Occupational Health and Safety in conjunction with the Yellowstone Safety Office. The Office conducted an exposure assessment of West Entrance Station employees to carbon monoxide, hydrocarbons, aldehydes, and noise levels. According to the memorandum summarizing the results of this assessment, "All results for all volatile organic compounds, aldehydes, and carbon monoxide were well below the occupational exposure limits and in most cases were below the detection limits of the analytical method. Results of volatile organic compounds showed most were below detection limits with the relative highest exposure being to benzene which was approximately 2% of the PEL" (Industrial Hygienist 2008). Clearly, although benzene is present in measurable quantities, those levels are so low that they are barely detectable and are far below the short-term, intermediate, and chronic exposure limits for employees. For these reasons, there has been no need for NPS to take remedial action on benzene.

Formaldehyde is another pollutant for which Spear and Stephenson (2005) and the Office of Occupational Health and Safety (Industrial Hygienist 2008) tested. Spear and Stephenson took four 8-hour time-weighted averages for formaldehyde, producing results varying from 0.008 ppm to 0.011. In all cases, the measurements were well below the 8-hour time-weighted recommended exposure limit (REL) of 0.016; the highest such reading was still less than 2/3 of the REL. As with benzene, Spear and Stephenson concluded that the formaldehyde did not pose a risk to public health. Last winter, the Office of Occupational Health and Safety also tested for formaldehyde, finding two calculated 8 hour time-weighted averages at Kiosk 1 of 0.017 and 0.023 ppm (of 7 total kiosk samples). Although these measurements were well below the OSHA PEL of 0.75 ppm and the ACGIH TLV of 0.3 ppm, they did exceed the NIOSH REL of 0.016 ppm. NIOSH REL's are recommended best management practices to ensure exposure will not impact public health. NIOSH REL's are recommendations by NIOSH scientists based on

science-based recommendations (animal and human studies), not legal standards—so, unlike the OSHA PEL's, agencies are not required to adhere to RELs. Nonetheless, the NPS has taken measures to reduce levels of air contaminants by installing new entry kiosks with ventilation. Furthermore, the agency remains concerned about the formaldehyde readings and will continue health and safety monitoring at the West Entrance in future winters to ensure formaldehyde does not pose a risk to the public and NPS employees.

For all emissions, levels are well below federal safety levels; monitoring and adaptive management will continue. Tables 3-16 through 3-20 below reflect average sample exposure sets gathered starting with the 1997 study. Five contaminants of concern – benzene, formaldehyde, acetaldehyde, particulates, and 1,3-butadiene – are shown.

Table 3-16: Average Benzene Levels

Sample Description	Kiosk A	Kiosk B	Kiosk C	Regulatory limit
Kado et al. 2001 – average of 666 two-stroke sleds through west entrance	0.035 parts per million (ppm) (kiosk not noted)			1 ppm (OSHA PEL) 0.1 ppm (NIOSH REL) 0.5 ppm (ACGIH TLV)
OSHA 2000 – 976 two-stroke sleds through west entrance	0.02 ppm	0.0087 ppm	0.1118 ppm	
IHI 2004 – average of 220 sleds, primarily four-strokes through west entrance	0.0031 ppm	0.0033 ppm	Not used during 2004	
Spear and Stephenson 2005 – average of 180 sleds, primarily four-strokes through west entrance	0.0035 ppm	No personal samples taken	Not used during 2005	
Spear, Hart, and Stephenson 2006 – average of 216 sleds, primarily four-strokes through west entrance	0.00325 ppm	No personal samples taken	Not used during 2006	
Office of Occupational Health and Safety (Industrial Hygienist 2008)	Below detection limits			

Table 3-17: Average Formaldehyde Levels

Sample Description	Kiosk A	Kiosk B	Kiosk C	Regulatory limit
Kado et al. 2001 – average of 666 two-stroke sleds through west entrance	Did not sample for 8 hour TWA 0.072 ppm for 170 minute sampling period, kiosk not noted			0.75 ppm (OSHA PEL) 0.016 ppm (NIOSH REL) 0.3 ppm (ACGIH TLV)
OSHA 2000 – 976 two-stroke sleds through west entrance	0.000 ppm	0.000 ppm	0.0332 ppm	
IHI 2004 – average of 220 sleds, primarily four-strokes through west entrance	0.0023 ppm	0.0028 ppm	Not used during 2004	
Spear and Stephenson 2005 – average of 180 sleds, primarily four-strokes through west entrance	0.01 ppm	No personal samples taken	Not used during 2005	
Spear, Hart, and Stephenson 2006 – average of 216 sleds, primarily four-strokes through west entrance	0.009 ppm	No personal samples taken	Not used during 2006	
Office of Occupational Health and Safety (Industrial Hygienist 2008)	0.02 ppm	Below detection limits		

Table 3-18: Average Acetaldehyde Levels

Sample Description	Kiosk A	Kiosk B	Kiosk C	Regulatory limit
Kado et al. 2001 – average of 666 two-stroke sleds through west entrance	Did not sample for 8 hour TWA 0.024 ppm for 170 minute sampling period, kiosk not noted			200 ppm (OSHA PEL) 25 ppm (ACGIH C)
OSHA 2000 976 two-stroke sleds through west entrance	Did not sample for acetaldehyde			
IHI 2004 – average of 220 sleds, primarily four-strokes through west entrance	0.002 ppm	0.002 ppm	Not used during 2004	
Spear and Stephenson 2005 –	0.0065	No	Not	

Sample Description	Kiosk A	Kiosk B	Kiosk C	Regulatory limit
average of 180 sleds, primarily four-strokes through west entrance	ppm	personal samples taken	used during 2005	
Spear, Hart, and Stephenson 2006 – average of 216 sleds, primarily four-strokes through west entrance	0.0063 ppm	No personal samples taken	Not used during 2006	
Office of Occupational Health and Safety (Industrial Hygienist 2008)	Below detection limits	Below detection limits		

Table 3-19: Average Particulate Levels

Sample Description	Kiosk A	Kiosk B	Kiosk C	Regulatory limit
Kado et al. 2001 – average of 666 two-stroke sleds through west entrance	0.1 mg/m^3 (kiosk not noted)			5.0 mg/m^3 (OSHA PEL) 5.0 mg/m^3 (NIOSH REL) 3.0 mg/m^3 (ACGIH TLV)
OSHA 2000 – 976 two-stroke sleds through west entrance	None taken	None taken	None taken	
IHI 2004 – average of 220 sleds, primarily four-strokes through west entrance	0.0236 mg/m^3	0.046 mg/m^3	Not used during 2004	
Spear and Stephenson 2005 – average of 180 sleds, primarily four-strokes through west entrance	0.017 mg/m^3	No personal samples taken	Not used during 2005	
Spear, Hart, and Stephenson 2006 – average of 216 sleds, primarily four-strokes through west ent.	0.031 mg/m^3	No personal samples taken	Not used during 2006	

Table 3-20: Average 1,3-Butadiene Levels

Sample Description	Kiosk A	Kiosk B	Kiosk C	Regulatory limit
Spear, Hart, and Stephenson 2006 – average of 216 sleds, primarily four-strokes through west entrance	0.0025 ppm	No personal samples taken	Not used during 2006	1 ppm (OSHA PEL) 2 ppm (ACGIH TLV)

Noise Exposure

Noise exposure was measured for both snowmobile riders and employees working at the West Entrance in studies conducted between the years 1997 through 2008. The exposure measured noise from all sources, including snowmobiles and other equipment. One way to measure employee exposure to noise, as below, is to compute the eight-hour Time-Weighted Average (TWA) of their exposure to noise, with hearing protection required when the TWA is above 85 dBA.

In 1997, personal exposure measurements for noise were conducted at the West Entrance. The 8-hour time-weighted average for the noise samples ranged from 70.9 dBA[8] to 82.0 dBA. These levels are below the action level[9] of 85 dBA and the OSHA permissible exposure limit of 90 dBA. The study concluded that noise did not appear to be a major hazard for employees at the West Entrance (Radtke 1997).

A 2000 OSHA study conducted personal and area sampling for noise. The study concluded that exposures were below permissible exposure limits and threshold limit values, but the express lane employee was overexposed to the ACGIH action level for noise of 85 dBA. The only noise overexposures to West Entrance employees occurred when two-stroke machines were allowed.

In 2004, occupational exposure to noise was evaluated with the conclusion that exposure did not exceed recommended limits. In 2005, another study at the West Entrance concluded that noise exposures were below OSHA permissible limits and other recommended maximum exposure levels (Spear and Stephenson 2005).

A recent study found that employee noise exposures at the West Entrance averaged 60.6 dBA for the winter 2004-2005 and 65.2 for the following winter, or 3.5% and 5.5% of the allowable noise exposure, respectively. Peak 8-hr TWAs for those two winters were 75 and 80dBA, or 12.5% and 26.0% of the allowable exposure respectively (Jensen and Meyer 2006). Clearly, while employees are exposed to some noise, those exposures are well within safeguards. However, when riding a snowmobile, employees may be exposed to TWAs approaching the action level of 85 dBA. For example, the Office of Occupational Health and Safety (Industrial Hygienist 2008) found that an employee was exposed to a TWA of 84.5 dBA in 2008.

Overall, since the change to four-stroke technology, employee exposure at the West Entrance has been below 85 dBA. Snowmobile rider exposure levels have also decreased with the use of four-stroke technology, but rider exposure levels remain over the OSHA action level when operated for more than four hours. Noise exposure while riding on snow machines can be controlled with standard ear plugs. All commercially available NIOSH-rated foam plugs provide

[8] dBA- A-weighted decibels, an expression of the relative loudness of sounds in air as perceived by the human ear, sounds at low frequencies are reduced, compared with unweighted decibels, in which no correction is made for audio frequency.

[9] American Conference of Governmental industrial Hygienists (ACGIH) Action Level- the noise level (85 dBA), calculated as an 8-hour TWA, at which OSHA requires exposed employees be included in the Hearing Conservation Program.

enough attenuation to protect employee hearing. For YNP, an estimated exposure of 77 dBA for 8 hours when wearing earplugs falls within acceptable exposure limits set forth by OSHA, NIOSH, and ACGIH.[10]

The OSHA hearing conservation standard (29 CFR 1910.95) states that employee exposures should not exceed the peak, or maximum level of sound, of 115 dBA for more than 15 minutes. OSHA also recommends that employees never be exposed to impulsive or impact noise that generates sound levels greater than 140 dBA. No noise sampling in the parks has indicated a maximum exposure above 115 dBA.

Average and maximum exposure levels at the West Entrance are summarized in Tables 3-21 and 3-22 below.

Table 3-21: Average Personal Exposure to Sound Levels

Sample Description	Kiosk A	Kiosk B	Kiosk C	Rider Average
Radtke 1997 – no snowmobile count taken, mostly two-stroke sleds through west entrance	70.9 dBA	Not sampled in 1997	Not sampled in 1997	Not sampled in 1997
OSHA 2000 – 976 two-stroke sleds through west entrance	72.1 dBA	75.2 dBA	88.3 dBA	93.1 dBA riding two stroke snowmobile
IHI 2004 – average of 220 sleds, primarily four-strokes through west entrance	62.9 dBA	68.8 dBA	Not used during 2004	82.4 dBA riding four stroke snowmobile
Spear and Stephenson 2005 – average of 180 sleds, primarily four-strokes through west entrance	60.6 dBA	Not sampled in 2005	Not used during 2005	85.5 dBA riding four stroke snowmobile
Spear, Hart, and Stephenson 2006– average of 216 sleds, primarily four-strokes through west entrance	71.3 dBA	71.0 dBA	Not used during 2006	Not used during 2006
Office of Occupational Health and Safety (Industrial Hygienist 2008)	68.4 dBA	69.5 dBA	Not used during 2008	84.5 (only 1 measurement)
Dosimeter settings set to evaluate compliance with OSHA Hearing Conservation Amendment (threshold = 80 dB; exchange rate = 5 dB Criterion Level = 90 dB; Time Constant = slow). Results are 'A-weighted.'				

[10] The lowest noise reduction rating (NRR) given to foam ear plugs used in the park is 23. To estimate noise exposures to people wearing any given set of ear plugs, the following equation is used: Workplace noise level [(dBA) – (NRR – 7 dB)/2] = Estimated exposure (dBA). For Yellowstone: [85 dBA – (23 – 7dB)/2] = 77 dBA.

Table 3-22: Maximum Exposure to Sound Levels

Sample Description	Kiosk A	Kiosk B	Snowmobile Riders
IHI 2004 – average of 220 sleds, primarily four-strokes through west entrance	114.0 dBA 108.3 dBA 106.6 dBA 89.6 dBA 106.8 dBA 97.8 dBA	112.5 dBA 112.8 dBA 108.3 dBA 103.8 dBA 108.3 dBA	110.3 dBA 111.6 dBA
Spear, Hart, and Stephenson 2006 – average of 216 sleds, primarily 4 strokes through west entrance (P) Denotes personal sampling; (A) Denotes area sampling	109.0 dBA (P) 96.0 dBA (A) 105.0 dBA (A) 114.0 dBA (P) 112.0 dBA (A) 109.0 dBA (A) 110.0 dBA (P) 104.0 dBA (A) 111.0 dBA (A)	113.0 dBA (P) 94.0 dBA (A) 110.0 dBA (A) 108.0 dBA (P) 96.0 dBA (A) 107.0 dBA (A)	

2005-2006 Summer and Winter Comparison

A common misperception is that the many more automobiles entering the park during summer months contribute more pollutants than do snowmobiles. Although the historic number of snowmobiles entering YNP during the winter (66,619) was, on average, a factor of 16 lower than the number of automobiles entering the park annually (1,075,295), snowmobile emissions equaled or exceeded total annual emissions for CO and HC from other mobile sources (i.e., cars, RVs, buses and snowcoaches). Prior to the implementation of BAT requirements, the contribution from snowmobiles to the total annual HC emissions ranged from 68-90%; to the total annual CO emissions, 35-68% (NPS 2000a).

Although BAT snowmobiles typically use modern computer controlled engines, they lack catalytic converters and therefore produce more emissions than automobiles. Nevertheless, current winter air quality conditions are excellent due to the implementation of BAT requirements, which represent emissions reductions of 90% for hydrocarbons and 70% for carbon monoxide compared to historic two-stroke snowmobiles. Lower overall numbers of snowmobiles also contribute to the improved air quality. Several monitoring efforts have been conducted to determine variances in summer and winter pollutant and exposure levels; these results are summarized below and indicate that total winter emissions are now close to total summer emissions. Ray (2005-2008) presents year around ambient air quality monitoring results at the West Entrance and Old Faithful. In addition, as noted above, inversions play an important role in winter pollution levels.

Employee exposure evaluations were performed July 5-6 and 11-12, 2005 at Yellowstone's West Entrance Station kiosks A and B. On average, 400 vehicles per day passed through kiosk A and B during the sampling time period. The noise and air sampling performed in the summer were collected in the same kiosks and the analyses were conducted using the same methods as the Yellowstone Winter Use Personal Exposure Monitoring study. The winter samples were collected at the West Entrance on January 15-17, 2005 and February 19-21, 2005. The comparison results are summarized below:

Noise - The average personal exposure in kiosks A and B for the summer was 57.75 dBA. The average noise level in kiosks A and B for the winter was 43.6 dBA. Both average noise levels were below the OSHA PEL.

Carbon Monoxide – The average carbon monoxide level in summer was near 0 ppm with a spike of 765 ppm. Entrance station employees observed CO levels above NIOSH limits when either a motorcycle or older, inefficient vehicle idled at the gate. None of the time-weighted averages exceeded exposure limits. The average carbon monoxide level in the winter was 0.95 with the maximum peak of 33.6 ppm.

Aromatic Hydrocarbons – The summer levels were less than the limit of detection. Nine out of ten winter samples were below the limit of detection. One winter sample showed a toluene level of 0.73 ppm. The OSHA PEL for toluene is 200 ppm for an 8 hour TWA.

Respirable Particulates – Both winter and summer samples were below the limit of detection.

Nitrogen Dioxide – The results showed exposures for summer 2005 to be 0.03575 ppm and 0.0978 ppm in the winter 2005. Both are well below the OSHA PEL of 5 ppm.

Volatile Organic Compounds – All results for both the summer and winter were well under all established exposure levels.

Formaldehyde – The winter study results were below the limits of detection. The summer results had two samples above the NIOSH recommended exposure limit of 0.016 ppm. The highest level detected was 0.024 ppm during summer sampling.

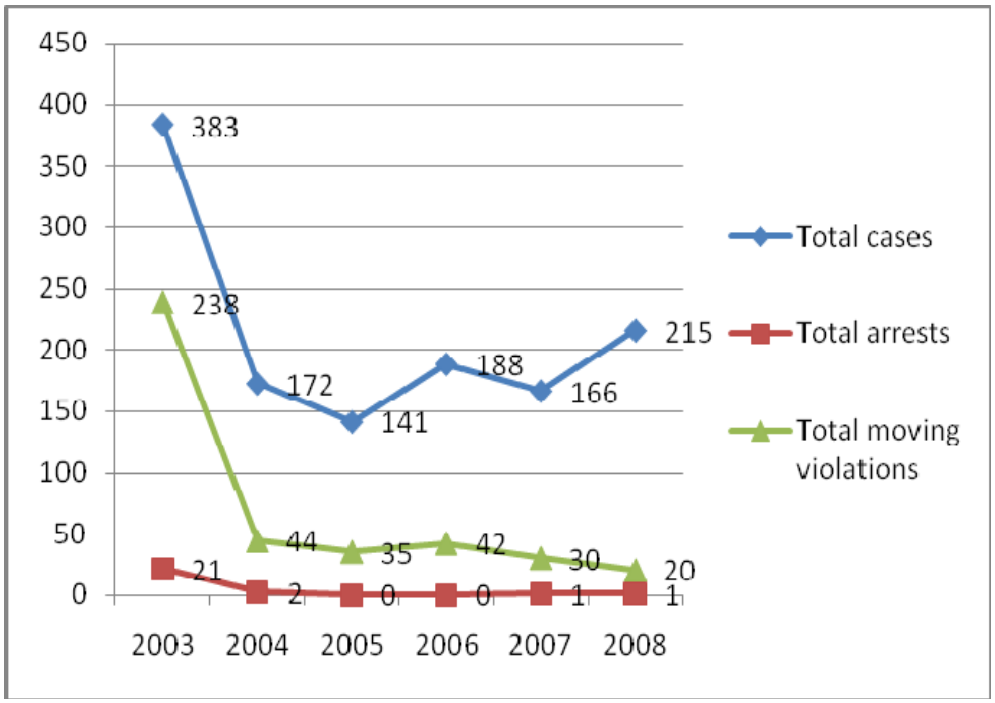
Law Enforcement Statistics

Since the winter of 2003-2004, all snowmobilers have been led by commercial guides. As shown in Figure 3-15, this has had a positive effect on visitor health and safety. Some visitors to Yellowstone have never ridden a snowmobile, and commercial guides can help teach them how to safely travel through the park. Commercial guides are experts at snowmobiling and/or snowcoach driving in Yellowstone and know the conditions associated with such travel. All commercial guides are trained in basic first aid and CPR. In addition to first aid kits, they often carry satellite or cellular telephones and radios for emergency use. They also carry shovels and equipment necessary to respond to avalanches and to vehicles that may need to be pulled from a soft road shoulder. Commercial guides use a "follow-the-leader" approach, stopping often to talk with the group. They lead snowmobiles single-file through the park, using hand signals to pass information down the line from one snowmobile to the next. Signals are effectively used and warn group members about wildlife and other road hazards, indicate where to turn, and when to turn the snowmobile on or off.

Figure 3-15 illustrates the declining number of law enforcement cases since the implementation of mandatory commercial guiding. After adjusting for reduced numbers, moving violations are down 92% from 2002-2003 to 2007-2008 (20 total that winter), total cases are down 44%, and there have been only one or two arrests each of the past five winter seasons as compared to 21 in

2002-2003 (72,560 OSV visitors in 2002-2003 and 53,764 OSV visitors in 2007-2008). Regarding 2008 and the increase in case incidents from the previous winter, the increase was attributed to more medicals and better reporting by field staff, not an actual increase in law enforcement situations.

Figure 3-15: Winter Law Enforcement Statistics, January 1-March 15, 2002-2003 through 2007-2008.



Avalanche Hazard Mitigation in Yellowstone National Park

Avalanche control at Sylvan Pass has long represented a safety concern to the National Park Service. The original winter use plan EIS (2000), the Supplemental Environmental Impact Statement (2003), the Temporary Winter Use Plan EA (2004), and the Winter Use Plan FEIS (2007) all clearly identify the significant avalanche danger on Sylvan Pass, and the danger has been well known for many years. There are approximately 20 avalanche paths that cross the road at Sylvan Pass. They average over 600 feet of vertical drop, and the East Entrance Road crosses the middle of several of the paths, putting travelers at risk of being hit by an avalanche. NPS employees must cross several uncontrolled avalanche paths to reach the howitzer used for discharging those avalanches, and the howitzer is at the base of a cliff prone to both rock-fall and additional avalanche activity (the howitzer cannot be moved without compromising its ability to reach all avalanche zones). Duds (artillery shells that do not explode on impact) occur and exist on the slopes, presenting year-round hazards to both employees and visitors, both in Yellowstone and the Shoshone National Forest. Natural avalanches can and do occur, both before and after howitzer use. Using a helicopter instead of a howitzer also is a high risk activity because of other risks a helicopter contractor would have to incur, as identified in the Operational Risk Management Assessment (ORMA) (NPS 2007c).

Although there has not been a serious incident at the pass in the 30+ years of avalanche control activity, an NPS employee lost his life traveling to the pass to check on conditions to determine if the pass was safe to open, and several close calls have occurred. During the 2007 FEIS

process, the additional, independent work by avalanche expert Bob Comey (Comey 2007) and the ORMA (into which several avalanche experts, including Mr. Comey, had direct input) reinforced that the past ways of doing avalanche control (through howitzer or helicopter) pose an unacceptably high risk to NPS employees. The ORMA indicated that travel to the pass area for assessment or mitigation action is a dangerous aspect of the operation. These reports also identified options describing how avalanche mitigation could be conducted in safer ways.

In the 2007-2008 winter, the NPS used a combination of helicopter and howitzer dispensed explosives in support of forecasting to determine if safety criteria could be met for the pass to be open. In the 2007-2008 winter, snowpack was about 120% of average, nine avalanche mitigation operations were completed (3 via helicopter and 6 using the howitzer), and the pass was fully closed 10 days and parts of 16 additional days (out of a total of an 82 day winter season). The NPS updated its operational procedures to make it clear that the pass would not be open unless safety criteria were met, and in the professional judgment of park managers, operations could be conducted within acceptable levels of risk. Area staff may use whichever tool is the safest and most appropriate for a given situation, with the full understanding that safety of employees and visitors comes first. Employees in the field make the operational determination when safety criteria have been met and operations can be conducted with acceptable levels of risk. The NPS will not take unacceptable risks. When safety criteria have been met, the pass will be open; when they have not been met, the pass will remain closed.

Historically, Sylvan Pass has been closed for several days during the winter to allow avalanche management to occur. That is, the pass has almost never been open for the entire season. Most reasonable avalanche mitigation techniques would result in the pass being closed for at least some days in the winter to conduct avalanche mitigation.

Use levels have always been relatively low on Yellowstone's East Entrance. Even during the highest winter use years in the 1990s, total use for the season rarely exceeded 5,000 people, less than 5% of Yellowstone's total winter visitation. Visitor access over Sylvan Pass is solely for recreational purposes. The East Entrance road is not a major highway, a commerce route, or a railroad. Other avalanche mitigation programs in this country are focused on routes with far higher traffic volume and economic value, often including high value interstate commerce.

Other avalanche areas also exist in Yellowstone (for example, the Talus Slope on the South Entrance road). None of the rest of these locations approaches the size and number of avalanche chutes that exist at Sylvan. However, all are monitored though use of regional avalanche forecasting and observation of local conditions. As with Sylvan Pass, if safety criteria are not met, these areas would also be closed, and appropriate avalanche operations would be conducted.

Severe Weather Conditions

According to industry standards established by the American Conference of Industrial Hygienists, all non-essential work should stop at a temperature of -25° Fahrenheit (F) if there is a 20 mile per hour wind. With no noticeable wind, the temperature at which non-essential work should cease is -45° F. Travel by snowmobile may produce wind-chill factors of 40 degrees.

Current Yellowstone employee procedures state that snowmobile travel is not advised for non-essential work at temperatures below -20° F. Non-essential work includes activities such as travel to meetings, training, and other administrative travel; avalanche control procedures; interpretive programs and roving interpretation; resource monitoring; research fieldwork, etc.

Temporary park closures may be enacted as necessary to provide for the safety of the public and employees during severe weather.

Visitor Access and Circulation

The affected environment for impacts to visitor access and circulation is generally limited to activities that occur within the parks, as discussed below. Some discussions include impacts to visitor access and circulation at, or from, various park entrances.

Regulatory and Policy Overview

Enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks. The NPS is committed to providing appropriate, high quality opportunities for visitors, and will maintain an atmosphere that is open and accessible to every segment of American society (NPS 2006: 8.1.1, 8.2, 8.2.2, 8.2.3, and 8.2.3.2).

Visitor access is constrained to uses that are appropriate to the purpose for which the park was established, and which can be sustained without causing unacceptable impacts. Visitor activities that may be enjoyed are those that are appropriate, inspirational, educational, and healthful, and that will foster an appreciation for park resources and values. Unacceptable impacts from visitor activities would include those that create an unsafe or unhealthy environment for visitors or employees and that would unreasonably interfere with the atmosphere of peace and tranquility, park programs, or other appropriate uses. The potential impact on park natural soundscapes is a key concern with respect to recreational activities whose appropriateness is being evaluated. Park managers are to take action to prevent or minimize noises that adversely affect visitor experience or that exceed levels that are acceptable for visitor use. This applies to the use of motorized equipment, including modes of access to the parks. Where motorized use is appropriate and necessary, the least impacting equipment, vehicles, and transportation systems should be used, consistent with public and employee safety.

Snowmobile access to and in park units is regulated under 36 CFR § 2.18, which states in part, "snowmobiles are prohibited except where designated and only when their use is consistent with the park's natural, cultural, scenic and aesthetic values, safety considerations, park management objectives, and will not disturb wildlife or damage park resources."

Regional Access

Yellowstone National Park is located in the northwestern corner of Wyoming, with 3% of the park extending into Montana and 1% into Idaho. The park is within Teton and Park Counties in Wyoming, Park and Gallatin Counties in Montana, and Fremont County in Idaho. Grand Teton National Park is located in west central Wyoming, immediately south of YNP and the Parkway. It is bounded on the south by the National Elk Refuge. Between the two parks is the John D. Rockefeller, Jr. Memorial Parkway, administered by GTNP. Highway infrastructure facilitating access to the two park units is readily apparent and will not be discussed here.

Park Roadways, Trails, and Winter Facilities

Snowpack Variability

Considerable variability occurs in snowpack development in Yellowstone and Grand Teton National Parks over the span of many years. In order to establish realistic opening and closing dates for use of oversnow vehicles on park roads, it is important to understand this variability. Weather data from several weather stations were recently analyzed to determine various threshold values of snow water equivalency (SWE) needed to sustain oversnow vehicle travel.

Historical opening data indicate that about 1.5 inches SWE is needed to open the oversnow roads to the public. This amounts to about 380 – 460 mm or 15 to 18 inches of cumulative snowfall (Farnes and Hansen 2005).

Snowpack on some of the park road system is more critical than in other areas. Specifically, snowpack at Madison Junction (the lowest point on Yellowstone's Lower Loop route) dictates when the road can be opened between West Yellowstone and Old Faithful and West Yellowstone to Norris Junction and Canyon. Spring closure dates closely match the date at which snowpack becomes isothermal (same temperature throughout the snowpack), which is the beginning of spring melt. Mid-winter melt can be a problem for maintaining snow on the roadways (Farnes and Hansen 2005).

Yellowstone National Park

Yellowstone roads are maintained for many purposes, including touring and sightseeing, accessing trailheads, and park management. During the winter, most park roads are closed to wheeled vehicular traffic with the exception of Highway 191, which provides access between West Yellowstone and Bozeman, Montana, and the park road from Gardiner to Mammoth to the Northeast Entrance (Cooke City). These roads provide the only wheeled vehicle access through the park during the winter, and are used by many visitors to view wildlife or access trailheads for cross-country skiing, snowshoeing, and/or hiking. All told, the NPS plows a total of 58 miles of primary road between Gardiner and Cooke City, with the State of Montana plowing the 20 miles of Highway 191 within YNP's northwest corner.

Oversnow vehicular travel is allowed on many other park road segments, with the exception of Dunraven Pass between Tower and Washburn Hot Springs overlook, which was closed to all recreational winter vehicle travel in the 1980s due to avalanche danger. Where OSV travel is allowed, the roads are groomed. Grooming begins when there is adequate snow cover and is accomplished using a tracked vehicle equipped with a blade on the front and a packer wheel and drag at the rear. The road segments from the West Entrance to Old Faithful are usually groomed every night. Most other sections are usually groomed every other day or night. All told, the NPS grooms 193 miles of OSV routes in YNP. Figure 1-1 (in *Purpose and Need*) displays the various YNP road segments with mileages.

About 30 miles of trails are groomed for non-motorized uses in Yellowstone. These trails include the Blacktail Plateau Drive, Bunsen Peak Road, Upper Terrace Drive, North Canyon Rim trail, Lone Star Geyser, the Upper Geyser Basin Trail, the Barns Trails, and some other trails in the Old Faithful areas. The portion of the Dunraven Pass Road from Tower Junction past Tower Falls to the top of the Chittenden Road is also groomed for skiing.

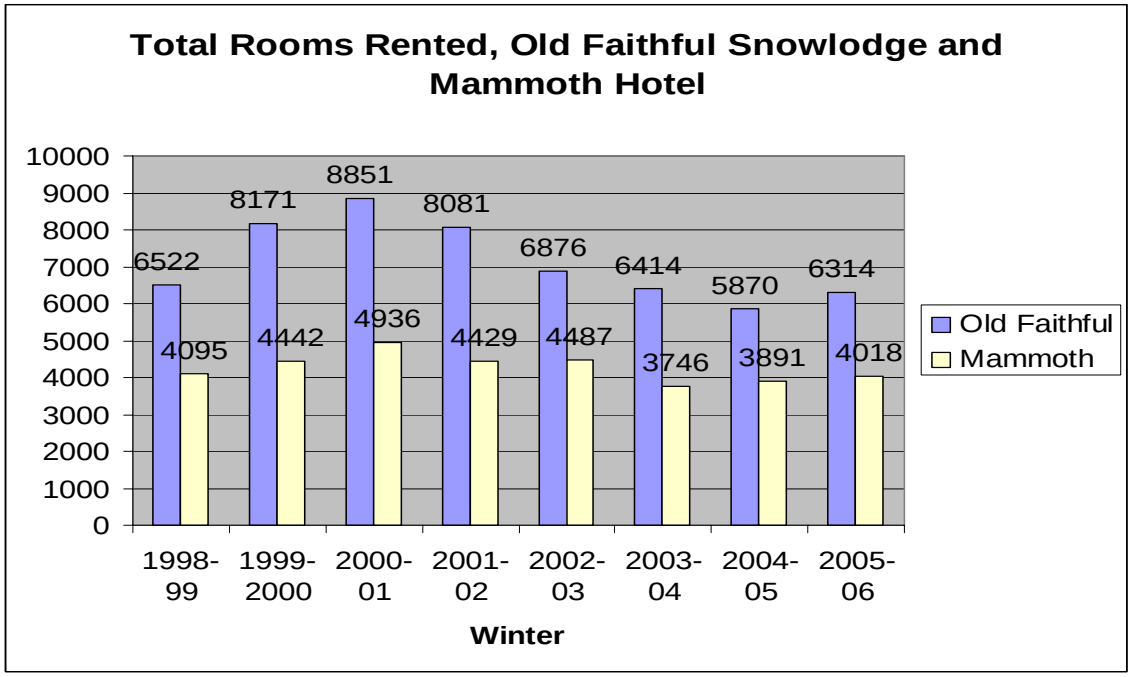
Staging areas, or points of access, for oversnow routes into the park are an important logistical component of the winter visitor experience. They typically include a parking area with appropriate signing and may have restrooms and other facilities. The staging areas for snowmobile and snowcoach trips into YNP are near Mammoth Hot Springs in the north, at Pahaska Teepee in the Shoshone National Forest near the East Entrance, at Flagg Ranch near the South Entrance, and in West Yellowstone near the West Entrance.

Warming huts in YNP are located at Mammoth, Canyon Village, Indian Creek, Fishing Bridge, Madison, and West Thumb. A new warming hut has been approved for Norris, but has not been constructed. The Canyon Village and Madison warming huts are in need of replacement. The Old Faithful warming hut was removed as part of the Old Faithful Visitor Education Center construction project and temporarily replaced with yurts, pending a decision on a long-term

warming hut. Warming huts at Mammoth, Madison, Fishing Bridge, and Canyon Village have small snack bars or vending machines. NPS interpreters or volunteers staff some of the huts and answer questions and provide information and various forms of assistance to visitors. Winter use fueling facilities are available at Old Faithful, Fishing Bridge, Mammoth, and Canyon Village.

Winter lodging facilities in YNP provide a total of 228 rooms with 448 beds. Winter lodging facilities are available at Mammoth Hot Springs Hotel and Old Faithful Snow Lodge. Figure 3-16 shows the total number of rooms rented per winter at the two hotels for the past eight years. As one would expect, business at the two hotels has generally paralleled the rises and falls in overall YNP visitation. In addition to the above lodging facilities, Yellowstone Expeditions operates six yurts plus a dining/community yurt and kitchen yurt near Canyon Village. The yurt camp logged 1,214 user days[11] during the winter of 2005-2006. In addition, the park issued 87 backcountry camping permits during the same time period.

Figure 3-16: Total Rooms Rented per Winter at Yellowstone Hotels, 1998-1999 through 2005-2006



Grand Teton National Park and the Parkway

The roadway system within GTNP and the Parkway consists of regional highways that pass through the parks and park roads that provide access to visitor destinations. In winter, some roads are plowed and maintained for motor vehicles, while others are closed to vehicles but may be used by non-motorized users, like cross-country skiers (See Figure 1-2 in *Purpose and Need*).

In addition to roads that are maintained for use by automobiles, routes that have historically been designated for snowmobile use included the Continental Divide Snowmobile Trail (CDST), the Grassy Lake Road, and numerous short segments that allow access to adjacent public and private lands and to inholdings within Grand Teton. The CDST is a long-distance snowmobile trail that traverses much of northwest Wyoming between Lander and Grand Teton

[11] The number of daily visitors summed over the entire season.

National Park, and since the mid-1990's a portion of the trail has been located alongside routes U.S. 26/287 and U.S. 89/191 in Grand Teton and the Parkway, providing access to the South Entrance of Yellowstone. The route also provided a connection to the Grassy Lake Road, which extends 7.6 miles between Flagg Ranch and the west boundary of the Parkway, connecting to an extensive network of snowmobile trails on the Caribou/Targhee National Forest. Snowmobiles are also allowed on the frozen surface of Jackson Lake to provide access for ice fishing.

Cross-country and backcountry skiing are popular activities at GTNP. In recent years, the NPS has groomed the unplowed Teton Park Road between the Taggart Lake Trailhead parking area and Signal Mountain Lodge for cross-country skiing. Grooming schedules have been variable, between one and three times per week. Skiers and snowshoers also enjoy trips into the park's backcountry, ranging from an easy 2-3 hour ski to Taggart Lake to multi-day ski mountaineering trips deep into the Teton Range.

Jackson Lake is located at the base of the Teton Mountain Range within Grand Teton National Park, and according to the Wyoming Department of Game and Fish (WDGF) is considered to be the most important lake trout fishery in the Snake River drainage of northwestern Wyoming. Stocking of Jackson Lake by WDGF has varied over time, with the majority of effort on improving the lake trout and Snake River cutthroat trout fisheries. Historically, the majority of winter anglers used snowplanes and snowmobiles to access Jackson Lake. More recently, anglers have used BAT snowmobiles for such access.

Flagg Ranch is the primary staging area for oversnow trips into YNP via the South Entrance, or for trips by snowmobile, ski, or snowshoe along the Grassy Lake Road. Flagg Ranch currently offers a convenience store, gasoline, and restrooms in winter. Snowmobile and snowcoach companies going into YNP's South Entrance stage their fleets at Flagg Ranch, utilizing portions of the main parking lot. No maintenance facilities are available except for a limited amount of garage space for the Flagg Ranch concessioner.

Few other visitor facilities are available during the winter within GTNP or the Parkway. The headquarters visitor center at Moose is open daily from 8 a.m. to 5 p.m., and the entrance stations at Moose and Moran are also staffed daily. Triangle–X Ranch provides a limited amount of overnight lodging. Dornan's, a privately owned inholding at Moose, provides dining, groceries, gasoline, and visitor information.

Modes of Transportation

Snowcoach Visitation

Snowcoaches have been used in YNP since the mid-1950s, well before snowmobiles first arrived on the scene in the early 1960s. Businesses in surrounding communities, especially West Yellowstone, have run touring enterprises based exclusively on providing snowcoach tours. Many of the first snowcoaches were manufactured by the Bombardier Company of Valcourt, Quebec, Canada. Bombardier ceased production of the vehicles in the 1980s (although the assembly line remains intact).

Since that time, Yellowstone-area businesses have used primarily 15-passenger vans that have been converted to run on snow-covered roads with track and ski assemblages. While such snowcoach conversions were initially prone to breakdowns, their operators have improved their reliability through stronger transmissions, better maintenance, and alternative track and/or ski combinations. Some van conversion snowcoaches are accessible to the handicapped. Most coaches now have double-paned or vented windows that resist fogging in the cold winter air.

Snowcoach operation and speed depend upon a variety of conditions, especially weather and snow conditions. Under most winter conditions, however, they can maintain speeds of 20 to 30 miles per hour.

In 2003, the NPS signed contracts with 14 businesses authorizing them to operate a specified number of snowcoaches for tours of YNP for 10 years. A total of 78 snowcoaches are currently authorized to operate in YNP, and the total visitor capacity of the snowcoach fleet is approximately 936.

Snowmobile Visitation and Commercial Guiding

Snowmobiles were first used in YNP in 1963. At that time, they were somewhat unreliable machines. However, manufacturers continually made improvements to them, and thousands of visitors entered YNP by snowmobile by the 1980s. Businesses in surrounding communities, especially West Yellowstone, have run touring enterprises based exclusively on providing snowmobile tours and rentals. Along with improvements to their reliability, manufacturers also made the machines more comfortable throughout this same era, equipping them with hand warmers and seat warmers. In the 2000s, manufacturers also debuted four-stroke machines, which substantially reduce emissions and somewhat reduced (and certainly changed the quality of) snowmobile sound.

Since the winter of 2003-2004, all snowmobilers have been required to use commercial guides in YNP, and all snowmobiles since the winter of 2004-2005 have had to be Best Available Technology (BAT) machines, which use newer technologies (primarily four-stroke engines) to reduce air and noise emissions (most snowmobiles the winter of 2003-2004 were also BAT machines). Guides are not required in GTNP, but BAT machines are required on Jackson Lake. Guided snowmobile service is available from a total of 22 different companies at the various park entrances.

Winter Visitation Data

Prior to the winter of 2002-2003, winter visitation to YNP was primarily by snowmobile, with 62% of all winter visitors touring the park in that manner (a daily average of 795 snowmobiles). Another 29% of visitors toured via automobile (or bus or RV) in the northern part of YNP, with 9% of park visitors taking a snowcoach into YNP (a daily average of about 15 coaches, which accommodated up to fifteen passengers). While cross-country skiers were not separately counted in entrance statistics (they are still not), about 20% of winter visitors (otherwise counted as visitors using either wheeled or oversnow transport) cross-country ski at some time during their stay in YNP (Littlejohn 1996).

However, beginning with the winter of 2002-2003 – prior to any change in winter access – a substantial drop in snowmobile visitation began. For the last five winters (2003-2004 through 2007-2008), snowmobile numbers have averaged between 240 and 300 per day (a 72% decline between 2001-2002 and 2004-2005). Several factors likely account for this change. The ongoing litigation during the winter of 2003-2004 brought a great deal of confusion about whether the parks were even open and what modes of transportation were allowed in them. The winters of 2002-2003 and 2004-2005 brought warmer and drier than normal conditions, making it impossible to open YNP roads according to schedule and necessitating the closure of some before the official end of the winter season. Some private snowmobile owners have been reluctant to rent best available technology machines and have chosen not to visit the parks. Finally, the requirement to use commercial guides discouraged some visitors from touring the parks.

More recently, snowmobile visitation has begun to increase, and snowcoach visitation has been increasing even more, suggesting that some who would otherwise snowmobile may be taking snowcoach tours instead. Snowmobile visitation has increased 31% over the winter of 2004-2005. These increases have been due partly to good snowmobiling conditions in those winters as compared to the winter of 2004-2005. During the same time period (2001-2002 to 2007-2008), the number of visitors touring YNP by snowcoach rose 72.0%, increasing from 25 to 35 coaches per day (with ridership averaging about 8 passengers per coach). For the winter of 2007-2008, 42 percent of OSV passengers in YNP traveled by snowcoach, with about 58 percent traveling by snowmobile (these figures exclude those traveling by wheeled vehicle).

Throughout this time period, visitation by automobile (and bus and RV) has remained stable, with a general upward trend (the 10-year average is over 40,000 visitors) of people enjoying YNP's northern area by wheeled vehicles.

Although oversnow visitation to YNP is still below that of the 2001-2002 winter and previous winters, it has risen 30% over the winter of 2004-2005 (the winter with the lightest use in recent years). Not only did better snow conditions encourage this increase, but efforts by the NPS and regional businesses and governments to advise people that the parks remain open assisted as well.

Figure 3-17 shows the three most common forms of winter visitation (automobile, snowcoach, and snowmobile) over the last ten winters. The drop in snowmobile visitation and concurrent increase in snowcoach visitation are evident, as is the consistency of automobile visitation to the Northern Range area of YNP. However, Figure 3-18 suggests that some variability in winter visitation is typical when visitation trends are viewed in a 20-year time frame. Figure 3-19 illustrates the daily patterns of snowmobile use in 2007-2008. In 2007-2008, 29 of 82 days exceeded 318 snowmobiles (and another 10 days were between 300 and 318 snowmobiles).

Figure 3-17: Yellowstone Winter Visitation by Mode of Travel, 1998-1999 through 2007-2008 (December to March each winter)

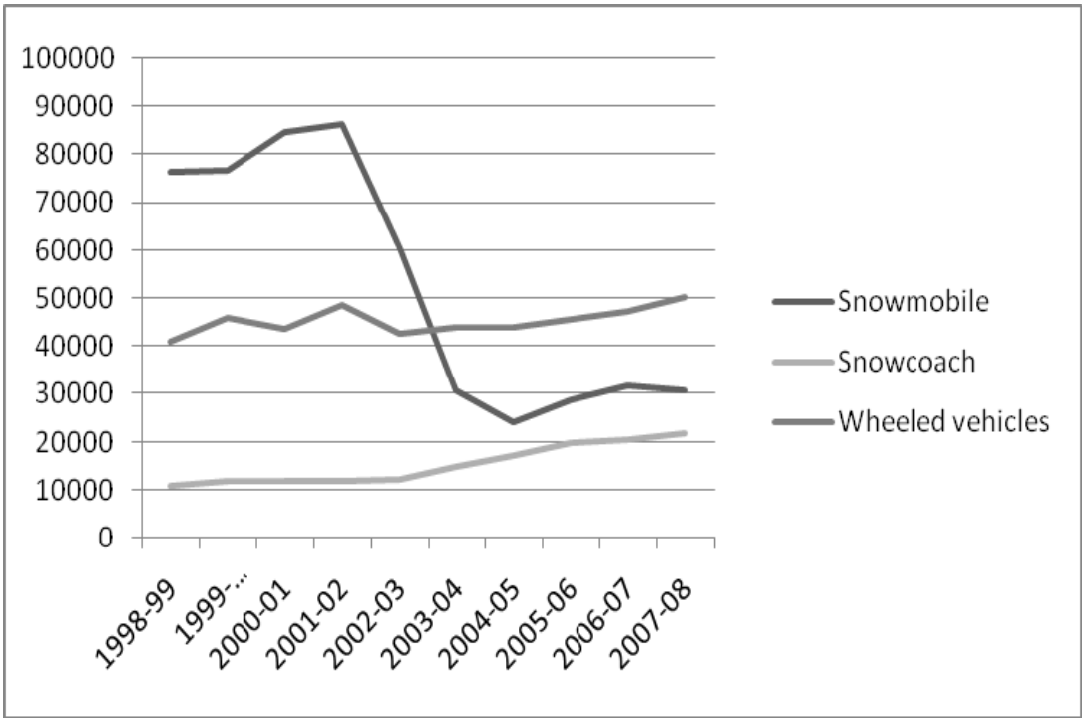


Figure 3-18: Total Yellowstone Winter Recreation Visitation, 1989-1990 through 2007-2008.

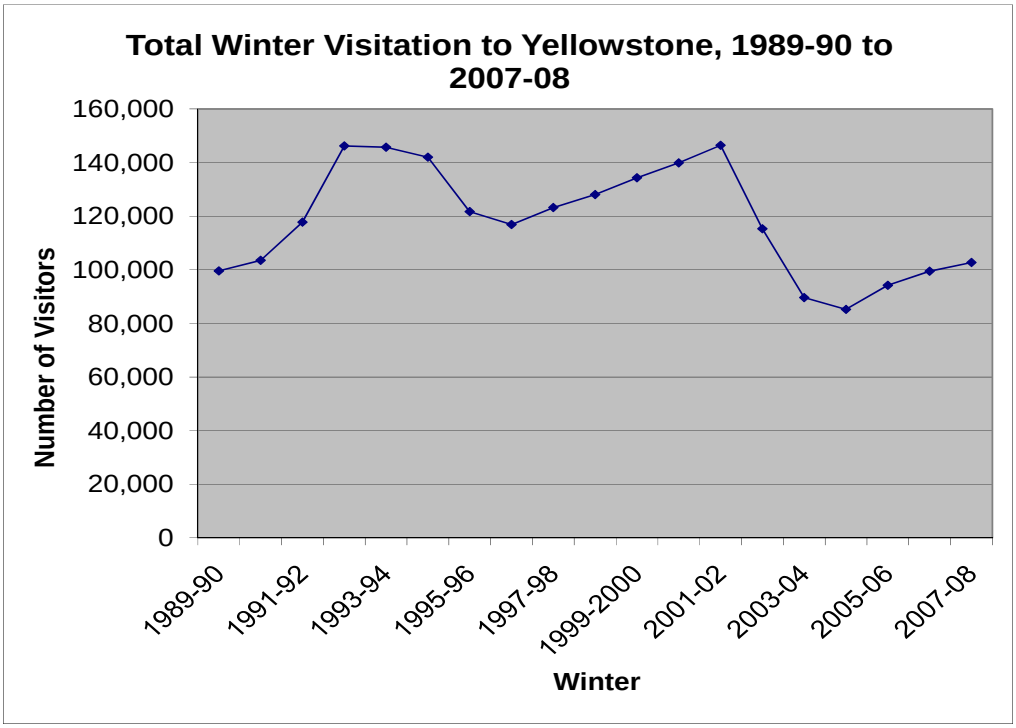


Figure 3-19: Daily Yellowstone Snowmobile Use, 2007 – 2008 Winter Season.

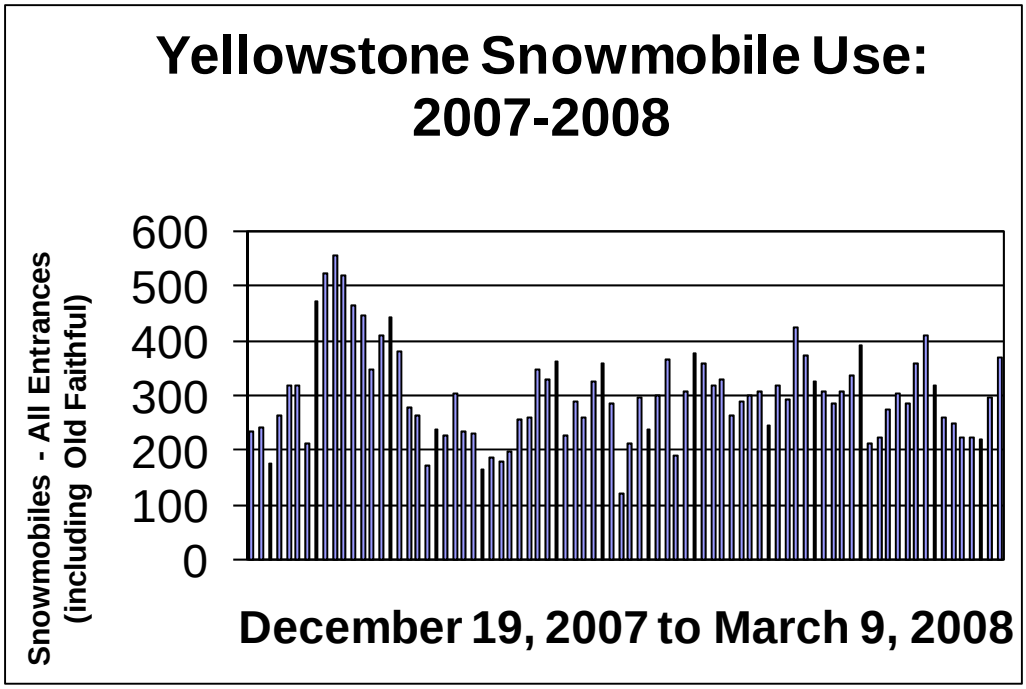


Table 3-23: Mode of Winter Arrivals in Yellowstone National Park, 1997-1998 through 2007-2008

Winter Season	Number of Visitors Entering the Park						Total Visitors[b]
	Auto	RV	Bus	Snow-mobile	Snowcoach	Skiers[a]	
1998-1999	36,450	90	173	76,271	10,779	446	124,209
1999-2000	37,872	140	747	76,571	11,699	351	127,380
2000-2001	43,036	138	3,071	84,473	11,683	389	142,790
2001-2002	47,750	215	417	87,206	11,832	307	147,727
2002-2003	41,666	278	796	60,406	12,154	322	115,622
2003-2004	42,643	181	1,141	30,437	14,823	438	89,663
2004-2005	42,639	138	1,153	24,049	17,218	468	85,665
2005-2006	44,136	92	1,288	28,833	19,856	271	94,476
2006-2007	45,519	144	1,658	31,805	20,350	289	99,675
2007-2008	48,404	104	1,667	31,420	22,344	261	99,975
Average Last 10 winters	43,012	152	1,211	53,147	15,274	354	112,718
% of Total Visitors	38%	0.1%	1%	47%	13.6%	0.3%	100%
Average Last 5 Winters	44,668	132	1,381	29,309	18,918	345	93,891
% of Total Last 5 Winters	47.6%	0.1%	1.5%	31.2%	20.1%	0.4%	100%

[a] This only includes visitors who ski through a park entrance; it does not reflect the total number of people who ski while visiting Yellowstone. Visitor surveys indicate about 20% of visitors ski in the park (Littlejohn 1996).

[b] These figures may double-count visitors entering the north entrance, because those visitors enter the park by automobile but also may take a snowmobile or snowcoach tour further into Yellowstone. For the same reason, percentages may not add to 100%.

Examining visitation by entrance, the North Entrance is the busiest in the winter because it is open for automobile travel. About half of YNP's visitors enter there. The West Entrance is the next busiest, with about 33% of YNP's winter visitors. The South Entrance accounts for 16% of park visitation, with the East Entrance admitting 0.5%. The Northeast Entrance is not staffed in the winter, since Cooke Pass is not currently plowed (and all traffic at the Northeast Entrance has already passed through the North Entrance). Table 3-24 provides average use levels for the last 5 winters in Yellowstone.

Nine out of ten visitors entering YNP through its North Entrance do so via wheeled vehicle. The primary attractions for them are Mammoth Hot Springs, the diversity and abundance of wildlife between Gardiner and the Northeast Entrance, access to Cooke City, and cross-country skiing

and snowshoeing across the northern portion of YNP. Some are also destined for the Cooke City area to snowmobile on national forest lands.

Table 3-24: Average use last 5 winters in Yellowstone.

Winter	Average Snowmobile Numbers	Average Snowcoach Numbers	Notes
2003-2004	259	24	Last winter of unguided; does not include Old Faithful entries
2004-2005	239	25	First winter of temporary plan; does not include Old Faithful entries
2005-2006	256	30	Does not include Old Faithful entries
2006-2007	299	34	Includes Old Faithful entries
2007-2008	294	35	Includes Old Faithful entries
Average of these 5 winters	269	30	Old Faithful entries averaged 11 per day in 2007-2008

Visitation to Grand Teton and the Parkway takes several different forms, as shown in Table 3-25. Most winter visitation in GTNP and the Parkway has and continues to be via wheeled vehicles. As the table demonstrates, visitation has remained relatively constant, although visitation to the CDST has dropped substantially in the past few winters. The use of snowplanes was prohibited in 2002. Also evident is the popularity of cross-country skiing in GTNP and the Parkway.

The column labeled "Parkway Snowmobile" includes snowmobiles departing Flagg Ranch for the South Entrance of YNP, as well as those using the Grassy Lake Road, although the vast majority of use shown in that column consists of snowmobiles bound for YNP. During the winter seasons of 2004-2005 and 2005-2006, use of the Grassy Lake Road amounted to 241 and 143 snowmobiles respectively (combined east and westbound for the entire season), although use in previous years was somewhat higher with an estimated average of 25 or less per day. The next column indicates snowmobile use on the CDST; most or all of these visitors traveled through both GTNP and the Parkway. The column labeled "GTNP Snowmobile" includes snowmobile use in GTNP, excluding use of the CDST. Prior to the winter season of 2002-2003, this included use of the Teton Park Road and the Potholes area, but it currently only includes use of Jackson Lake since the Teton Park Road and Potholes are no longer open for snowmobile use. The last column in the table indicates total recreation visits to the park, such as visitors who are only sightseeing or otherwise not participating in skiing or snowmobiling.

Table 3-25: Winter Use by Activity in Grand Teton and the Parkway, 1997-1998 through 2007-2008

Winter Season	Parkway Snow-mobile	CDST Snow-mobile	GTNP Snow-mobile	GTNP Snow-plane	Parkway Skiing	GTNP Skiing	Total Recreational Visitors (including visitors in wheeled vehicles)
1998–1999	17,160	1,639	3,436	851	1,149	4,242	180,367
1999–2000	23,400	1,329	4,800	1,091	1,581	5,687	223,944
2000–2001	31,011	1,307	2,618	1,148	1,987	4,774	211,700
2001–2002	26,401	2,006[d]	3,421	1,299	1,842	7,346	217,999
2002–2003	23,062	1,752[d]	2,305	0[a]	2,099	7,007	227,964
2003–2004	9,217	139	1,939	0	1,389	8,000[b]	186,871
2004-2005	7,351	11	149	0	1,775	6,751	174,840
2005-2006	10,161	17	268	0	1,456	9,843	174,250
2006-2007	11,710	14	287	0	997	11,197	192,379
2007-2008	12,444	11	309	0	1,315	13,005	187,813
Average	17,192	n/a[c]	n/a	n/a	1,559	6,615	197,813

Source: Data obtained from NPS visitation records.

[a] Snowplanes were prohibited from GTNP beginning with this winter season.

[b] Exact count is unavailable; this figure represents a best estimate.

[c] No average given for CDST because use has been highly variable.

[d] Estimate based upon previous average percentage of Parkway users.

Visitor Experience

2007-2008 Visitor Survey

The most recent visitor survey was conducted in winter 2007-2008 in Yellowstone at the Old Faithful area by the University of Montana and included separate surveys and interviews to provide managers with a better understanding of the roles of natural soundscapes and bison interactions in the experiences of oversnow winter visitors and the effectiveness of guiding (Freimund et al. 2008). Two separate surveys of visitors occurred (along with interviews) in the Old Faithful area, with one survey focused on soundscape-related topics and the other on bison questions. This profile information is a summary from both surveys.

Although 26% of visitors were from the three states of Montana, Idaho, and Wyoming, 45% were from a variety of states all across the United States (in descending order, Georgia, Colorado, Texas, Florida, Virginia, New York, Ohio, Washington, Pennsylvania, California and South Carolina). International visitors were 5% of those surveyed. Seventy three percent had a college degree and 43% had some graduate education or advanced degree. The average age of visitors was about 50 (47 in one survey; 51 in the other). Although 35% grew up on a farm, in a rural setting or small town (fewer than 5,000 people) and 65% of those surveyed grew up in

small or medium cities or major metropolitan areas, only 26% of those surveyed now live in rural or small town settings. Seventy-four percent live in small or medium cities or major metropolitan areas. Their activities (which were not exclusive) were: snowcoach touring (57%), snowmobiling (41%), cross country skiing (26%), and snowshoeing (25%).

Soundscapes Results

The soundscapes survey and in-depth interviews suggest that winter visitors to Old Faithful agree that Yellowstone is a place for natural quiet, to hear natural sounds and a quiet place. There was less agreement that Yellowstone is a place free of motorized noise. The opportunity to experience natural sounds was perceived to be important to both the value of Yellowstone and the visitors' experience (by 89% of visitors). There were some differences in the degree to which respondents supported the idea that Yellowstone is a place for natural quiet, to hear natural sounds. Visitors who participated in snowmobiling or snowcoach touring were somewhat less likely to agree that the Yellowstone is a "place free of motorized noise" (33% and 55%, respectively) as compared to skiers and snowshoers (both about 66%).

Eighty-one percent of the respondents indicated that the natural sounds had a positive effect on their experience and 83% were somewhat or very satisfied with their experience of natural sounds. Seventy-one percent of the visitors suggested they found the level of natural sound they desired for half or more of the time they desired it. Eighty-seven percent of the respondents were "very satisfied" with their overall experience and the remaining thirteen percent were "satisfied."

Respondents were asked about their support for a variety of management actions "to protect opportunities to experience natural sounds." Requiring best available technology, continuing to require guides, limiting the total number of snow machines in the park per day and limiting group sizes to 11 per guide were strongly supported by a minimum of sixty-eight percent of the respondents. Closing the roads to all over snow vehicles or to snowmobiles only was opposed or strongly opposed by 77% and 59%, respectively, of the respondents. Plowing the roads for automobile access was strongly opposed by seventy-one percent of the respondents and opposed by another nine percent.

In-depth interviews illustrate that the natural soundscape assists in providing a deep connection to nature that is restorative and even spiritual for some visitors. Natural sounds influenced respondent's motivation to visit Yellowstone and were an unexpected yet significant part of the experience for over a third of the interviewees. All interviewees indicated that the natural sounds are part of what makes the park special. Interviewees mostly accept mechanical sounds in the park, especially near developed areas, and they generally wanted some time in their experience to be quiet and natural (Freimund et al. 2008).

Bison Results

The bison survey results suggest that the opportunity to view bison remains an important part of the winter experience for visitors to Yellowstone National Park (71% of visitors described it as very to extremely important). Also, visitors overwhelmingly (87%) find this aspect of their Yellowstone winter experience very satisfying.

By the time visitors arrive at Old Faithful, most have seen bison on 6-8 different occasions. During these viewing opportunities, 99% of the visitors have at least one encounter in which bison appeared not to react to humans in a significant way. Conversely, 21% of visitors have witnessed an encounter where the bison were hurried, took flight, or acted defensively (the three most intense bison responses examined in the survey). And overall, visitors

overwhelmingly (>72%) appraised both the bison human interactions they witnessed and the park setting as a whole as "very" appropriate/acceptable.

There does appear to be a relationship between the nature of the interaction and visitor appraisals of those interactions. When asked to appraise the human bison interaction they witnessed where the bison showed the most significant response, those seeing the most intense responses from bison (hurried, took flight, or were defensive) are more likely than expected to describe the bison in the specific incident as agitated (37% compared to 2% for the group of visitors for which "no response" from bison was observed). They also are more likely to describe bison in the park overall as stressed (32% compared to 4% for the group of visitors for which "no response" from was bison observed). They are more likely to describe the bison overall as somewhat to very dangerous (56% versus 33%). Further, there is a relationship between the intensity of bison response to humans witnessed in a particular interaction and normative judgments about acceptability/appropriateness of those specific interactions: as a group, those who witness the most intense bison response are less likely to find them "very" acceptable/appropriate and more likely to say "somewhat" inappropriate. Even so, the majority (72-78%) of the 21% of visitors who witnessed the most intense bison responses described the incidents as "somewhat" to "very" acceptable/appropriate.

Primary activity (skiing/snowshoeing versus snowmobiling versus snowcoach touring) does not appear to have a strong or consistent influence on appraisals of specific human bison interactions. However, it does exert more of an influence on overall appraisals of bison in Yellowstone as a whole. The two most notable differences had to do with the appraisals "stressed/peaceful" and "dangerous/safe". Snowmobilers were more likely to say the bison were "very" peaceful (67%) than were skiers/snowshoers (26%) while skiers/snowshoers were more likely to say bison were "somewhat" stressed (26% compared to 6% of snowmobilers). On the dangerous/safe dimension, 60% of skiers/snowshoers rated bison as either "very" or "somewhat" dangerous compared to 53% of the snowmobilers saying bison were "very" or "somewhat" safe.

Finally, differences in appraisals resulting from type of community in which visitors currently reside and "wildlife values" specifically for bison as measured in the survey were explored, but these factors were not found to be significant influences (Freimund et al. 2008).

Guiding Results

The guide portion of the survey was conducted through interviews with guides in the Old Faithful developed area. Because of the type of survey, generalizations cannot be made from the results, but some themes are evident. The idea of the guide as a mentor, one who is focused on transmitting and interpreting information, is reflected in many of the comments of the guides interviewed during the course of this research. The guides themselves were interested in learning about the park and enhancing visitors' experiences by attaching meaning to what they were seeing through interpretation and education. In this way, the guide's role as an interpreter is then one of communicating information in such a way as to produce a visitor who is mindful of the destination, willing to learn and broaden their perspective by understanding Yellowstone and its unique landscape. As a wilderness "servicescape," Yellowstone has service providers such as snowmobile and snowcoach guides who are charged with the responsibility of ensuring that visitors' impacts on the environment are minimized first, even at the expense of visitors' needs and wants. As such, guides are communicating the wilderness values held within Yellowstone to their clients, exerting influence on how their clients interpret their own experiences. Therefore, the guides, some consciously, are conveying ideas of preservation of

the park to their clients. The result of this could be a reshaping of visitor attitudes towards environmental protection and encouraging environmentally responsible behavior. The discussion of changes in client attitudes is particularly salient here as many snowmobile and even a few snowcoach guides noted that a good portion of visitors who started out the day thinking they did not need a guide were, at the end of the day, appreciative of what they learned about the park. Also of relevance is the possibility that the people attracted to having a winter-visitor experience in Yellowstone are those who share the same environmental values as are portrayed through park policies. These issues are, however, speculative and would require further research in order to determine if the anecdotal information by the guides does in fact coincide with what the visitor is experiencing (Freimund et al. 2008).

Previous Survey Results

A variety of other winter surveys have been conducted since the late mid-1990s. In January to March 2005 and 2006, the University of Montana surveyed 266 snowcoach passengers on YNP tours originating in West Yellowstone, Montana. The most commonly listed reasons for visiting YNP in winter included viewing wildlife during that season, seeing the "winter wonderland image," and seeing geothermal activity in winter. Being surveyed at the end of their tour, passengers strongly agreed that their tour provided them with an appreciation of nature, an educational experience, a sense of wonderment, and relaxation. They strongly disagreed that their snowcoach experiences were either uncomfortable or a disappointment (Nickerson et al. 2006).

In addition to the 2006 survey, a number of reports looked at visitors from the mid-1990s through 2003, and found that in terms of demographics, winter visitors to YNP came primarily from western states. Specifically, about a third came from four local states (Montana, 20%; Wyoming, 6%; Idaho, 6%; and Utah, 6%), while another 10% came from the Upper Midwest (Minnesota, Wisconsin, and Michigan). As expected, the country's more populous states were also home to many visitors, even though those states are more distant from YNP (California, 5%; Florida, 5%; New York, 3%; Texas, 4%; and Washington, 4%). The 2006 snowcoach and 2008 surveys found very similar results. GTNP receives more local visitation, with almost half of those surveyed coming from Wyoming.

These studies also found that winter visitors are relatively more educated (88% had some college or a degree) and wealthy (71% earned more than $60,000 per year in 2003 dollars) than the general population. Snowcoach passengers in the 2006 survey were primarily professionals, health care workers, or retired, with 42% of them earning over $100,000 annually. The majority of visitors were employed and married, and the average age of visitors was in the mid-40s. While 70% of snowmobile riders were male, the gender ratio of non-snowmobilers was about even. More than half of all visitors were touring with family groups (57%), with most of the remainder touring with friends (45%--some traveled with both friends and family, which is why the percentages add to greater than 100%). Almost a third purchased packaged tours. The snowcoach survey found the average group size to be 4.4.

For most visitors, a winter visit to the parks is a multi-day, multi-destination, and often multi-activity experience. In YNP, 55% of the sample indicated that the primary activity on their trip was riding a snowmobile without a guide (by contrast, all snowmobile and snowcoach riders now must take guided tours). Downhill skiing outside the parks was the next most popular primary activity (17% of the sample). In GTNP, 62% of those sampled chose cross-country skiing as their primary activity, and downhill skiing was again the second most popular primary activity (14% of the sample). In the YNP sample, 15% were on day trips compared to 40% in the

GTNP sample. Visitors on multi-day trips – which averaged five days – to both parks spent more time outside the parks than inside the parks during their trips (the average was 1.5 days in the parks). About 70% of YNP visitors stopped at Old Faithful while in Yellowstone. Again, the 2006 snowcoach passenger survey reported very similar findings about the typical visitor vacation to the Yellowstone area.

Visitors also answered a question on where they stayed and how many nights they stayed there. Almost half of the respondents spend time in West Yellowstone (usually over three nights), 20% stayed in Jackson (an average of over four nights), 11% in Big Sky (almost six nights), 13% in Gardiner (about two nights), and 12% at either Old Faithful Snow Lodge or Mammoth Hot Springs Hotel, the two open hotels inside YNP (about two nights at either).

Finally, the 2003 survey participants were asked to name one thing they would change about their trip. In YNP, 41% said they would not change anything about their trip, 20% of non-snowmobile riders said they would have liked fewer snowmobiles in the park, and 14% of snowmobilers wanted smoother snow on the roads. At Taggart Lake, 60% of the sample would not change anything about their trip.

A programmed creel survey was conducted by the Wyoming Department of Game and Fish on Jackson Lake during the 2005 winter season. According to the survey, between January and April, an estimated 1,549 anglers spent 8,036 hours on the ice. The total angler estimate was down 73% from the 1996 estimate of 5,816 anglers. Lake trout dominated the creel and were caught at a rate of 0.32 per hr, below the WDGF management objective of 0.5 lake trout per hour. The estimated catch rate for all trout was 0.34 per hour, half of the 1996 estimate of 0.68 fish per hour. Snake River cutthroat trout and brown trout *Salmo trutta* were incidental to the creel. Hatchery-reared lake trout comprised 11% of the total creel.

Winter Operations

The NPS, park concessioners, contractors, researchers, and other duly permitted parties depend on snowmobiles and snowcoaches for their administrative functions. These uses of the parks are not within the purpose and need, but are within the scope of analysis in this EA because as shown in the analysis for some impact topics, such as soundscapes, winter operations have an effect. Likewise, these uses are not part of the decision to be made relative to this plan. The affected environment for winter operations in the parks is discussed below.

Regulatory and Policy Overview

Administrative use of oversnow vehicles (OSVs), as described above, is addressed by the following policy and guidance (see also Appendix A):

- EO 11644 (Use of Off-Road Vehicles on the Public Lands, section 2(3)(B) and (C))
- Management Policies 2006, section 8.2.3
- February 17, 2004, memorandum from Assistant Secretary, Fish and Wildlife and Parks, to Director, National Park Service
- 36 CFR 1.2 (d)

EO 11644 and the relevant policies shown are presented in full in Appendix A. Also in Appendix A, the 2004 memorandum is duplicated. In essence, because administrative use of oversnow vehicles can adversely impact park resources and values, it is to be limited to the level necessary for management of public use, to conduct emergency operations, construction, and

resource protection activities that cannot be accomplished by other means. Also, it is intended that NPS leads by example through the use of BAT snowmobiles and snowcoaches.

NPS and Concessions Employees

Approximately 75 permanent and seasonal NPS employees plus their family members currently over-winter in the interior of Yellowstone National Park (this is a decrease of about 20 employees since 2001). Additionally, Xanterra Parks & Resorts stations approximately 150 employees in the interior during the winter season, almost exclusively at Old Faithful. These NPS and Xanterra employees not only provide critical law enforcement, interpretive, and guest services to winter visitors, but they also maintain and protect Yellowstone's natural and cultural resources. For example, some employees clear accumulating snow from the park's historic buildings, including National Historic Landmarks such as the Old Faithful Inn and the Fishing Bridge, Madison, and Norris museums.

Some of the employees living in Yellowstone's interior occupy a unique environment, for they have no wheeled vehicle access to their homes. Their only access to groceries, supplies, and medical care is by oversnow vehicles (OSVs). Almost nowhere else in the United States, outside Alaska, are whole communities of people living and working in an oversnow environment such as the interior of Yellowstone National Park (YNP). Grand Teton National Park (GTNP) has no such snow-bound employees, although some inholdings are only accessible by OSV.

Other NPS and concessions employees, as well as permitted researchers and authorized contractors, conduct similar work and personal activities by OSV. Park guides and outfitters are also authorized to use non-BAT snowmobiles and snowcoaches in the park for administrative access to repair or tow disabled vehicles. Northwestern Energy and Qwest employees use non-BAT machines to access utility systems off the groomed roads.

While most permanent interior NPS employees own personal snowmobiles, most interior-based concessions employees do not. As of about 4 winters ago, there were approximately 89 NPS employee-owned and 10 concession employee-owned snowmobiles in Yellowstone. At that time, most were non-BAT. Since then, the NPS increased its administrative fleet and allowed employees to use government BAT snowmobiles to accomplish personal errands (groceries, medical appointments, etc). This has reduced use of non-BAT employee owned snowmobiles (though many still own their non-BAT snowmobiles). For those considering the purchase of a snowmobile, the NPS is encouraging them to purchase BAT snowmobiles in anticipation of such a requirement beginning in the 2011-2012 season.

Guests of any employees are encouraged to utilize best available technology (BAT) OSVs when authorized to enter the park. Permitted researchers are required to utilize BAT vehicles as a condition of their permit. Any newly issued contracts that require a contractor to travel via OSV to conduct their work in the parks (for example, a construction project) include a BAT requirement. Older contracts may not include this requirement.

The majority of the NPS administrative OSV fleet in YNP and GTNP is now BAT. For the 2005-2006 season, YNP had 131 snowmobiles in its administrative fleet, of which 87% met BAT requirements. All non-BAT vehicles (13 turbo four-stoke, and six two-stroke snowmobiles) are needed for specialized use, such as law enforcement (boundary patrol, search and rescue) and other administrative purposes on a limited basis where the heavier weight and lower horsepower of current BAT machines do not perform adequately.

In addition to administrative snowmobiles YNP operates 32 other oversnow vehicles. These include ten groomers, two snowcoaches, and assorted pickups, vans and utility vehicles, ambulances, and fire engines.

Thus on a typical winter day, between 50 and 75 non-BAT administrative snowmobiles may be operating in the park in addition to visitor recreational BAT snowmobiles. As described in the soundscapes reports (Burson 2008a), using attended logging, administrative vehicles of all types comprise 21-26% of all audibility.

The NPS transports goods and materials to support winter operations via some of these OSVs. Although all fuel and larger goods are transported to interior locations by wheeled vehicle before the start of the winter season, during the course of the winter, additional supplies are conveyed via OSV to support park personnel accomplishing their work in the winter. Other OSV uses include resource monitoring, personal use, and concession support.

Visitor Fuel Consumption by Mode of Transportation

Fuel usage and cost is an issue for the NPS, guides and outfitters, as well as visitors. Consequently, an analysis of the fuel that would be consumed under different winter modes of transportation was completed. This analysis assumed that 100 visitors would enter the park via the West or South entrances and that all visitors took the same 70-mile roundtrip tour, that both their choice of transportation modes and ridership per vehicle replicated current conditions, and the ratio of which entrance such visitors chose would be the same as the average for the last four years, which is 2/3 to the West Entrance and 1/3 to the South Entrance.

Seventy miles is the average distance of the most common tour taken from those two entrances, the round-trip tour to Old Faithful. At the West Entrance, an average of 61% of visitors have chosen to tour Yellowstone by snowmobile the last four years, with the other 39% choosing snowcoaches. At the South Entrance, the respective percentages are 73% and 27%. For wheeled vehicle access in the winter (an alternative considered but rejected in this EA), all visitors entering the West Entrance were assumed to travel by bus (assuming the road from there to Old Faithful were plowed). For vehicle ridership, an average of 1.3 persons have ridden each snowmobile and 8.0 each snowcoach for the past four years, and an average of 20 people were assumed to ride each bus.

Average oversnow vehicle fuel efficiencies were computed using the data obtained by Bishop et al. 2006 and Bishop et al. 2007. Average snowmobile fuel efficiency was found to be 25.1 mpg, a simple average of the three snowmobiles tested by Bishop et al. in those two reports. The snowcoach average used was 3.43 mpg, an average of the nine gasoline-fueled and two diesel-fueled coaches tested by Bishop et al. over the two years. The average wheeled bus fuel efficiency used for this analysis was 9 mpg, an average of the 6 mpg that Xanterra full-size buses get, the 9 mpg that NPS's new yellow buses get, and the 12 mpg that Xanterra's 15-passenger vans get (assuming that the commercial wheeled vehicles would be split evenly between these three different kinds of vehicles).

Using these assumptions, 100 visitors taking a 70-mile tour of Yellowstone would use 229 gallons of fuel under the provisions of Alternative 2. Visitors touring by snowcoach-only (an alternative considered but rejected in this EA), would consume the most fuel, 255 gallons. Visitors touring by a mix of wheeled vehicles (again, a concept considered but rejected in this analysis) on the park's west side, and a mix of snowcoaches and snowmobiles on the east and south sides, would consume less than half as much fuel as those touring via any other alternative, 100 gallons, reflecting the efficiency of mass transportation vehicles.

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CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Methodology

This chapter analyzes the potential environmental consequences, or impacts, that would occur as a result of implementing the proposed project. Direct, indirect, and cumulative effects, as well as impairment are analyzed for each resource topic carried forward. Potential impacts are described in terms of type, context, duration, and intensity. General definitions are defined as follows, while more specific impact thresholds are given for each resource at the beginning of each resource section.

- **Type** describes the classification of the impact as either beneficial or adverse, direct or indirect:
  - *Beneficial*: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
  - *Adverse*: A change that moves the resource away from a desired condition or detracts from its appearance or condition.
  - *Direct*: An effect that is caused by an action and occurs in the same time and place.
  - *Indirect*: An effect that is caused by an action but is later in time or farther removed in distance, but is still reasonably foreseeable.
- **Context** describes the area or location in which the impact will occur. Are the effects site-specific, local, regional, or even broader?
- **Duration** describes the length of time an effect will occur, either short-term or long-term:
  - *Short-term* impacts range from days to three years in duration.
  - *Long-term* impacts extend up to 20 years or longer.
- **Intensity** describes the degree, level, or strength of an impact. For this analysis, intensity has been categorized into negligible, minor, moderate, and major. Because definitions of intensity vary by resource topic, intensity definitions are provided separately for each impact topic analyzed in this environmental assessment.

Cumulative Impact Scenario

The Council on Environmental Quality (CEQ) regulations, which implement the National Environmental Policy Act of 1969 (42 USC 4321 et seq.), require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts are considered for both the no-action and preferred alternatives.

Cumulative impacts were determined by combining the impacts of the preferred alternative with other past, present, and reasonably foreseeable future actions. In addition to previous winter use analysis and NEPA processes, implementation of either of the alternatives in this EA may influence or be influenced by other planning efforts. No known or potential conflicts between

the proposed action and other plans, policies or controls have been identified. Following are relevant, recent, and ongoing planning efforts.

Broad trends occurring outside the parks which could have cumulative impacts on this analysis include:

- Population growth in the Greater Yellowstone area (GYA). This area has been experiencing rapid population growth for the last twenty years. Such growth can lead to more demand for recreation (especially snowmobiling, cross-country skiing, and snowshoeing), more recreationists in wildlife habitat, and more resulting impacts upon air quality, soundscapes, economics, and wildlife.
- Suburban & rural land subdivision in the Greater Yellowstone area. The area's population growth is accompanied by rapid suburban and exurban subdivision and human structure development (houses, roads, etc.). While this is related to population growth, rural land subdivision can lead to fragmentation of wildlife habitat and changing recreation geography.
- Changing demographics. Americans, and particularly westerners, have expressed an increasing interest in recreation in the last twenty years (all kinds of recreation, but especially bird watching, hiking, and walking (Cordell 2004)). Such changing demographics can affect the demand for different kinds of recreational activities, at times bringing them into conflict with each other.
- Reduction of public land access. Some trailheads or public land access points are privately owned and can become off-limits to the public when sold. While impossible to predict, such occurrences make access to public lands more difficult and can affect demand for recreation in other areas and visitor access and circulation.
- Improving snowmobile technologies. Snowmobile manufacturers have consistently improved the performance of their machines, enabling some of them to reach ever more remote terrain. Usually off-trail, such kind of travel is prohibited in Yellowstone, but can bring snowmobilers elsewhere into conflict with wildlife and non-motorized users.
- Increasing outfitter/guide activity. Visitors are increasingly utilizing outfitters and guides, especially for skilled or knowledge-based activities like kayaking, wildlife viewing, and photography. This trend can affect wildlife habitat, demand for recreation, economic activity, and other aspects of winter recreation.
- Consolidation of checkerboard lands on the Gallatin National Forest. In the last ten years, the Gallatin National Forest has negotiated several land exchanges which have consolidated some previously checkerboarded holdings. While this has generally positive effects for most wildlife (because consolidated lands are less subject to development), it has the negative side effect of private land consolidation (especially in the Big Sky area), which has allowed more land subdivision and rural growth to occur there, with consequent effects on wildlife, air quality, socioeconomics, and visitor access and circulation.
- Forest plan amendments for grizzly bear conservation. The U.S. Forest Service has modified all forest plans in grizzly bear habitat areas to assure conservation of the species after it was removed from the threatened and endangered species list of the Endangered Species Act ("delisted"). Generally, such changes will keep ORV access at or below current levels, making it more difficult for the agency to respond to increasing demand for recreation by building new sites or opening new areas, but assuring grizzly bear preservation.

- Northern Rockies lynx amendment to all USFS Forest Plans. These amendments are intended to conserve this species, listed as threatened on the endangered species list. As with the grizzly bear amendments, these changes would keep recreation at or near current levels in occupied lynx habitats to ensure species survival.
- Noxious weed growth. Noxious weeds are a problem throughout the Greater Yellowstone area, although most counties, states, and federal agencies have programs to keep them in check, with varying levels of success. Noxious weeds can impact forage available to big game.
- Whitebark pine reduction. In many years whitebark pine nuts are the most important food source for grizzly bears, but the tree is increasingly vulnerable to death by insect attack and white pine blister rust. Reduction of this species could harm the grizzly bear's long-term survival.
- Timber harvest on national forest lands. Timber harvest on such lands is an ongoing activity in places, although more and more of it entails fuels reduction efforts with only small-diameter timber being taken. Harvesting can affect wildlife species in various ways (depending on their habitat preferences), along with possible economic effects.
- Grazing and mining on federal lands. Grazing will continue to be similar in extent to current levels on USFS and BLM lands. Mining is more difficult to predict, but will have to undergo NEPA review. Both actions can affect wildlife species and economics.
- Forest and range fires. Both kinds of fires occur regularly on federal lands in the Greater Yellowstone area and can affect wildlife (to differing degrees, depending on wildlife habitat preferences) and air quality.
- Hunting. Big-game hunting occurs throughout the area surrounding the parks, and is likely to continue. While it affects wildlife, the states manage their hunts in such a way as to sustain wildlife populations. Hunting also affects socioeconomics.
- Oil and gas leasing. Parts of Wyoming and Montana are experiencing record amounts of oil and gas leasing. These can affect regional and local air quality and socioeconomics.
- Motorized visitor use on forest and private lands outside the parks. Such use could affect soundscapes within the parks.
- Urban, industrial, and recreational uses. While such uses are more scattered in the Greater Yellowstone area than elsewhere in the U.S., they do exist and generate air quality impacts.

Proposed or recent actions from national parks include the following:

- Administrative Travel in Yellowstone and Grand Teton. NPS and concessions staff must utilize snowcoaches and snowmobiles as part of their regular duties and to obtain necessary supplies (groceries, medicine, etc.). Such travel is not included in the impact determinations for each subject area because this EA covers only visitor travel. Administrative travel can affect wildlife, soundscapes, air quality, and health and safety.
- Construction of Old Faithful Visitor Education Center. Yellowstone is constructing a new visitor center at Old Faithful, on the site of the previous facility, now demolished. This facility could affect socioeconomics, visitor access, and visitor experience.

- Construction of new West Entrance. Yellowstone recently completed a new West Entrance immediately east of the existing facility. This facility could affect socioeconomics, employee and visitor health and safety, and visitor circulation.
- Interagency Bison Management Plan. Completed in 2000, this plan provides management guidance for bison that leave Yellowstone in the winter. This plan affects bison, mainly when they leave Yellowstone.
- Remote vaccine delivery EIS for bison. In progress, this EIS will focus on delivering brucellosis vaccine(s) to bison remotely, and will affect bison management.
- Reconstruction of East Entrance Road (ongoing), Gibbon Canyon (proposed), Dunraven Pass (first half completed, second half proposed), Canyon rim drives (underway), and Mammoth-Norris road (proposed). These Yellowstone road projects are or will upgrade these road segments to modern standards. They may affect socioeconomics, visitor access and circulation, and wildlife.
- Construction of the Craig Thomas Discovery and Visitor Center, Moose, Wyoming. Grand Teton National Park opened the new visitor at Moose to public use in August 2007. This facility could affect socioeconomics and visitor circulation.
- Grand Teton National Park Transportation Plan. The park has begun implementation of portions of the transportation plan, including development of a 43-mile system of multi-use pathways. Several miles of the pathway system were constructed in 2008. Implementation of elements of the plan could affect socioeconomics, wildlife, and visitor access and circulation.
- Laurance S. Rockefeller Preserve. The 1,106-acre property formerly known as the JY Ranch, became part of Grand Teton National Park in November 2007, and a new visitor center opened in June 2008. Visitor use of the Preserve could affect visitor access and circulation, wildlife, and socioeconomics.
- Changing winter use plans in the parks and changing restrictions on winter visitor use between 2000 and 2007. These affected visitor access, visitor experience, socioeconomics, soundscapes, air quality, wildlife, and safety.
- Elk and Bison Management Plan for Grand Teton. This plan guides the management of these two species in Grand Teton National Park. In addition to its affects on these two species, it could affect socioeconomics.

Proposed or recent actions from surrounding lands include the following:

- Shoshone National Forest plan revision. The USFS is in the process of revising this forest's master plan. It could affect a number of aspects of this EIS's analysis.
- At least two businesses with a substantial number of employees have moved their operations out of Cody in the last decade, including Marathon Oil and part of the mail order operation for Sierra Trading Post. These changes affect the town and county's socioeconomics.
- North Fork (Shoshone River) fuel reduction. Through mechanical means and prescribed fires, this project is attempting to reduce hazardous fuels along the North Fork Shoshone River. It could affect wildlife and air quality.
- Bridger-Teton National Forest plan revision. The USFS is in the process of revising this forest's master plan. It could affect all aspects of this EIS's analysis.

- Construction of a natural gas pipeline through Hoback Canyon to serve Jackson. This pipeline will improve natural gas delivery to the Jackson area. It could affect socioeconomics, wildlife, and air quality.
- Reconstruction of Togwotee Pass Highway. The State of Wyoming is rebuilding U.S. 287 over Togwotee Pass. This project could affect wildlife, socioeconomics, and visitor access and circulation.
- Replacement of tram at Jackson Hole Ski Resort. This well-known ski resort recently replaced the tram to the summit of Rendezvous Mountain. This project could affect socioeconomics and visitor access to the backcountry of Grand Teton.
- Teton Pathways Master Plan. Teton County approved this master plan for non-motorized recreational pathways in 2007, with implementation to occur through 2013. This plan could affect air quality, wildlife, socioeconomics, and visitor access and circulation.
- Beaverhead-Deerlodge National Forest travel plan revision. The USFS is in the process of revising this forest's master plan. It could affect a number of aspects of this EIS's analysis.
- Gallatin Travel Plan revision. The USFS recently completed the travel plan for this national forest. It could affect socioeconomics, wildlife, air quality, soundscapes, and visitor access and circulation.
- Proposed reopening of the Sleeping Giant Ski Area near Yellowstone's East Entrance. This project could affect recreation opportunities and socioeconomics.
- Reclamation of historic mines above Cooke City. This ongoing project will reclaim 10-20 mines in the New World Mining district. It could affect wildlife (mainly grizzly bears) and winter recreation (the area is popular with snowmobilers and cross-country skiers).
- Gardiner Basin and Cutler Meadows restoration. The USFS and NPS are implementing long-term projects to restore native plants to these areas. These projects could affect wildlife.
- Rendezvous Ski Trail development plan. The USFS and Rendezvous trail managers are revising their trail plan, which would develop, improve, abandon, and/or maintain the cross-country ski trails there. This could affect socioeconomics and visitor access and circulation.
- Beartooth District of Custer NF travel management plan. The USFS is revising the travel plan for this national forest district. It could affect socioeconomics, wildlife, air quality, and visitor access and circulation.

Unacceptable Impacts

As described in *Purpose and Need*, the NPS must prevent any activities that would impair park resources and values. The impact threshold at which impairment occurs is not always readily apparent. Therefore, the Service will apply a standard that offers greater assurance that impairment will not occur. The Service will do this by avoiding impacts that it determines to be unacceptable. These are impacts that fall short of impairment, but are still not acceptable within a particular park's environment. Park managers must not allow uses that would cause unacceptable impacts; they must evaluate existing or proposed uses and determine whether the associated impacts on park resources and values are acceptable.

Virtually every form of human activity that takes place within a park has some degree of effect on park resources or values, but that does not mean the impact is unacceptable or that a particular use must be disallowed. To determine if unacceptable impact could occur to the resources and values of the parks, the impacts of proposed actions in this environmental assessment were evaluated based on monitoring information, published research, and professional expertise, and compared to the guidance on unacceptable impacts provided in *Management Policies* 1.4.7.1, provided in Appendix A. A determination on unacceptable impacts is made at the end of this chapter.

By preventing unacceptable impacts, park managers also ensure that the proposed use of park resources will not conflict with the conservation of those resources. In this manner, the park managers ensure compliance with the Organic Act's separate mandate to conserve park resources and values.

Effects on Wildlife

Methodology

The area of analysis for wildlife is the three park units. Because there is considerably less OSV travel in Grand Teton and the Parkway and because the species analyzed in this document occur more frequently on the OSV routes in Yellowstone, the analysis primarily focuses on wildlife in Yellowstone. The impacts upon wildlife in Grand Teton and the Parkway would be expected to be similar to, but of a lower intensity than, the impacts upon wildlife in Yellowstone.

The assessment of effects upon wildlife was based primarily upon the following sources:

- Monitoring information from the past five winters.
- Scientific literature on species' life histories, distributions, habitat selection, and responses to human activities. Some of this literature was based on Yellowstone's monitoring data; the remainder is generic to the species found in Yellowstone.
- Site-specific information on wildlife species in the parks, including unpublished information and the professional judgment of biologists familiar with the management concerns related to individual species.

There will always be uncertainty regarding the effects of winter recreation on wildlife in the parks because of the complex interactions of the disparate variables involved. Managers will inevitably need to act without the luxury of complete knowledge, using the best available information to evaluate the range of possible effects. They will also need to weigh the potential benefits and costs of alternate management actions against the risks of inaction. Following is an explanation of some of these uncertainties, associated assumptions used in the subsequent analysis, and the reasons that park managers are able to make informed decisions regarding winter recreation management.

Random weather events (e.g., severe snows, cold temperatures, etc.) during winter in mid- to high-elevation mountain environments interact with animal density to strongly influence population dynamics and how individual animals move and distribute themselves across the landscape. Although the wildlife monitoring of the past several winters in the parks has provided some information on such population dynamics, most of that data have been gathered over a series of relatively mild to moderate winters, with the exception of the winter of 2007-2008. If last winter is an indication, wildlife responses in such winters are more muted than in more moderate winters. Specifically, most animals responded to human recreation either with no

response or a look and resume response; they used more intense responses such as travel, alarm or flight less often (McClure and Davis 2008).

Still, it is difficult to discern whether the reduction in responses was indeed attributable to the severe weather that winter. Visitation remained low relative to the 1990s and early 2000s and was completely guided. The lower responses could be a reflection of wildlife becoming accustomed to the predictability of guided winter recreation [wildlife responses in the winter of 2006-07 were also subdued in intensity, even though it was a more moderate winter (Davis 2007)] or they could reflect better guide enforcement of proper human behaviors. Still other factors could account for the seeming reduction in wildlife response rates, reflecting the complex ecology and behavioral flexibility of Yellowstone's wildlife, as well as the numerous, non-linear interactions between wildlife responses, winter recreation, and other stressors (e.g., snow pack). For this analysis, because severe winters are known to increase energetic costs and chronic under-nutrition in most wildlife species, the NPS assumed that effects of OSVs and associated human activities would be exacerbated during such winters.

Oversnow vehicle activities may cause a wide range of responses from wildlife with effects at differing scales. For example, collisions between OSVs and wildlife can cause direct mortality, while single or repeated interactions between OSVs and wildlife can lead to energy expenditures from flight reactions. Animals can be displaced from important habitats by human activity (Gill et al. 1996), or they can experience less obvious effects like elevated heart rate and metabolism which, in turn, can result in high energy expenditures (Canfield et al. 1999), elevated production of stress hormones (i.e., glucocorticoids), increased susceptibility to predation, decreased reproduction, and diminished nutritional condition (Geist 1978; Aune 1981; Moen et al. 1982; Cassirer et al. 1992; Picton 1999; Hardy et al. 2001; Creel et al. 2002). Thus, this analysis assumes that higher oversnow vehicle traffic would result in more frequent responses by, or stress to, wintering wildlife (Hardy 2001; Creel et al. 2002; Borkowski et al. 2006; White et al. 2006).

This analysis assumes that the likelihood of wildlife species actively responding to snowmobiles or snowcoaches increases with vehicle group size. The estimated odds, based on wildlife monitoring from 2003 to 2006, of observing a movement response compared to no response by bison, swans, and bald eagles were 1.1 (threshold value[1] of 8 snowmobiles), 1.1, and 1.3 (threshold value of 18) times greater, respectively, for each additional snowmobile (White et al. 2006).

Similarly, although existing data does not allow precise quantification or direct comparison of the relative effects to wildlife of actions that increase levels of snowcoach use while decreasing snowmobile use, some comparisons are possible. This analysis assumes that the likelihood of some species actively responding to oversnow vehicles is higher for snowcoaches than for snowmobiles. Snowcoaches present a larger visual profile than snowmobiles, which could elicit greater responses (see especially McClure and Davis 2008). Based on monitoring information from 2003 to 2006, the estimated odds of observing a movement response compared to no response by bison, elk, swans, and bald eagles were 1.5 (threshold value of 3), 1.8, 1.7, and 4.2 times greater, respectively, for each additional coach (White et al. 2006).

Since 2004, the NPS has had a mandatory guide requirement in Yellowstone whereby all visitors to the park must either snowmobile with a commercial guide or tour in a snowcoach, driven by a trained commercial driver. Guided groups are much more likely to pass bison and other animals

[1] Threshold values are the number of coaches or snowmobiles beyond which the animal no longer increasingly responds. In this instance, once eight snowmobiles have been reached, there is no longer an increasing movement response; the animals have reacted as much as they will.

that are on or near park roadways with a minimum of wildlife reaction or harassment. Similarly, guides have the responsibility to enforce proper wildlife viewing behavior, such as limiting interaction times and the distances at which their clients approach wildlife. Guides also enforce proper food storage, preventing their clients from inadvertently allowing wildlife to obtain their food (Taber 2006). Given these behaviors, the NPS assumed in the following analysis that mandatory use of commercial snowmobile guides and snowcoach drivers would reduce adverse wildlife reactions and opportunities for wildlife to obtain human foods.

Despite these assumptions, some uncertainties remain and thereby limit managers' abilities to fully predict the effects of the alternatives. For example, the effects of the alternatives upon habituation of most wildlife are difficult to predict because research findings regarding habituation differ. Additionally, animals that are in poor condition (sick, low energy reserves, etc.) might be less likely or less able to respond visibly to human presence (again, this could account for the lower responses last winter). Animals in these situations could appear to display habituated tolerance levels even if they are disturbed by the activity. Responses can also be also species-specific.

However, enough research and monitoring-based information exists to enable park managers to make reasoned decisions regarding winter recreation management. In general, the results of monitoring data collected over the past five winters of wildlife monitoring indicate that bison, coyotes, eagles, elk, and trumpeter swans in Yellowstone National Park exhibit some individual behavioral responses to oversnow vehicles in association with human activities (White et al. 2005; Borkowski et al. 2006). However, as several wildlife researchers have found, the majority of behavioral responses are low in intensity and do not appear to be adversely affecting the population dynamics or demography of these species (Hardy 2001; White et al. 2006, Borkowski et al. 2006). As discussed in more detail in the relevant sections below, estimates of bison, elk, and bald eagle abundance have increased despite large variations in annual OSV numbers and ongoing levels of minor disturbance to individual animals. Trumpeter swans may be declining in number, but that decline is probably due to other causes, not winter recreation. Grizzly bears are doing so well that they have been removed from the endangered species list. Wolves were doing well enough to be delisted, but have since been placed back on the endangered list for reasons unrelated to winter use in the parks. Research is ongoing regarding the status of wolverines. Coyotes and ravens are abundant throughout the parks and in no danger of population reduction. Finally, the only action alternative analyzed in this document requires all visitors to travel in the company of commercial guides or snowcoach operators, a provision with the potential to continue the reduction in impacts upon wildlife populations seen in the last five years.

Regarding coyotes and ravens in particular, the concern regarding winter recreation is not that they will be displaced, but rather that they will become habituated to human use and will seek out human foods. Both species are widespread throughout Yellowstone and the American West, and neither is in any danger of population-level impacts in Yellowstone. Consequently, the discussion of impacts upon these two species is confined to a section under behavioral responses for Alternative 2.

Impacts of actions proposed in the two alternatives were analyzed on the basis of five major concerns, with the general effects of each summarized below.

- Vehicle-caused mortality to individual animals
- Displacement impacts

- Behavioral responses of wildlife groups to OSVs and associated human activities
- Physiological responses of wildlife groups to OSVs and associated human activities
- Demographic effects at the population level

Impact Threshold Definitions

Although the focus of the impact definitions and associated analysis is predominantly the impact on wildlife populations, the NPS seeks to minimize adverse impacts to individual animals. As discussed extensively in *Affected Environment*, the NPS adheres to the North American Wildlife Conservation Model, which focuses on the health and management of wildlife *populations*. Overall, NPS's goal is to minimize human impacts (including on wildlife individuals) and avoid significant effects from disturbance to abundances, diversities, dynamics, distributions, habitats, and behaviors of wildlife populations and the communities and ecosystems in which they occur, pursuant to 36 CFR § 2.18 and *Management Policies* 4.4.1.

Negligible: An action that may affect a population or individuals of a species, but the effect would be so small that it would not be of any measurable or perceptible consequence to the population.

Minor: An action that may affect a population or individuals of a species, but any measurable effect would be a small and localized consequence to the population.

Moderate: An action that will affect a population or individuals of a species; measurable effects will have a considerable, but localized, consequence to the population.

Major: An action that will noticeably affect a population or individuals of a species; the effect will be measurable and have a substantial and possibly permanent consequence to the population.

Effects of Alternative 1

This alternative would prohibit all visitor use and would consequently have negligible impacts upon wildlife populations or individuals. With no visitor OSV travel occurring, no vehicle-caused mortality would result, wildlife would not be displaced, wildlife would suffer no behavioral or physiological effects, and there would be no demographic effects at the population level. Mitigations would be unnecessary, because visitors would be causing no effects upon wildlife. For cumulative impacts, see the cumulative impacts discussion under Alternative 2 for a listing of potential actions that could affect wildlife, even under this alternative (including administrative travel). Without any visitor effects on the wildlife in the park, though, cumulative impacts would be minimal under this alternative.

In summary, Alternative 1 would result in negligible impacts on wildlife populations or individuals in the parks. Because there would be negligible effects upon wildlife, this alternative would not result in either unacceptable conditions or impairment of wildlife resources.

Effects of Alternative 2

Under this alternative, up to 318 snowmobiles and 78 snowcoaches per day would be allowed into Yellowstone, with another 50 snowmobiles in Grand Teton and the Parkway. Assuming Yellowstone's season would be 90 days long and these limits would be filled to capacity every

day of the winter season, a total of 35,640 vehicles would travel Yellowstone's roads. That number is well below the 50,000 cap recommended by NPS biologists (White et al. 2006).

Note that in the original paper, White et al. recommended that park managers "continue to conduct winter recreational activities in a predictable manner with OSV [over-snow vehicle] traffic levels at or below those observed during the last 3 years of our study (i.e., <50,000 over-snow visitors)." White et al. erred in stating winter use should be limited to 50,000 over-snow *visitors*. Rather, they intended that the phrase read "<50,000 over-snow vehicles" (White 2008). This change is significant, for it allows substantially more visitors to enter the parks; previously, not even the snowcoach-only alternative from the 2007 FEIS would have accommodated fewer than 50,000 visitors.

The following analysis assumes full entrance station utilization per day, using monitoring information from the last several winters as the primary basis of analysis.

Vehicle-caused Mortality (All Animals of Concern)

Based on monitoring data from the last five years, no bison, elk, wolves, bald eagles, swans, lynx, wolverines, or coyotes have been killed by visitor oversnow vehicles. This data suggests that requiring all visitors to tour Yellowstone with either a commercial snowmobile guide or professional snowcoach driver greatly minimizes the possibility of wildlife mortality due to collisions with oversnow vehicles.

Looking further back in Yellowstone's winter use history, the annual number of ungulate deaths caused by snowmobiles from 1989-1999 was estimated as <1% of each species' total abundance in Yellowstone. The possibility of individual bison and elk being killed by OSVs exists, but no population-level impacts to bison and elk have been detected during periods of higher OSV levels. With wolves, out of well over a hundred documented wolf deaths between 1995 and the present, none were from oversnow vehicles, and the total amount of roadkilled wolves (i.e. wolves killed by wheeled vehicles) represented less than 1% of the estimated Yellowstone wolf population. For lynx and wolverines, the low numbers, wide distribution, and secretive nature of the two animals are expected to result in a continuing extremely low incidence of vehicle-caused mortality (the majority of the lynx confirmed by Murphy et al. (2006) were located within 12 km of Yellowstone's East Entrance Road, and preliminary information suggests the same to be true for wolverines, but oversnow vehicles permitted to enter the East Entrance under this alternative would be very low, at 20 or fewer snowmobiles and 2 snowcoaches per day). Finally, there are no records of any vehicle-killed bald eagles or swans from 1989 to 2006. There is documentation of other road-killed birds in Yellowstone, including ravens, typically during the spring and summer months, but these do not include eagles or swans and the small numbers of such road kills are not considered threatening to the species involved.

Despite the small number of road-killed ungulates compared to the size of their populations, the NPS is concerned about these losses and seeks to minimize collisions caused by motorized vehicles of all kinds. The provisions for 100% guided snowmobile travel and snowcoach travel substantially accomplish this objective, because guides are trained in where wildlife tend to occur and are responsible for adhering to safe travel speeds (themselves and their groups).

Based on the monitoring data, mandatory commercial guiding and/or snowcoach touring appears to minimize wildlife mortality. The NPS assumes that increasing OSV traffic through the winter ranges of wildlife relative to current conditions during winter would likely increase the frequency of road-killed wildlife. Because this alternative would maintain snowmobile visitor use at or about existing levels and would require all visitors to utilize commercial guides or

snowcoaches, there would be little, if any increase in ungulate mortality. Consequently, vehicle collision impacts to all wildlife species under this alternative are predicted to be negligible, adverse, short-term, and direct.

Displacement of Animals

Bison, Elk, Eagles, and Swans

As discussed in *Affected Environment*, bison, elk, eagle, and swan displacement seems to be localized, short-term, and existing only for individuals, not the population of the species in question. All four species continue to occupy the same historical winter range in the Madison and Firehole drainages of Yellowstone while exposed to the highest contemporary levels of OSV traffic in the park, minor amounts of short-term displacement, and some visitor use levels higher than those contemplated in this alternative. Regarding swans and eagles in particular, their historical nesting patterns in Yellowstone indicate that they are not likely to experience substantial displacement from OSV traffic or winter recreation. Largely because the winter OSV season lasts less than 90 days, current levels of OSV use are likely to cause only short-term, individual, and localized displacement, but not long-term displacement for individuals or the population. Because this alternative would continue winter use at those same levels (but with a possibility of increased snowcoach use), displacement impacts to these animals under this alternative are predicted to be minor, adverse, short-term, and direct.

As discussed in *Affected Environment* for bison in particular, the NPS is examining the relationship between groomed roads and bison further, based upon the research proposal from Garrott and White (2007), the Gates report, and the bison workshop that occurred in January 2006. These research findings will not be available until after the conclusion of this temporary plan. For the duration of this plan, the NPS will be proceeding with the understanding that bison have not been displaced from important winter range due to oversnow vehicle road grooming.

Wolves, lynx, and wolverines

For wolves, lynx, and wolverines, the discussion of displacement is combined with the discussions for behavioral and physiological response. As discussed in *Affected Environment*, the low incidence of wolves encountered during surveys over four years suggests that wolf interactions with OSVs are rare. The presence of wolves along the busiest OSV route in Yellowstone (West Yellowstone to Old Faithful) and the low number of interactions with OSVs suggest that wolves avoid human activity generally, hence OSVs, in the daytime. Overall displacement events of wolves by OSVs appear to be short in duration, in part because wolves are sometimes active in proximity to roads and developed areas at night. This minimizes the possibility of direct behavioral and physiological impacts to wolves from OSV use. Although displacement of wolves is low overall, this analysis assumes, based on monitoring data from the last five years, that current levels of winter use result in minimal amounts of displacement to wolves and that increased levels of OSV use, and associated human activity, would increase disturbance to, and responses by, wolves.

Generally, according to the best available information, lynx and wolverines appear unlikely to be adversely impacted by expected levels of OSV traffic in the parks. More specifically, the daily level of OSV use on the East Entrance Road is small and likely represents little direct impact to wolverine and lynx. Operations necessary to maintain the road include avalanche control and road grooming. The impacts of avalanche control in the parks on lynx and wolverine are not known, but there have been no direct impacts from these activities recorded upon lynx and

wolverines in the parks, probably resulting from the low density of both species. For these reasons, this analysis assumes that lynx and wolverines would probably not be affected by the levels of OSV traffic proposed in the parks under this alternative.

Based on this monitoring data, the associated assumptions and literature, displacement and behavioral and physiological impacts to wolves, lynx, and wolverines under this alternative are predicted to be negligible to minor, adverse, short-term, and direct.

Behavioral Responses

Ungulates

Wildlife monitoring for the past several winters indicates that 90% or more of bison and elk responses to winter use are either no response or look and resume responses. Less than ten percent of responses are active responses, and they do not have known population-level effects. In many cases, active responses are merely walking away from the threat, a response that causes little overall adverse fitness effects to the animal or population. Other situations, however, are more serious, such as snowmobilers inadvertently or intentionally chasing animals on roadways. These situations are unacceptable, but are largely eliminated by the requirements to utilize commercial guides and/or snowcoaches.

Professional expertise indicates that the use of commercial guides may help to reduce such interactions because guides may be trained to limit their groups' interaction time with animals, to prevent wildlife harassment and chasing, and to limit the distance at which their groups approach animals. Similarly, guides may be trained in recognizing and minimizing those situations where two or more factors may increase wildlife stress. Because this alternative will continue the mandatory guiding practices of the last five winters and will continue human use of the parks at the relatively low levels of the same time period (although snowcoach use could increase), behavioral impacts to ungulates are predicted to be negligible to minor, adverse, short-term, and direct.

Coyotes and Ravens

As previously discussed, there is no concern that coyotes or ravens will suffer adverse effects at the population level due to OSV use and associated recreationist presence. Rather, the concern with both species is that they will actively seek out interactions with people in winter in an effort to obtain food at a time of scarcity. Although coyote and raven behavior cannot be controlled, human behavior can; mandatory guiding substantially reduces the availability of human foods for these two species. Because this alternative retains the mandatory guiding in effect for the past five years, and thus the ability of the NPS to quickly inform guides when a problem is occurring, behavioral impacts of this alternative on coyotes and ravens are predicted to be negligible, direct, short-term, and adverse.

Eagles and Swans

For eagles and swans, the discussions of behavioral and physiological responses are combined.

As with ungulates, behavioral data indicate that use levels similar to those allowed under this alternative have resulted in most eagle and swan reactions to oversnow vehicle use being either no response or look and resume responses. Although there is a small percentage of stronger reactions to human use, these are localized and short-term, affecting individuals but not the populations that have continued to utilize the same winter range for decades.

Additionally, the NPS's experience in the last five years with mandatory guiding assumed that the use of guides helps to reduce such interactions because guides are trained to limit their groups' interaction time with animals, to prevent wildlife harassment and chasing, and to limit the distance at which their groups approach animals. Guides may also be trained in recognizing and minimizing those situations where two or more factors may produce more wildlife stress. Also based on monitoring data, the likelihood of bald eagles and trumpeter swans actively responding to snowmobiles or snowcoaches increases with vehicle group size and with vehicle size (i.e. snowcoaches will produce a greater response than snowmobiles).

There is no current information from the parks that would allow inferences about avian physiological stress in reference to OSV use. Therefore, as with other species and in agreement with behavioral response data, this analysis assumed that higher OSV traffic would result in more frequent physiological responses by, and more stress to, bald eagles and trumpeter swans.

This alternative would allow levels of snowmobile use similar to those seen in the last five years, along with obligatory guiding. Snowcoach use could rise moderately. Based on the monitoring data from the past five years, behavioral and physiological impacts of this alternative on eagles and swans are predicted to be minor to moderate, direct, short-term, and adverse.

Physiological Responses (All Species of Concern)

As monitoring in Yellowstone indicates, the majority of responses by wildlife to OSV use in Yellowstone have been low-intensity vigilance or movements such as travel (Borkowski et al. 2006, White et al. 2006). Just because an animal exhibits no external response, however, does not mean physiological responses are absent. Animals may experience elevated heart rate, blood pressure, breathing rate, and release of adrenaline. Quantifying these physiological responses in wildlife is extremely difficult, though some researchers have attempted to do so with Yellowstone elk and bison. They found that stress hormones in bison showed little relationship to oversnow use but that such levels in elk increased through a winter use season, especially after 7,500 oversnow vehicles had entered the park (Hardy 2001; Creel et al. 2002). However, measuring these physiological responses to recreation by wildlife is challenging due to numerous assumptions and poorly defined parameter estimates. Given these difficulties, it is safest to state that increasing levels of disturbance, including OSV traffic, would likely result in increased stress to wintering wildlife. Hardy and Creel noted, however, that despite the increased stress levels they observed, bison and elk continue to utilize the same winter range year after year and their populations seem unaffected by winter use, even at levels substantially higher than that seen in recent years. Because this alternative would continue winter use at approximately the same levels as seen in those recent years, along with mandatory guiding, the physiological effects of this alternative on all species are predicted to be negligible to minor, adverse, direct, and short-term.

Population-level Impacts/Demographics

Ungulates

As discussed in *Affected Environment*, oversnow vehicle use and winter recreation in Yellowstone and Grand Teton National Parks have not affected bison and elk populations. Any adverse behavioral and energetic effects of OSV recreation to these ungulate populations have apparently been compensated for at the population level. If roads continue to be groomed (as they would under either alternative, though less frequently under Alternative 1 than 2), research strongly suggests that bison populations will continue to be abundant, dominated by natural processes, and healthy. Although individuals will continue to suffer the minor amounts of

disturbance that monitoring has revealed occurs, bison populations are not expected to be adversely affected by winter use.

An unknown number of individual bison and elk will incur adverse effects when exposed to snowmobile and snowcoach traffic and winter recreation under this alternative. Small numbers or groups of bison and elk may be displaced or experience impacts from interactions with oversnow vehicles, for instance. Mitigation measures listed below seek to lessen the frequency and intensity of impacts to individual animals. But again, population level impacts are not expected. Further, the Madison-Norris bison/groomed road experiments may reveal if any changes in bison distribution, survival, and ability to move out of the park have been experienced. Still, based on the research summarized in *Affected Environment*, the forms of winter recreation practiced in the parks may have cumulative effects to individual animals, but such impacts have not risen to the level at which they impact overall wildlife populations in the parks.

Because this alternative would continue winter use at approximately the same levels as seen in the last five years but with the possibility of increased snowcoach use (levels that have not affected bison or elk populations or demographics), the effects of this alternative on ungulate populations and demographics are expected to be negligible, adverse, short-term, and direct.

Wolves

As discussed in *Affected Environment*, wolf populations increased throughout the GYA since their reintroduction, and populations remain healthy throughout the area, including heavily-traveled areas such as Yellowstone's Lamar Valley. Impacts to denning wolves that could cause decreases in reproduction are not expected to occur because wolves den in April, after the closure of the OSV season in the parks.

Significant predictive correlations have been found with park and wilderness lands and wolf presence, as well as negative relationships between roads and wolves. As noted, wolf populations in the GYA are healthy, suggesting that the levels and types of human recreational activity in the parks and road densities therein (pre-existing paved roads are the only OSV routes in Yellowstone and Grand Teton national parks) are generally below the threshold necessary to adversely impact wolf populations. The combined evidence, then, suggests that if existing human winter activity were displacing wolves, the impacts have not been sufficient to significantly increase mortality or decrease reproductive success at the population level.

Because this alternative would only continue winter use at existing levels, the general lack of population or demographic effects on wolves seen since wolf reintroduction is expected to continue. Therefore, the population and demographic effects of this alternative on wolves are expected to be negligible, adverse, short-term, and direct.

Lynx and Wolverines

Of the three lynx identified through DNA in Yellowstone, one was offspring (Murphy et al. 2006). Although detections of offspring do not confirm the presence of a viable, reproductively-stable population in the park or ecosystem, they do suggest resident females. The dynamics of the GYA lynx population are not well understood, making the impacts of the proposed action to a regional lynx population difficult to determine with accuracy. However, impacts to breeding lynx are not expected to occur because the winter recreation season in the parks overlaps the initiation of the lynx breeding season by only a week or two.

Similarly, predicting the effects of any alternative upon wolverines is difficult due to the paucity of information about them anywhere in published literature. However, their preferences for habitat and denning sites mean that they will rarely occur near the road systems of the parks, the majority of which is in habitat that wolverines utilize primarily only as travel corridors between areas of preferential habitat. Further, their wide-ranging nature means that even places like Sylvan Pass, which, although good habitat, may only be rarely frequented by wolverines.

Because this alternative would only continue winter use at existing levels (but with the possibility that snowcoach will increase), because travel over Sylvan Pass would be minimal, and because both wolverines and lynx tend to avoid road corridors anyway, this alternative's population and demographic effects upon the two species are expected to be negligible, direct, adverse, and short-term.

Eagles and Swans

Decreases in reproductive rates have been detected in birds exposed to increased recreational activity. Impacts on large numbers of birds would presumably result in a cumulative, detectable population-level impact. However, nesting success and numbers of fledgling bald eagles in Yellowstone increased during a period of intense OSV use, 1987 to 2005, and were not correlated with cumulative OSV traffic. This suggests that any impacts to individual bald eagles have been compensated for at the population level.

Swan numbers have been declining for several decades, including those in productive areas such as the Centennial Valley of Montana. It is unlikely that poor production across the GYA has resulted from OSV use in Yellowstone or GTNP, because swans in the parks generally return to their breeding territories between February and late May, with young hatching in late June, when OSV traffic is no longer a presence in the parks. Further, swan numbers in the parks decrease as areas of open water diminish with the onset of winter, exposing proportionally fewer trumpeter swans to OSV use in the parks.

Based on this information, those forms of winter recreation practiced in the parks may have cumulative effects to individual birds, but such impacts have not risen to the level at which they impact overall eagle or swan populations in the parks. Because this alternative would only continue winter use at existing levels, because bald eagle and swan breeding periods do not substantially overlap winter use, because the populations of both do not correlate with winter use levels, and because all visitors would continue to be guided, the population and demographic effects of this alternative on bald eagles and swans are predicted to be negligible, adverse, direct, and short-term.

Mitigations

The impacts identified above would be mitigated in several ways under this alternative. First, the daily entry restrictions would limit OSV visitation to a level approximating that seen for the past several seasons. Snowcoach use could increase, and their larger size appears to evoke a higher response rate, but the impacts of that would be mitigated by the fact that snowcoach drivers are trained just like commercial guides in how to pass wildlife safely and observe wildlife responsibly. Because most impacts with the number of visitors seen in the last several years have been minor or negligible, continuing to restrict visitor vehicles and associated human numbers to similar numbers limits wildlife impacts.

Second, monitoring of human-wildlife interactions will continue under either alternative. If this monitoring indicates that human presence or activities are having unacceptable effects on

wildlife that cannot otherwise be mitigated, selected areas of the parks (including sections of roads) may be closed to visitor use.

Third, and as discussed in *Affected Environment*, the requirement to use commercial guides is an effective mitigation for some human impacts upon wildlife. Guides are trained to avoid causing wildlife displacement or stress and are familiar with likely wildlife locations along the road system. Accompanied by guides, OSV users may be less likely to interact improperly with wildlife, causing less mortality, less displacement, and fewer negative behavioral and physiological responses.

Finally, both parks have the authority to enact closures for wildlife purposes, such as to prevent disturbance of denning lynx or wolverines. Should such dens be identified in areas of the parks near human activities (and, therefore, likely to cause disturbance to both individuals, and, because these are rare animals, potentially their populations), the superintendents could implement such closures.

Cumulative Effects

The area of concern for cumulative impact analysis is that which is used by these species for wintering and seasonal migration. This includes all of the three park units plus adjacent lands utilized by affected wildlife, primarily in winter.

Bison that leave Yellowstone are currently subject to brucellosis risk management actions at the park boundary, pursuant to the 2000 Interagency Bison Management Plan (IBMP). Such controls include hazing back into Yellowstone, retaining the animals in holding facilities for eventual release back into Yellowstone, and/or removal from the population. The plan provides the IBMP agencies to emphasize non-lethal management measures when the bison population reaches 2,100. If the bison population reaches 2,100, the agencies are required to increase implementation of non-lethal management measures.

Hunting of both bison and elk is allowed outside the parks and (for elk) in Grand Teton National Park. Hunting seasons and limits are managed by the states (and jointly by the NPS and State of Wyoming within Grand Teton) in such a way as to ensure long-term wildlife viability. Since grizzly bears were removed from the threatened and endangered list in 2007, the surrounding states now managing their populations have not announced hunting seasons for them.

Population growth in the GYA, rural land subdivision, improving snowmobile technologies, and increasing outfitter/guide activity can all influence wildlife populations by introducing more recreationists into big game habitat and/or fragmenting wildlife habitat. Additionally, Grand Teton has recently completed a summer transportation plan, and Teton County has completed the Teton Pathways Master Plan. These actions could have some effect on wildlife, especially those species that are allowed to range outside the parks. Presumably, however, state wildlife management agencies would attempt to minimize significant population declines. Additionally, the large amount of federal land in the GYA and large amounts of elk winter range that have been placed in federal ownership in the last twenty years add some security to elk populations as well as those of most other wildlife species.

The Gallatin National Forest has consolidated much of its checker-boarded holdings in recent years, although that has also been accompanied by the consolidation of private lands, especially in the Big Sky area. It is difficult to predict the net effect of these actions on wildlife, because the consolidated USFS lands are less likely to be developed while the private lands are more likely to be.

Noxious weed growth is a problem throughout the GYA, with potentially adverse effects on wildlife. The federal, state, and county agencies have active noxious weed control programs that attempt to prevent further spread of these plants, limiting their effect on most animal species. Additionally, restoration of some of the Gardiner Basin would have likely benefits for some species, because the native plants preferred by some would be favored by such restoration.

Timber harvest, grazing and mining, fires, and fuels reduction projects will continue to occur on federal and other lands outside the parks. These actions have variable effects on animal species, sometimes stimulating the growth of their preferred forage and sometimes limiting it.

Several national forests in the region are revising their forest plans and/or travel plans. Also, Yellowstone is in the process of writing an EIS on the remote delivery of brucellosis vaccine for bison and Grand Teton has recently completed an elk and bison management plan. These plans will have variable effects on wildlife species, but all such actions would most likely ensure the continued viability of wildlife populations.

Road construction is a recurring event in the region, as are other construction projects. Within the parks, these projects are undertaken in such a way as to minimize their effects on wildlife. On the national forests, this is generally true as well. For example, most facility construction projects within the parks and forests are subject to environmental analysis and are either replacements of existing facilities or are within existing developed areas, therefore minimizing their effects upon wildlife. However, the faster travel speeds resulting from road improvements can result in greater wildlife road kill.

Administrative travel by both the NPS and park concessions will continue in both parks under both alternatives, although it will be somewhat reduced over current levels in Alternative 1 (because there would be no motorized oversnow travel and Old Faithful Snowlodge will be closed). Employees are trained in how to pass wildlife without harassment; such training is ongoing and can be focused on particular problems that monitoring may unveil. Administrative travel can affect wildlife individuals but probably not wildlife populations. For example, one bison was killed by administrative travelers in the last ten years, but such mortality is otherwise very rare. Some displacement and behavioral and physiological effects could be felt on certain wildlife individuals as park employees travel throughout the park to accomplish their duties. However, no population-level effects would be expected from such travel. In general, employee training would serve to minimize such effects on park wildlife, and monitoring would continue to be performed and utilized to minimize any unforeseen effects.

Ranching and cattle grazing will continue to occur outside and adjacent to the parks, and to some extent within Grand Teton. While the majority of wolves prey exclusively on wild game, a small percentage preys upon domestic livestock. When this occurs, the depredating wolves are usually removed from the population. Such control activities will continue. These actions clearly have adverse effects upon wolves, but the state and federal governments are required to maintain viable populations of wolves for perpetuity.

Overall, most of these actions would have either negligible or minor effects on wildlife in the parks, because most such actions have mitigations that limit their effect on wildlife populations. The cumulative effects of these actions, when combined with those incurred by implementation of either Alternative 1 or 2, are expected to be negligible to minor.

Conclusions

Monitoring of winter wildlife reactions to oversnow vehicle use has indicated some small-scale, short-duration, and individual impacts. However, such impacts appear to be compensated for at

the population level, because no wildlife species are experiencing declines in their populations due to winter use.

Alternative 1 would discontinue visitor OSV travel, while Alternative 2 would continue winter use at approximately the same levels as experienced in the past five years, with the possibility of snowcoach travel increasing. Snowcoaches do elicit a larger response than snowmobiles due to their larger profile. However, all winter visitors to Yellowstone would continue to be required to travel in a guided group, whether with a commercial snowmobile guides or in a snowcoach. Effects on wildlife in all three parks under Alternative 2 are expected to be similar to those seen in the last five years: primarily negligible to minor (with possible moderate effects on swans and eagles). Effects are expected to be direct, short-term, and adverse, and are not expected to significantly affect the environment in the parks. The cumulative effects of administrative travel would raise the effects of implementing Alternative 1 to minor, adverse, direct, and occurring over the life of this plan.

Unacceptable Impacts and Impairment

The effects on wildlife seen under either alternative are expected to be acceptable because wildlife populations are expected to remain healthy and abundant. Although monitoring reveals some disturbance to individual animals, no wildlife populations are declining due to winter use (swan populations are declining, but this decline is being experienced regionally, not just in Yellowstone). Few, if any, animals are expected to be killed as a result of vehicle collisions, displacement and behavioral and physiological effects are expected to be minor and of little consequence to wildlife populations (with possible moderate effects on swans and eagles under Alternative 2), and only negligible population effects are expected. Wildlife populations will be abundant and influenced primarily by natural forces; park purposes and values, and desired future conditions will both be attained. Visitors will continue to find wildlife to be both wild and easily viewed; they will all travel with commercial guides or in snowcoaches, learning about and enjoying the abundant wildlife sightings and the safe environment. Because no unacceptable conditions will result, impairment of wildlife resources will also be absent. For the same reasons, NPS will comply with the regulations in 36 CFR 2.18.

Effects on Soundscapes

Methodology

The area of analysis for soundscapes is the three park units. The following analysis of potential adverse effects to soundscapes is limited to the two alternatives for OSV recreation in the parks. The analysis complies with NPS regulations and policies for management of soundscapes.

The natural soundscape of the park units is affected by many non-natural sound sources as described in *Affected Environment* and in this chapter's *Cumulative Impacts*. Administrative oversnow vehicle use is one of those non-natural sound sources that is additive to any visitor use of OSVs. The NPS is engaged in a multifaceted approach to mitigate administrative OSV soundscape impacts as described elsewhere in this document. This chapter's analysis focuses on the soundscape consequences of visitor oversnow vehicle use, with administrative use analyzed as part of the cumulative effects discussion.

Methods are based on monitoring information compiled from the last four years. Estimates of audibility and maximum sound levels for the visitor use levels described under each of the alternatives were computed using this monitoring information. Those levels were then compared to the impact threshold definitions below.

There would be no impacts on the parks' soundscape from Alternative 1 because there would be no motorized visitor use. To determine the impacts of Alternative 2, monitoring information from the past four winters was used to determine the average percent time audible and maximum sound levels for those days with 318 or fewer snowmobiles, plus all snowcoaches that passed the monitoring sites on those same days (see Burson 2008). Snowcoach entry numbers were not tallied separately, but their audibility and maximum sound thresholds were included in the monitoring data. Next, the percent time audible calculated from monitoring data was reduced by the percentage that administrative travel composed, 21% for road corridors and 26% for developed areas (these are the figures for Yellowstone; the contribution of administrative travel to Grand Teton soundscapes is not known, but would be much less than for Yellowstone since most administrative activities do not require the use of snowmobiles). For backcountry zones, the percent time audible was reduced by the percentage that administrative travel composed for road corridors, because road corridor travel is a greater contributor to backcountry soundscapes than is travel within developed areas. Those resulting figures were compared to the impact threshold definitions to determine the level of impact. Analyses were done for three soundscapes management zones: developed areas, roadside corridors, and backcountry zones.

Impact Thresholds

Impact threshold definitions were taken from the 2004 Temporary EA, because the 2007 FEIS definitions were for modeled data and the analysis in this document is based on monitoring data collected in Yellowstone and Grand Teton. Soundscapes science is still fairly new to the national parks, with systematic monitoring data for Yellowstone and Grand Teton only having been collected for the past five winters. Park managers are learning more about park soundscapes with each passing year and continue to reevaluate soundscape thresholds and indicators used to best evaluate the impacts to park soundscapes.

In applying these definitions, if the assessed impact level (i.e., negligible, minor, moderate, or major) for one parameter is higher than for the other, the overall impact is judged to be at the higher level. For example, if an alternative is predicted to have a minor impact for the percent time oversnow vehicles are audible but a moderate impact for the maximum sound level present, the overall impact conclusion is for a moderate impact.

Threshold Definition[a]	**Management Zone**[d]	**Audibility % Time**[b]	**Maximum Sound Level**[c] **dBA**
Negligible: An action that may affect the natural soundscape or potential for its enjoyment by resulting in oversnow vehicle sound that is heard with infrequent occurrence and only for short duration or at a decibel level that may not be noticeable to humans engaged in other activities.	Developed	< 25	< 45
	Travel Corridor	< 15	< 40
	Backcountry	< 5	< 40
Minor: An action that may affect the natural soundscape or potential for its enjoyment by resulting in oversnow vehicle sound heard for a relatively small percent of the time or at a decibel level that would begin to affect conversation.	Developed	25-45	< 60
	Travel Corridor	15-25	< 60
	Backcountry	5-10	< 40

Threshold Definition[a]	Management Zone[d]	Audibility % Time[b]	Maximum Sound Level[c] dBA
Moderate: An action that may affect the natural soundscape or potential for its enjoyment by resulting in oversnow vehicle sound heard for modest amounts of time or at a decibel level that would affect conversation.	Developed	45-75	< 70
	Travel Corridor	25-50	< 70
	Backcountry	10-20	< 45
Major: An action that may affect the natural soundscape or potential for its enjoyment by resulting in oversnow vehicle sound heard for substantial amounts of time or at a decibel level that would make normal conversation difficult.	Developed	> 75	> 70
	Travel Corridor	> 50	> 70
	Backcountry	> 20	> 45

[a] Daily averages are calculated for 8 a.m. to 4 p.m; unit of analysis is the daily average for the winter use season.

[b] Audibility is the ability of humans with normal hearing to hear a sound.

[c] dBA = decibels measured on an A-weighted scale, measured at least 100 feet from the sound source.

[d] The transition zone is not included in the impact definitions.

Effects of Alternative 1

This alternative would have no visitor use of snowcoaches or snowmobiles in Yellowstone or Grand Teton. Oversnow recreational vehicles would not be audible, nor would there be maximum sound levels from them. Without any oversnow vehicle visitor use, the impacts of implementing Alternative 1 on park soundscapes would be negligible, long-term, direct, and neither beneficial nor adverse. Cumulative effects on park soundscapes under this alternative would be the same as those under alternative 2; see that discussion below. No unacceptable conditions or impairment would result, because no visitor oversnow vehicle use would occur.

Effects of Alternative 2

Under alternative 2, up to 318 snowmobiles and 78 snowcoaches would travel Yellowstone's roads per day, plus the associated administrative travel. In addition, 25 snowmobiles per day would be allowed on Jackson Lake on Grand Teton and 25 on the Grassy Lake Road in the Parkway.

Affected Environment, *Soundscapes*, presented the audibility levels associated with this level of use as monitored for the past two winters in Yellowstone. For this analysis, the 8:00 a.m. to 4:00 p.m. period will be used. Monitoring data from four sites represent the soundscapes management zone for developed areas, seven sites represent the travel corridor zone, and two sites represent the backcountry zone. Table 4-1 displays the average audibility at each of these sites.

Table 4-1: Audibility at representative monitoring sites for days with 318 and fewer snowmobiles, winters 2005-08.

1) Location	2) Percent Time OSVs were audible	3) Visitor use contribution to this level	4) Estimated audibility under Alternative 2[b]	5) Impact level
Developed area management zone sites				
Old Faithful	69%	74%	51%	Moderate
West Thumb	56%	74%	41%	Minor
Flagg Ranch	28%	Unknown (Grand Teton/Parkway site)	28%	Minor
Colter Bay	3%	Unknown (Grand Teton/Parkway site)	3%	Negligible
Travel corridor management zone sites				
Madison Jct.	54%	79%	43%	Moderate
Grant Village/Lewis Lake	37%	79%	29%	Moderate
Spring Creek	35%	79%	28%	Moderate
Spring Creek 2[c]	42%	79%	33%	Moderate
West Yellowstone 3.1[d]	35%	79%	28%	Moderate
Mud Volcano	22%	79%	17%	Minor
Grassy Lake Road	6%	Unknown (Grand Teton/Parkway site)	6%	Negligible
Backcountry management zone sites				
Fern Lake	0%	79%	0%	Negligible
Shoshone Geyser Basin	18%[a]	79%	14%	Moderate

[a] Audibility for Shoshone Geyser Basin is computed for the entire 7 days of monitoring there; those days included some with more than 318 snowmobiles.

[b] Computed by multiplying the audibility level (Column 2) by the percentage attributable to visitors and unknown users (Column 3).

[c] The Spring Creek site was moved about ¼ mile between the two winters of its usage.

[d] While all other sites averaged 274 to 305 snowmobiles/day, this site averaged only 225 snowmobiles/day.

Audibility in developed areas is estimated to be negligible to moderate; in the travel corridors, moderate (with one site being minor and another negligible); and in the backcountry, negligible to moderate. Because the highest impact level for audibility is predicted to be moderate, the

overall impact for audibility is predicted to be moderate for Yellowstone and minor for Grand Teton and the Parkway.

Note that for the Old Faithful monitoring site, average audibility for days with less than or equal to 318 snowmobiles was *greater* (69%) than the average including all days over 318 snowmobiles (68%). Similarly, for the West Yellowstone site, average audibility for days between 274 and 318 snowmobiles was slightly less than it was when days with less than 274 snowmobiles were included. These computations reinforce the point made in *Affected Environment*, that audibility is influenced by many factors, with wind being a substantial influence on audibility. Therefore, it is important to include other forms of measuring sound, such as maximum sound levels.

Maximum sound levels were discussed in *Affected Environment*, with Figure 3-7 illustrating the peak sound levels at the Madison Junction 2.3 monitoring site for every day analyzed. Backcountry zones had no values over 40 dBA, and the slower travel speeds in the developed area at Old Faithful resulted in no values over 70 dBA there. Travel corridors had regular occurrences of maximum sound levels over 70 dBA. Ninety-four percent of these there were from high-stack Bombardiers. These are all snowcoaches owned by the NPS and operated under contract by Xanterra. As discussed in *Alternatives*, NPS is working with Xanterra to direct a retrofit or replacement of these vehicles by 2011 so that they meet the same BAT noise requirement as snowmobiles authorized for use in Yellowstone. This will eliminate the highest sound levels over the course of this plan, bringing maximum sound levels to within the moderate range of impacts. Therefore, Alternative 2 is expected to have moderate impacts for maximum sound levels.

Overall, Alternative 2 is predicted to have moderate impacts for both audibility and maximum sound levels in Yellowstone, as based on analyses of monitoring data, coupled with the implementation of snowcoach BAT during the life of this plan. Soundscapes impacts are predicted to be moderate, adverse, direct, and short-term in Yellowstone.

As described in the *Affected Environment, Soundscapes* section, soundscape monitoring in Grand Teton and the Parkway was conducted when snowmobile use levels were well below the daily entry limits allowed under this alternative. Therefore, unlike in Yellowstone where monitoring data exists for use levels consistent with the daily entry limits under this alternative, no such data is available for Grand Teton. The monitoring data that does exist, reflecting actual conditions over several previous winters, would be judged as negligible or minor for any of the management zones. Since it would be reasonable to expect some increase in use of Jackson Lake as more winter anglers acquire BAT snowmobiles, some increase in the audibility levels would also be reasonable to expect. For example, snowmobile use on Jackson Lake totaled 309 for the 2007-2008 winter season, with a peak day of 15, indicating a slight upward trend over the previous three years (although the daily average for the season was only about 3 snowmobiles). It should also be noted that snowmobiles are only used on Jackson Lake for travel to and from fishing locations, rather than for touring, sightseeing, or other activities. Therefore, they are in use only for relatively brief periods of time and shut down for the majority of the day. Based on the very low levels of audibility monitored to date, the very modest growth trend exhibited on Jackson Lake, and the type of use, the NPS does not expect that audibility impacts would exceed minor levels in the foreseeable future, or upon reaching the daily entry limit under this alternative. Likewise, historic use of the Grassy Lake Road, the available monitoring data, and lack of any factors that indicate the potential for substantial increases in use of that route strongly suggest that impacts would not exceed minor in the foreseeable future or upon reaching the daily entry limit.

Overall, the effects of Alternative 2 on natural soundscapes for Grand Teton and the Parkway would be expected to be minor.

Mitigations

The impacts identified above would be mitigated in several ways under this alternative. In addition to the elements fundamental to the alternative that already help to mitigate soundscapes impacts (low snowmobile number limits, BAT requirements for snowmobiles, guided groups), at least three other mitigations would be employed.

First, as discussed in *Alternatives*, BAT requirements for snowcoaches would go into effect in 2011, just after the expiration of this plan. In preparation for the implementation of this requirement, however, snowcoach operators—primarily Xanterra—have already begun taking steps to reduce snowcoach sound levels. Xanterra has already retrofitted three of its high-stack Bombardier snowcoaches to be in compliance with the BAT noise requirement and has plans to retrofit or retire its remaining Bombardiers during the life of this plan. These mitigations should help to ensure that maximum sound levels remain below 70 dBA, and will also cause audibility levels to decrease (quieter vehicles cannot be heard as far as loud vehicles).

Second, changes in snowcoach driver behaviors can also help to reduce both audibility and maximum sound levels. The NPS (and Xanterra) provide annual training to all guides and outfitters. At such sessions the NPS educates drivers on the effects of their driving behaviors on OSV audibility and maximum sound levels. Through educational efforts, the NPS will promote behaviors that are beneficial to the park soundscapes. Those behaviors can also include changes in snowmobile guide behaviors, such as encouraging their clients to shut off their snowmobiles when stopped to view wildlife or scenery and avoiding maximum accelerations.

Third, soundscapes monitoring will continue under this alternative. If this monitoring indicates that OSV use is having unacceptable effects on soundscapes that cannot otherwise be mitigated, the NPS can take steps, including reducing the daily allowable numbers of either snowcoaches or snowmobiles, to protect park soundscapes sufficiently.

Cumulative Effects

The area considered for cumulative impact assessment is natural soundscapes within the boundaries of the three park units. Because individual sources of sound are generally transient and short lived, the potential cumulative impact on the winter soundscape are those sounds occurring during the winter season. Sounds other than those that naturally occur in the park units during the winter include the sound of wheeled vehicular traffic along roads, the sound of oversnow vehicles on groomed routes, aircraft overflights, sounds associated with skiers and snowshoers, and mechanical and electrical sounds coming from facilities in developed areas (see *Affected Environment, Soundscapes*).

Along travel corridors, backcountry areas, and in developed areas, the natural soundscape is affected by non-natural sounds. There are areas in the parks where the total cumulative effect from OSV activities and facilities (buildings, utilities, etc.) is such that it masks the natural soundscape for most of a winter day. Conversely, particularly in transition zones, unoccupied road corridors, and in the backcountry, natural sounds such as wind, bird calls, or thermal activity dominate.

Administrative use of both snowcoaches and snowmobiles by NPS and concessions employees and their researchers, contractors, and guests will continue under either alternative, although such use will be reduced under Alternative 1 relative to current levels because Old Faithful

Snowlodge will be closed. As discussed above, monitoring indicates that such uses constitute 21 to 26% of the percent time OSVs are audible. In developed areas, the contribution of administrative travel is not so high as to raise the impact determinations, but at one travel corridor site, Madison Junction 2.3, it could raise OSV audibility from the predicted 46% (a moderate impact) to 54% (a major impact).

The NPS will mitigate this cumulative impact in several ways. An action common to both alternatives is that NPS will require all park employee guests and all park researchers and contractors to utilize BAT snowmobiles or snowcoaches for their intra-park travel. Park employees will be required to utilize such vehicles for their travel by the end of this plan and will be encouraged to do so before then. NPS will be moving toward implementing BAT sound requirements for snowcoaches during the life of this plan. At the annual guide and outfitter training, NPS will educate guides about the effects of their driving and guiding habits on park soundscapes. NPS will continue its monitoring efforts and will use the adaptive management plan to adjust OSV numbers as needed to protect park soundscapes. NPS will also encourage its employees to take fewer trips or combine multiple trips into single ones. In these ways, NPS seeks to minimize the contribution of administrative travel to OSV audibility and expects that audibility levels will fall within the moderate range of impacts.

Sound sources from outside the park may contribute to the sound environment in the parks, particularly near park boundaries. These influences may include motorized uses on adjacent lands, including the town of West Yellowstone and some USFS lands. Monitoring data about three miles inside the Yellowstone boundary near West Yellowstone indicated that OSVs outside the park boundary were heard as often as visitor OSVs within the park.

In addition, the following may contribute to the cumulative effects on soundscapes in the parks:

The GYA has been experiencing rapid population growth for the last twenty years. Such growth can lead to more demand for recreation (especially snowmobiling, cross-country skiing, and snowshoeing), with more recreationists in and near the parks.

Various planning efforts are under way for the National Forests surrounding the parks. These plan revisions could contribute to or decrease sounds near park boundaries, depending on technology requirements and route designations or area closures:

- Shoshone National Forest master plan revision.
- Bridger-Teton National Forest master plan revision.
- Gallatin National Forest Travel Plan revision. The USFS recently completed the travel plan for this national forest.
- Beartooth District of Custer National Forest travel management plan revision.

During the winter, the Yellowstone natural soundscape is relatively unaffected by sources of non-natural sound other than oversnow vehicles, except for aircraft overflights, which are audible between 3-10% of the average day (NPS unpublished data). Where roads are plowed in the northern portion of the park, most human-caused sound is from wheeled vehicles – but this source lies outside the primary area of concern. Without recreational OSV use (i.e. if Alternative 1 is implemented), other sources of non-natural sound would decrease with the reduced need for administrative travel, grooming, and other support.

In Grand Teton, the sound of oversnow vehicles would be additive to other sources including transient aircraft overflights, activities associated with the Jackson Hole Airport, and highway

traffic along US 191 from Jackson Hole north to Flagg Ranch and US 26 from Moran Junction to the park's east boundary. As a portion of the cumulative human-caused sounds in the park, OSV use would be a smaller component than in Yellowstone. However, in the northern areas of Grand Teton and the JDR, where there are fewer cumulative sound sources, OSV sounds would contribute a higher proportion to the total cumulative impact, for Alternative 2.

Grand Teton is currently preparing an Environmental Impact Statement on extending the Jackson Hole Airport's use agreement for an additional two ten-year terms (for 2033-2053). While the overall trend during the recent years has been increasing numbers of enplanements and aircraft operations, if the agreement is extended, soundscape impacts from the Jackson Hole Airport operation are expected to increase slightly through 2025. In Grand Teton, the cumulative effects of non-natural sounds are likely to have minor effects.

These cumulative soundscape impacts, overall, are likely to have minor effects on Yellowstone soundscapes, with the exception of potential moderate effects within a few miles of the western boundary near the USFS lands with heavy OSV use. The NPS will mitigate the effects of administrative travel in several ways, such that the overall effects of this alternative along with cumulative effects on Yellowstone's soundscape will be moderate.

Conclusions

Monitoring data from the last four winters was used to analyze the effects of implementing the two alternatives. Alternative 1 would result in minor impacts to park soundscapes, because visitor travel would cease but administrative travel would continue and sound from West Yellowstone would continue to affect western portions of Yellowstone. Alternative 2 would result in moderate impacts, due to impacts on audibility and maximum sound levels in Yellowstone, and minor impacts on audibility and maximum sound levels in Grand Teton. Neither alternative is expected to significantly affect the environment in the parks.

Unacceptable Impacts and Impairment

The effects on soundscapes estimated under either alternative will not be unacceptable because winter silence will be predominant away from developed areas and road corridors and present at certain times of day and certain places even in those areas (for example, under Alternative 2, during the midday periods on the West Entrance Road, when most guided groups are at Old Faithful or other park attractions). The soundscapes impacts are also acceptable under Alternative 2 because some non-natural sounds are expected in developed areas and road corridors due to the need for people to use motorized vehicles to reach Yellowstone and Grand Teton's widely spaced wonders, and the levels of such sound under that alternative are at only moderate levels. Finally, maximum sound levels under both alternatives are expected to remain below levels that are acceptable to most visitors as snowcoaches are retrofitted to be BAT. Although some motorized sounds will be evident in developed areas and roadside corridors, winter's silence and the natural soundscapes will generally be readily available to the majority of visitors. Because no unacceptable conditions will result, there will be no impairment of soundscapes (by definition, impairment is worse than unacceptable conditions).

Effects on the Socioeconomic Environment

Methodology

This section analyzes how winter use management alternatives would likely impact recreational use in the Greater Yellowstone Area (GYA) and how impacts to such use would impact economic activity (expenditures and employment) within the area. The economy of the GYA

and the estimated socioeconomic impacts associated with the winter use management alternatives are described in an analysis prepared for the National Park Service (NPS) by Duffield and Neher (2006 and 2007). This section summarizes the methodology and data used in the analyses. Readers are encouraged to refer to those documents for technical details.

Duffield and Neher (2006 and 2007) describe the economy of the GYA at three different levels: a state level (Idaho, Montana, and Wyoming), a county level (Fremont County in Idaho, Gallatin and Park Counties in Montana, and Park and Teton Counties in Wyoming), and a community level (Cody, Jackson, and Wapiti, Wyoming, and West Yellowstone, Montana). Recreational use and visitor expenditure levels were estimated and then the economic impacts associated with each alternative were estimated at the three levels described above.

The economic impacts of Alternative 2 are estimated relative to Alternative 1, the no-action alternative, which would prohibit recreational snowmobile and snowcoach use in the parks and would not allow plowing of interior roads (except the road from Gardiner to Mammoth to Cooke City and U.S. 191 would still be plowed).

An estimate of socioeconomic impacts is presented that is based primarily on the observed visitation resulting from visitation under the 2004 *Temporary Winter Use Plan* (and the winter of 2007-08, covered by the 2007 FEIS).

IMPLAN Modeling

The socioeconomic analysis relies on IMPLAN modeling. IMPLAN is an "input/output" economic model designed by the U.S. Forest Service and is commonly used by state and federal agencies for planning and evaluation purposes. For example, Dean Runyan and Associates used IMPLAN modeling in a report to the State of Wyoming on the economic impact of travel in Wyoming (Dean Runyan 2006). Among other outputs, IMPLAN generates estimates of output and employment. Output is the total business revenue generated by a given activity such as park visitation, and employment is the resulting number of jobs (all jobs – full and part time) associated with that activity.

There are four important caveats that are relevant to the interpretation of the IMPLAN model estimates generated for this analysis. First, the model is static in nature and measures only those effects resulting from a specific activity change at one point in time. Thus, IMPLAN does not account for any subsequent behavioral adjustments that may occur in the economy. For example, a change in the NPS plan for snowmobile management within the parks may encourage local businesses to diversify or modify their operations. These changes could thereby abate potential reductions in output and employment, a change not captured by IMPLAN. Further, IMPLAN does not estimate any potential re-employment of the labor force that may be displaced by management changes (for example the increased employment opportunity provided by guiding). Therefore, the long-run net output and employment impacts resulting from the modeled changes in winter use management would likely be smaller than those estimated by the model. The second caveat to the interpretation of the IMPLAN model estimates generated for this analysis is that they rely on the economic relationships derived from the latest data available, which are from 2003 (Prior analyses relied on earlier IMPLAN data sets and that information is available in those documents—the 2000 EIS, 2003 SEIS, and 2004 EA). Third, IMPLAN information is based on year-round data; winter seasonal information may not be as accurate. Fourth, for small analysis areas (Wapiti, Wyoming, for example) the IMPLAN data may not be an accurate representation of the actual economy due to lack of information. However, the most powerful use for economic modeling is in the comparisons between

alternatives. The impacts of the two alternatives on economic resources can be modeled and compared and the decision maker can understand the effects of the different alternatives.

IMPLAN Model Application

The modeling of the regional economic impacts associated with changes in visitation (and associated visitor spending) on an economic area requires several types of information. In the case of this analysis, the primary driving factor for the IMPLAN model is the changes in the number of visitors from outside an analysis area who decide not to visit the analysis area. For the following analysis, the percentage of visitors to the parks who did not live in each of the economic analysis areas was taken from the results of the 1997-1998 survey of winter park visitors (Duffield and Neher 2000). Specifically, 82.5 percent of visitors lived outside of the five-county area, 65.5 percent lived outside the three-state region, and 99 percent lived outside each of the three communities (Cody, Jackson, and West Yellowstone).

In addition to the change in visitation, the average spending per visitor is required. As noted in *Affected Environment*, per-visit expenditures were estimated using a time series model of West Yellowstone resort tax collections and West Entrance visits. This regression model of winter visitation and tax receipts estimates that for every West Entrance winter visit, $175.33 is spent on taxable goods and services in the community of West Yellowstone. This spending does not represent total trip spending for an individual as he or she may visit the park more than once on a trip or may visit other areas in the vicinity such as national forest lands.

Finally, in order to accurately input the expenditure changes into the IMPLAN model, it is necessary to understand the general distribution of non-resident visitor spending across economic sectors (for instance, lodging, restaurants, rental cars, etc.). The distribution of spending across economic sectors is also drawn from the 1997-1998 winter visitor survey. That survey asked winter park visitors to detail their spending patterns within the GYA. Based on these responses, visitor spending was allocated as 27.5 percent lodging, 24.6 percent automotive and gas stations, 17.1 percent miscellaneous retail expenditures, 14.3 percent eating and drinking establishments, 11.5 percent scenic and recreational transportation, and 5 percent other amusement services. Using these parameters, total estimated direct changes in non-resident visitor spending due to an action alternative, and relative to one of the no-action alternatives, is input into the IMPLAN program.

The IMPLAN program estimates total output and employment impacts, which include indirect and induced impacts arising from the initial direct spending impact, and allocates these impacts across the sectors of the analysis area. Direct impacts reflect the initial spending at local businesses by visitors from outside the GYA. Indirect impacts reflect the subsequent spending by businesses for required inputs such as capital and labor. The induced effects reflect the resulting changes in household income for local residents.

At its most aggregated level, IMPLAN modeling applies output and employment multipliers to the initial visitor spending to arrive at estimated total output and employment impacts. In general, the smaller and less diverse the analysis area is, the closer its expenditure multiplier is to 1.0. Conversely, the larger and more diverse an economy, the larger are its multipliers.

The resulting output and employment impacts are presented below. These impacts represent changes (adverse or beneficial) from the existing economic output and employment levels presented in Table 3-4. The definitions of impact categories below were used to qualitatively describe these impacts.

Current and Historical Use Levels

Recent visitation data and trends are presented in *Affected Environment, Visitor Access*. For the economic impact estimates, use was assumed to be equal to current use levels, as represented by the 2005-2006 winter (a total of 88,718 visits). These are Yellowstone-only numbers because use levels on the Grassy Lake Road, and Jackson Lake are relatively small, and other types of use (wheeled vehicle travel and skiing) are not altered by any alternatives in Grand Teton.

Two different historical use levels are used for comparison: the 1997-1998 winter (or total of 119,274 visits in Yellowstone) and winter 2001-2002 (the most recent high winter and nearly equaling the historical high winters of the early 1990s) or 144,490 visits (Duffield and Neher 2007).

Assumptions for Recreational Use Levels by Alternative

Alternative 1 would have no snowmobile or snowcoach access. Motorized oversnow use in Yellowstone National Park has historically composed over 70 percent of total winter visitation and nearly all visitors entered via the west, south, and east entrances. An analysis of the distribution of recreational use since the winter use management plan changes began in 2001 suggests little evidence of substitution between park entrances. Additionally, an analysis of snowmobile use on national forest land near the West Entrance suggests that snowmobile use in national forests is possibly a complement to snowmobiling in the parks rather than a direct substitute. For these reasons, for the impact estimates, the level of recreational use under this alternative was assumed to be equal to the North Entrance wheeled vehicle entries plus park-wide skiing entries during the 2005-2006 winter (a total of 40,029 visits).

The estimated baseline output and employment for wheeled vehicle and ski/snowshoe use is: Three State area: $9,445,730 and 173 jobs; Five County area: $7,687,891 and 146 jobs; West Yellowstone: $5,782,282 and 125 jobs; Jackson: $1,726,509 and 30 jobs; and Cody: $14,324 and 0 jobs.

Alternative 2 would continue recent use trends. The estimated level of recreational use under this alternative is recent visitation levels, 88,718 visits (2005-2006 visitation).

Impact Threshold Definitions

Negligible: The impact is at the lower levels of detection (< 5% change in either total output or employment)

Minor: The impact is slight, but detectable (5-10% change in either total output or employment)

Moderate: The impact is readily apparent and has the potential to become major (10-20% change in either total output or employment)

Major: The impact is severe, or if beneficial, has exceptional beneficial effects (>20% change in either total output or employment)

Effect of Alternative 1

Under alternative 1, no oversnow motorized recreational access would occur. As noted above, wheeled vehicle access would continue to occur through the North Entrance of Yellowstone as far east as Cooke City, Montana. With no oversnow visitation, the result is that the positive results of "no motorized oversnow access" impact estimates provided in the tables below for alternative 2 would disappear. For example, examining Table 4-2, if Alternative 1 were to be

adopted, the 3-state area would suffer an economic loss of $11,489,249 and West Yellowstone a loss of $7,033,239 (taking the figures in the far right column). With no-motorized oversnow access, the baseline output and employment, as described above, would remain.

The economic impacts presented in the tables below for "no motorized access" are the IMPLAN outputs as compared to the definition of impacts, above. A negligible impact means that the impact is difficult to detect at the state, 5-county, or community level. It does not mean that within any of those three levels adverse (or beneficial) effects are not occurring. They are. For businesses and their employees who are the companies and people behind reduction in output and employment, the adverse impacts are anything but negligible. The results also mask adverse impacts that may be occurring to types of businesses or businesses in a geographic area that is particularly dependent on park visitors. For example, businesses along the North Fork of the Shoshone River state that if the East Entrance is closed under alternative 1, most of them would close in the winter. Further exacerbating their situation is the recent downturn in visitation that has already caused some of the businesses to curtail operations or close entirely in the winter. To these businesses and others similarly situated near other entrances, the impacts of the current conditions are adverse and long-term, and alternative 1 would make the situation far worse. As another example, alternative 1 would result in the closure of the Snowlodge at Old Faithful (and probably the Mammoth Hot Springs Hotel) in the winter because the expected reduction of access would result in these overnight lodging facilities no longer being viable to operate. Also, the yurt camp at Canyon would be closed.

If Alternative 1 were to be implemented, the effects on the socioeconomic environment would be negligible-beneficial to major-adverse and long-term and regional.

Effects of Alternative 2

The economic impact estimates for alternative 2 are presented in absolute terms in Table 4-2, and in relative terms (percentages) in Table 4-3. The absolute impact levels are annual estimates. The impacts are then categorized as to intensity level in Table 4-4.

As described in Alternative 1, the economic impacts presented in the following tables for Alternative 2 are the IMPLAN outputs as compared to the definition of impacts. A negligible impact means that the impact is difficult to detect at the state, 5-county, or community level. It does not mean that within any of those three levels adverse (or beneficial) effects are not occurring. They are. For businesses and their employees who are the companies and people behind reduction in output and employment, the adverse impacts are anything but negligible. The results also mask adverse impacts that may be occurring to types of businesses or businesses in a geographic area that is particularly dependent on park visitors. To these businesses, the impacts of the current conditions are adverse and long-term, and Alternative 2 would continue those impacts into the future.

Table 4-2: Absolute Economic Impact Estimates, Alternative 2

Alternative 2 Absolute Impact Levels		---------- As compared to ----------		
Area/Estimate	Impact[a]	Historical Conditions 1997-1998	Historical Conditions 2001-2002	No Motorized Oversnow Access (and Alternative 1 losses if implemented)
3-State Area				
	Total Output	-7,210,366	-13,160,640	11,489,249
	Total Employment	-134	-245	214
5-County Area				
	Total Output	-5,868,525	-10,711,461	9,351,114
	Total Employment	-109	-198	173
Cody, WY				
	Total Output	-303,488	-414,499	121,114
	Total Employment	-7	-9	3
Jackson, WY				
	Total Output	-1,317,925	-2,405,528	2,100,028
	Total Employment	-23	-41	36
West Yellowstone, MT				
	Total Output	-4,413,885	-8,056,395	7,033,239
	Total Employment	-95	-174	152
Wapiti, WY				
	Total Output	-204,983	-279,963	81,803
	Total Employment	-6	-8	2

[a] Total output is in dollars, and total employment is in full and part-time jobs.

Table 4-3: Relative Economic Impact Estimates, Alternative 2

Alternative 2: Relative Impact Levels		---------- As compared to ----------		
Area/Estimate	Impact [a]	Historical Conditions 1997-1998	Historical Conditions 2001-2002	No Motorized Oversnow Access (and Alternative 1 losses if implemented)
3-State Area				
	Total Output	-0.00%	-0.01%	0.01%
	Total Employment	-0.01%	-0.01%	0.01%
5-County Area				
	Total Output	-0.06%	-0.11%	0.10%
	Total Employment	-0.09%	-0.17%	0.15%
Cody, WY				
	Total Output	-0.03%	-0.05%	0.01%
	Total Employment	-0.06%	-0.09%	0.03%
Jackson, WY				
	Total Output	-0.07%	-0.13%	0.11%
	Total Employment	-0.11%	-0.20%	0.18%
West Yellowstone, MT				
	Total Output	-2.64%	-4.82%	4.21%
	Total Employment	-4.08%	-7.44%	6.49%
Wapiti, WY				
	Total Output	-1.99%	-2.72%	0.79%
	Total Employment	-5.40%	-7.83%	2.16%

[a] Impacts are expressed as percentage changes from the respective existing economic output and employment levels presented in Table 3-1.

Table 4-4 indicates the potential effects of implementing Alternative 2. All effects would be long-term, regional, and both direct and indirect.

Table 4-4: Categorization of Economic Impact Levels for Alternative 2

Alternative 2 Economic Impacts	---------- As compared to ----------		
Area	Historical Conditions 1997-1998	Historical Conditions 2001-2002	No Motorized Oversnow Access
3-State Area	Negligible Adverse	Negligible Adverse	Negligible Beneficial
5-County Area	Negligible Adverse	Negligible Adverse	Negligible Beneficial
Cody, WY	Negligible Adverse	Negligible Adverse	Negligible Beneficial
Jackson, WY	Negligible Adverse	Negligible Adverse	Negligible Beneficial
West Yellowstone, MT	Negligible Adverse	Minor Adverse	Minor Beneficial
Wapiti, WY	Minor Adverse	Minor Adverse	Negligible Beneficial

Cumulative Effects

In *Purpose and Need*, a variety of trends and actions are listed that directly or indirectly influence socioeconomics. Some of these beneficial trends are population growth and suburban and rural land subdivision in the communities and counties of the Greater Yellowstone Area and oil and gas leasing. Some of these beneficial trends are reflected in the 1999-2003 comparisons found in *Affected Environment, Socioeconomics*.

Specific projects in the parks that have (or will have) a generally beneficial bearing on socioeconomics include the new Old Faithful and Canyon visitor centers in Yellowstone, the new Craig Thomas Discovery and Visitor Center and Laurance S. Rockefeller Preserve in Grand Teton, road reconstruction in Yellowstone and Grand Teton, and Grand Teton's summer transportation plan. Some of these longer-term beneficial projects may, in their implementation phase, depress visitation. For example, road construction projects are aggravating to most drivers, some of whom may avoid the portion of the park (and nearby communities) where road work is occurring. Similarly, replacing visitor centers often means a temporary facility is provided (not to mention the disturbance from construction activities). This may also be discouraging to some visitors.

Elsewhere in the region, some of the specific projects that have affected socioeconomics include the relocation of a substantial number of Marathon Oil Company employees from Cody, highway reconstruction over Togwotee Pass, and replacement of the tram at the Jackson Hole Ski Resort. The first had a substantial adverse impact on output and employment in Cody and Park County, Wyoming. The latter two, when completed, could be beneficial to visitation and recreation.

An increase in park visitation would be additive to the existing broad trend of economic growth and employment opportunities. A reduction in park visitation would be somewhat offset by the beneficial regional economic trend related to resource extraction, residential growth, other recreation opportunities, and wildlife and other natural environment attractions. Alternative 2 would allow for levels of use that equal average current use and allow for some growth, particularly through snowcoaches. Therefore, this alternative would likely be additive to all

other current and reasonably foreseeable actions contributing to a beneficial multi-regional economy.

As indicated in *Purpose and Need* and noted in the Alternative 2 cumulative effects, a number of trends and actions inside and outside the parks have the potential to impact the economics of the communities or the region. A reduction in park visitation might be somewhat offset by the beneficial regional economic trend related to resource extraction, residential growth, other recreation opportunities, and wildlife and other natural environment attractions. With the prohibition of motorized oversnow recreational use, Alternative 1 would likely discourage out of state visitors from coming to the area and contributing to local regional economies. It is likely that this alternative would represent an overall adverse impact on regional economic trends.

Conclusions

The direct impacts of implementing Alternative 1 would range from beneficial, negligible to major, adverse impacts resulting from direct and indirect actions and would be long-term and regional. As described earlier, the adverse direct impacts would be most directly felt by communities and businesses near the parks, especially in areas that have a higher proportion of business tied directly to park visitation. The indirect impacts from implementing alternative 1 would be negligible, beneficial (for communities near the North Entrance) to major, adverse, long-term, and regional for the balance of park gateway communities and regions. As individual businesses are adversely affected, they would reduce purchases of other goods and services from suppliers.

In terms of cumulative impacts, some of the communities and areas near the park have already identified adverse impacts, including reduced income and employment, which have occurred over the past few years; implementing Alternative 1 may exacerbate these effects. Implementing Alternative 1 would contribute a negligible, beneficial to major, adverse, long-term, regional impact to past, present, and foreseeable actions and impacts on socioeconomics.

The direct impacts of implementing Alternative 2 would generally range from negligible, beneficial to minor adverse and would be long-term and regional. As described earlier, the adverse, direct impacts would be most directly felt by communities and businesses near the parks, especially in areas that have a higher proportion of business tied directly to park visitation. The indirect impacts from implementing Alternative 2 would be negligible, beneficial to moderate, adverse, long-term, and regional. As individual businesses are adversely affected, they would reduce purchases of other goods and services from suppliers.

In terms of cumulative impacts, some of the communities and areas near the park have already identified adverse impacts, including reduced income and employment, which have occurred over the past few years; implementing alternative 2 may exacerbate these effects. Implementing alternative 2 would contribute a generally negligible-beneficial to negligible-adverse, long-term, regional impact to past, present, and foreseeable actions and impacts on socioeconomics.

Effects on Air Quality and Air Quality-Related Values

Methodology

The area of analysis for air quality and air quality related values is the three park units.

Methods are based on monitoring information compiled from the last five years; both alternatives are compared to periods of time with similar use levels. Air quality monitoring has been year-round, including times in fall and spring when only administrative travel is present in

the park, with no visitors present. These time periods serve as good proxies for Alternative 1, because it would allow administrative travel but no recreational travel. The last two winters have seen visitor use levels similar to those that would be allowed under Alternative 2, so the air quality monitoring information from those two winters serves as good proxies for that alternative.

Impact Threshold Definitions

Using monitoring information as the basis for determination of impacts is not always possible, because the impacts of a given alternative may never have been seen in a given locale. In this case, as discussed above, excellent monitoring information is indeed available. The strength of this analysis, then, lies in the fact that on-the-ground, real-world conditions are being used to assess impacts, not air quality modeling. While air quality modeling is useful in the instances where monitoring information is limited or not available, it is hypothetical and may not be accurate.

Because the impact threshold definitions in this document are based upon monitoring, they must be given in the same terms in which monitoring results are provided. Therefore, stating impact threshold definitions in tons per year of a given pollutant, as the 2007 FEIS did, is not useful here, because it is very difficult to calculate the annual mass of a pollutant when the monitoring provides only the concentration of the pollutant.

The National Park Service has provided some guidance (NPS Natural Resources Program Center 2003) to all parks for establishing air quality impact threshold definitions. Although this guidance is based partly on the tons per year of a given pollutant, it is also based on the current air quality or concentration of that pollutant. Those current concentrations are given in percentage of the National Ambient Air Quality Standards (NAAQS): a negligible impact is <60% of the NAAQS for that pollutant, minor is <80%, and both moderate and major are >80% (with the difference between the two based on the tons per year of the given pollutant). The NAAQS are an objective standard established by the EPA in order to protect air quality and public health. Therefore, they are appropriate levels to use as baseline to ensure that air quality within the park is not impaired or adversely impacted by oversnow vehicle use.

Because the tons per year of any pollutant were not available for this analysis, the following impact threshold definitions are based only upon the current concentration portion of the national guidelines. To confer a higher level of protection on Yellowstone's air quality, the suggested definitions for current air quality were adjusted downwards, to be more conservative (and therefore protective of park resources) as air quality is examined.

Because CO and particulates are the primary pollutants of concern with winter use, the focus of this analysis is on them. Hydrocarbons are also a concern, but more from an employee health and safety perspective; that section of this EA discusses hydrocarbons.

Negligible: The impact on air quality is not measurable or perceptible. Measured emissions concentrations are less than 40% of the NAAQS for CO or PM. No perceptible visibility impacts are likely (no visible smoke, plume, or haze).

Minor: The impact on air quality is measurable, but localized within a relatively small area. Measured emissions concentrations are between 40 and 60% of the NAAQS for CO or PM. No perceptible visibility impacts are likely (no visible smoke, plume, or haze).

Moderate: The impact on air quality is measurable and perceptible, possibly throughout the parks, but could be reversed and generally localized. Measured emissions concentrations are between 60 and 80% of the NAAQS for CO or PM. Perceptible visibility impacts occur, but are only visible from a small area of the park, are of short duration (less than one day) and visible to only a few park visitors on the days that they occur.

Major: The impact is substantial and highly noticeable park-wide. Measured emissions concentrations are more than 80% of the NAAQS for CO and PM. Perceptible visibility impacts occur and are visible from several areas of the park, occur between one and several days, and many park visitors may observe them on the days that they occur. Class I air sheds, or areas within them, are degraded.

Effects of Alternative 1

This alternative would prohibit motorized recreational use of the parks, so the only travel—and therefore emissions—would derive from administrative travel. Currently, Yellowstone's interior roads are closed to public travel from the first weekend of November through mid-December, when they reopen to public oversnow travel. In spring, the oversnow roads close to the public in early to mid-March for spring plowing; they are reopened to the public beginning in mid to late April. These two periods, then (spring and fall), have conditions nearly identical to what would occur if this alternative were implemented.

Table 4-5 displays the air quality monitoring results from spring and fall of 2006 and 2007 from the West Entrance. Note that spring and fall data are not available for Old Faithful.

Table 4-5: Spring and fall emissions concentrations for 2006 and 2007 at Yellowstone's West Entrance (CO in ppm, PM2.5 as ug/m^3).

Statistics	Spring 2006	Fall 2006	Spring 2007	Fall 2007
Max. 1-hr. CO	0.60	0.70	0.90	1.10
Max. 8-hr. CO	0.33	0.41	0.26	0.35
Season average for CO	0.16	0.10	0.15	0.10
90^{th} percentile for CO [a]	0.20	0.20	0.20	0.20
NAAQS for CO: 1-hr. is 35 ppm for National & WY, 23 ppm for MT; 8-hr is 9 ppm for all three.				
Max. 1-hr. PM2.5	15	262	16	275
Max. 24-hr. PM2.5	4.1	37.1	4.4	14.1
Season average	1.8	3.6	4.4	12.2
98^{th} percentile	4.1	37.1	2.3	3.1
NAAQS for PM2.5: 24-hr PM 2.5 98^{th} percentile is 35 for National & MT (15 for MT for annual), 65 for WY				

[a] The 90^{th} percentile is not used by the NAAQS. It is a useful way to track higher concentrations without the points being dominated by possible statistical outliers.

Alternative 1 would probably result in slightly lower emissions concentrations than given in Table 4-5, for three reasons. The data provided in this table come from the West Entrance monitoring station, which is very close to West Yellowstone. Some pollutants could drift in from the town, raising the levels over what would be found elsewhere in Yellowstone, such as at Old Faithful. Second, Alternative 1 could result in even lower administrative travel than currently occurs in spring or fall, because the Old Faithful Snowlodge would be closed, resulting in a

reduction in concessions administrative travel. Third, there is little, if any smoke in winter from wildfires, which accounts for the high readings in fall.

Calculating the percentage of the NAAQS that spring and fall CO values comprise was done by averaging the four 1-hour values and the four 8-hour values. The 1-hour values average 0.825 ppm, which is 2.4% of the NAAQS (using the national standard; the same value is 3.6% of the more conservative MT standard). The 8-hour values average 0.3375 ppm, which is 3.8% of the national standard (and the MT and WY standards). All these values fall well within the negligible category.

For PM2.5, the autumn values were discarded because they are influenced by wildfire smoke (Ray 2008); such smoke is not present in winter. Some smoke from woodstove or fireplace fires would be present, but it is already included in the spring values (spring is easily within the heating season in the Northern Rockies). The average of the two spring 98th percentile values is 3.2 ug/m^3, which is 9.1% of the national standard (21.3% of Montana's annual standard and 4.9% of Wyoming's standard). All of these values fall within the negligible range of impacts.

The NPS is not aware of any visibility impacts from spring or fall at either West Yellowstone or Old Faithful (other than wildfire-related impacts, which are not included in this analysis). Therefore, the NPS expects that implementation of this alternative would not result in any visibility problems.

For CO, PM2.5, and visibility, the effects of implementing Alternative 1 on air quality and air quality related values would be negligible, direct, adverse, and lasting for the duration of this plan.

Effects of Alternative 2

In allowing 318 snowmobiles and 78 snowcoaches per day in Yellowstone, this alternative would have use levels similar to those seen in the last two winters. Last winter, an average of 294 snowmobiles and 35 snowcoaches per day entered the park; two winters ago, 299 snowmobiles and 34 snowcoaches per day was the average. Actual use levels in Grand Teton the last several winters have been far less than the authorized levels (this alternative would permit 25 snowmobiles each on Jackson Lake and the Grassy Lake Road). In 2007-08, Jackson Lake saw an average of less than three snowmobiles per day, and only 165 snowmobiles were recorded on the Grassy Lake Road the entire season.

Air quality monitoring data for the past two winters serves as an excellent proxy for the air quality impacts likely to be experienced under this alternative. For snowmobiles, the averages from the last two winters are within 10% of the limit proposed under this alternative; for snowcoaches, these averages are less than half the number permitted by this alternative. However, the air quality monitoring data from the last two winters include 29 days where more than 396 OSVs (a number equivalent to the combined number of snowmobiles and snowcoaches permitted under this alternative) entered the park (14 days from last winter and 15 from 2006-07), along with 50 days where between 318 and 396 OSVs entered the park (25 days from each winter). The data, therefore, include many days with a number of vehicles traveling through Yellowstone similar to that which would be seen if this alternative would be implemented. These data are presented for both the Old Faithful and West Entrance monitoring sites for both winters in Table 4-6.

Table 4-6: air quality monitoring results from the last two winters (CO in ppm, PM2.5 as ug/m^3).

Statistics	Winter 2006-07, West Entrance	Winter 2006-07, Old Faithful	Winter 2007-08, West Entrance	Winter 2007-08, Old Faithful
Max. 1-hr. CO	3.7	0.9	6.1	0.9
Max. 8-hr. CO	0.8	0.4	1.6	0.4
Season average for CO	0.19	0.27	0.23	0.19
90th percentile for CO [a]	0.27	0.19	0.4	0.24
NAAQS for CO: 1-hr. is 35 ppm for National & WY, 23 ppm for MT; 8-hr is 9 ppm for all three.				
Max. 1-hr. PM2.5	40	20	44	32
Max. 24-hr. PM2.5	8.8	6.6	9.5	8.1
Season average	2.1	3.3	2.6	3.2
98th percentile	8.7	6.4	7.8	5.8
NAAQS for PM2.5: 24-hr PM 2.5 98th percentile is 35 for National & MT (15 for MT for annual), 65 for WY				

[a] The 90th percentile is not used by the NAAQS. It is a useful way to track higher concentrations without the points being dominated by possible statistical outliers.

Table 4-7 displays the percent of the NAAQS that the values in table 4-6 comprise.

Statistic	West Entrance (average of two winters)	Old Faithful (average of two winters)	Average of both West Entrance and Old Faithful
1-hr CO, percent of national NAAQS	14.0%	2.6%	8.3%
1-hr CO, percent of MT NAAQS	21.3%	3.9%	12.6%
8-hr CO, percent of all 3 NAAQS	13.3%	4.4%	3.5%
98th percentile PM 2.5, percent of national NAAQS	23.6%	17.4%	20.5%
98th percentile PM 2.5, percent of MT annual NAAQS	55%	40.7%	47.8%
98th percentile PM 2.5, percent of WY NAAQS	12.7%	9.4%	11.0%

The NPS is not aware of any visibility impacts the last two winters at either West Yellowstone or Old Faithful. Therefore, the NPS expects that implementation of this alternative would not result in any visibility problems.

All of the comparisons to the national NAAQS (from 2.6 to 23.6% of the NAAQS—the highlighted rows in Table 4-7) fall within the negligible range of impacts identified in the impact threshold definitions. Therefore, Alternative 2's effects on air quality in Yellowstone are expected to be negligible, direct, adverse, and lasting for the duration of this plan.

In Grand Teton, both the actual use levels over the previous few winters, as well as use levels authorized under Alternative 2, are far lower than use levels in Yellowstone. Therefore, impacts on air quality for Grand Teton and the Parkway would be less than in Yellowstone; overall, they would be negligible, direct, adverse, and long-term.

Note that modeling was done in the 2004 EA for an alternative with a level of snowmobiles and coaches similar to Alternative 2 in this EA. That modeling suggested that 318 snowmobiles and 87 snowcoaches would produce 123 tons/season of CO and 4 tons/season of particulates. Comparing these to the impact threshold definitions in the 2007 FEIS, Alternative 2 would have a moderate impact on air quality (moderate was defined to be between 100 and 250 tons per year of a pollutant). As noted previously, however, using the monitoring results as the primary basis of comparison is generally more credible, since those are based on real-world conditions. For purposes of this EA, therefore, Alternative 2 is assessed as having negligible impacts as indicated.

Mitigations

Given that neither alternative will have even minor impacts upon the parks' air quality, the continued use of BAT for snowmobiles, the continued conversion of snowcoaches to BAT during the term of this plan, and the numerical restrictions on both kinds of oversnow vehicles will serve as sufficient mitigations to protect Yellowstone's pristine air quality.

Cumulative Impacts

The area of concern includes the airshed described by all three park units and by adjacent Class I areas on national forests. Although ambient air pollution generated at great distances beyond the park boundaries is of concern compared to air quality in the parks, it is unreasonable to consider all of the western United States as an area of concern.

Levels of nitrates found in Yellowstone's snowpack can be related to regional industry (Ingersoll et al. 1997) confirming the fact that additional air pollution in the parks comes from regional industry within 150 km of the park (including oil and gas drilling and processing, power plants, and industrial combustion), urban uses, and recreational uses outside the parks. In addition to these known sources, other trends, plans, and actions that may affect air quality in the parks include population growth (such as that in Big Sky and Jackson) and the construction of a natural gas pipeline in Hoback Canyon, both of which may further degrade air quality, although to an unknown extent. Countering these effects (or improving air quality) may be the forest plan and/or travel plan revisions being undertaken by the national forests in the GYA and the Teton Pathways & Grand Teton Summer Transportation Plan, which may promote alternative transportation.

Background concentrations of air pollutants, along with pollutants from all other sources both within and outside of the parks, are already included in the monitored results. Therefore, the monitored results provide an excellent indication of what air quality conditions would be like under either alternative, including impacts from cumulative sources.

Conclusions and Unacceptable Impacts and Impairment

Under either alternative, air quality in the parks is expected to remain pristine, at less than 24% of the federal NAAQS. This small a percentage indicates how clean the winter air in the parks is

expected to be under either alternative in this EA: in a word, excellent. Unacceptable impacts would be levels of pollutants that are considerably closer to violations of the federal NAAQS, with impairment being even worse (perhaps violations of the NAAQS). With the conservative use limits and Best Available Technology restrictions for snowmobiles and the move towards cleaner snowcoaches, the NPS expects implementation of either alternative to preserve excellent air quality in the parks, air that is far removed from being unacceptable in quality or being impaired. Neither alternative is expected to significantly affect the environment in the parks.

Effects on Public and Employee Health and Safety

Methodology

The area of analysis is the parks. To assess the level of impact to employee and public health and safety for each alternative, the following types of information were used:

- Safety policies and guidelines
- Results of air monitoring near the West Entrance in Yellowstone
- Results of personal exposure and sound monitoring
- Reports from employees and commercial guides
- Past and current avalanche analyses.

Overall impacts to health and safety, including impacts for avalanche control in the Sylvan Pass area of Yellowstone, are defined below. Because personal and occupational exposure to air quality and noise contaminants has been monitored in Yellowstone, the alternatives are compared qualitatively, using the monitored data (See Jensen and Meyer, 2006; Spear et al., 2006).

Impact Threshold Definitions

Negligible: No noticeable or perceptible impact; no mitigation needed. 8-hour time-weighted noise exposure levels are below 60 dBA; peak sound pressure levels (SPL) are below 75 dBA.

Minor: Measurable or perceptible impact if ATSDR Minimum Risk Levels (MRLs)* or other established limits are rarely exceeded. If mitigation were needed, it would be relatively simple and would likely be successful. 8-hour time-weighted noise exposure levels are below 70 dBA; peak noise levels are below 80 dBA.

Moderate: Impact could cause a permanent change; ATSDR MRLs or other established limits are exceeded daily. Mitigation measures would probably be necessary and would likely be successful. 8-hour time-weighted noise exposure levels are below 85 dBA; peak noise levels are below 90 dBA.

Major: Substantial impact to employee or public health and safety; ATSDR MRLs or other established limits are exceeded more than once per day. Extensive mitigation measures would be needed, and their success would not be guaranteed. High potential exists for serious accidents or hazards. 8-hour time-weighted noise exposure levels exceed 85 dBA; peak noise levels routinely exceed 90 dBA. Maximum one second Leq levels exceed 130 dBA.

*From the Agency for Toxic Substances & Disease Registry at http://www.atsdr.cdc.gov/mrls/index.html

Effects of Alternative 1

Under this alternative, all oversnow motorized visitor use in the parks would cease, so effects on visitors would be negligible. Administrative use of the parks would continue, with road grooming done on a reduced (as-needed) basis. Sylvan Pass would be closed to such travel, with no avalanche control operations occurring (other than those necessary for search and rescue operations and spring opening procedures). Employee exposure to high noise levels would exist only when using a snowmobile. Therefore, the effects of implementing this alternative on employee health and safety would be moderate, adverse, short to long-term, and direct.

Effects of Alternative 2

This alternative would allow snowmobiles and snowcoaches to continue in Yellowstone, although all snowmobiles would have to be BAT and guided (and coaches would be guided and moving towards BAT). Administrative uses would continue, exposing visitors and employees to high noise levels. Road grooming would be done regularly, so travel conditions would generally be good, with few rough road conditions. However, continued snowcoach use could expose all travelers to snowcoach-caused ruts and bumps.

Exposure to low amounts of benzene and formaldehyde would continue under this alternative. As explained in *Affected Environment,* exposure to benzene has not exceeded any federal standards. Exposure to formaldehyde has exceeded the most conservative such standard. For both of these air toxics, monitoring will continue and adaptive management will be utilized should concerns be present.

Snowmobile use would be allowed in Grand Teton on Jackson Lake, and in the Parkway on the Grassy Lake Road. Such use levels would be relatively low, and the locations where that use would occur would be limited. The amount of associated administrative use, such as for law enforcement, would also be relatively small. Therefore, the exposure to high noise levels or other adverse conditions would be limited.

As described in *Affected Environment*, avalanche work is inherently dangerous and risks to employees may be greater than those generally posed to visitors because 1) employees conducting avalanche hazard mitigation spend more time in the pass, and 2) avalanche control work, by its very nature, is hazardous. Under alternative 2, the risk would be addressed through implementation of a strict safety-based, risk reduction program. The pass would not be open unless safety criteria are met and, in the professional judgment of park managers, operations can be conducted within acceptable levels of risk.

Significant closures of the pass may result and avalanche operations will not occur if safety criteria cannot be met. A combination of avalanche mitigation techniques may be used, including risk assessment analyses as well as forecasting and helicopter and howitzer dispensed explosives. Area staff may use whichever tool is the safest and most appropriate for a given situation, with the full understanding that safety of employees and visitors comes first. Employees in the field make the operational determination when safety criteria have been met, and operations can be conducted with acceptable levels of risk. The NPS will not take unacceptable risks. When safety criteria have been met, the pass will be open; when they have not been met, the pass will remain closed. As with past winters, extended closures of the pass may occur. Also, during the winter season, the pass will not be open for administrative travel unless it is also open to public travel, further reducing employee exposure to risk.

The results of previous safety evaluations of Sylvan Pass by the Occupational Health and Safety Administration and an Operational Risk Management Assessment will be reviewed and updated, and the NPS will evaluate additional avalanche mitigation techniques and risk assessment tools in order to further improve safety and visitor access.

Because exposure to high noise levels will continue, because exposure to avalanche risk will continue, and because the NPS will strictly adhere to safety and risk reduction measures, Alternative 2 will result in moderate, adverse, direct, and long-term impacts to employee and visitor health and safety in Yellowstone. During the duration of the temporary plan, the risk management and safety concerns will continue to be reviewed and assessed. Because the use levels and risk factors in Grand Teton and the Parkway are substantially less than in Yellowstone, the impacts on visitor and employee health and safety would also be less, and are considered to be minor, direct, adverse, and long-term.

Mitigations

For both alternatives, current mitigation measures such as the wearing of appropriate winter clothing, helmets, and earplugs would continue as needed. Other personal protective equipment would be made available for employee use as appropriate.

For Alternative 2, guiding is an effective mitigation for visitor and employee health and safety, because guides are effective at enforcing proper touring behaviors, such as staying within speed limits and on the groomed road surfaces. Requirements for BAT on snowmobiles and snowcoaches have dramatically reduced exposure to air toxics and mitigated exposure to noise. Snowcoach size limits would mitigate the effects of large vehicles upon the road surfaces. The use of hearing protection is an effective mitigation against noise exposure; the NPS recommends such protection for all OSV users, including visitors. Monitoring of air toxics and exposure to noise will continue and adaptive management utilized as needed to protect employee and visitor health and safety.

For Alternative 2, exposure to avalanche hazards would be mitigated by area-specific forecasting, control methods such as helicopter dispensed explosives, howitzer operations, grooming and/or other appropriate control methods and mitigation measures. Other mitigation includes closure of the pass when necessary to protect human health and safety (as determined by NPS personnel). During the winter season, administrative travel will only be allowed when the pass is open to the public. Closures may occur frequently for unlimited periods of time and are likely to inconvenience planned employee and visitor travel.

Cumulative Impacts

The area of concern is the parks. Few if any actions or trends from outside the parks would influence public and employee health and safety in the parks. For example, the trend toward increasing guide and outfitter activity extends to the parks, but the NPS strictly regulates the provision of guided services within the parks. As well, although changing demographics means an increasing interest in outdoor activities, all snowmobiling in Yellowstone is guided, reducing the occurrence of unsafe snowmobile behaviors.

For employees exposed to noise and rough roads, health effects may accumulate over the course of a season. Additionally, there is the potential for synergistic effects. However, under alternative 2, the provisions for BAT, limited entries, and guided groups substantially mitigate these effects. A variety of other hazards associated with winter travel may also be experienced while traveling in the parks during the winter, all of which are common to winter travel in the intermountain west. These hazards may include avalanches, rock fall, hypothermia, blowing

snow, traffic accidents and poor driving conditions. To some extent these hazards are mitigated by management action such as the cold weather advisory system and temporary road closures.

Overall, the moderate, short-term, and adverse impacts resulting from direct and indirect actions described in both alternatives would contribute a minor to moderate, adverse, short-term impact to past, present, and foreseeable actions and impacts on employee health and safety.

Conclusions

For both alternatives, continued use of snowmobiles would expose employees and/or visitors to potentially high noise levels, although the wearing of earplugs can mitigate this to a large degree. Road grooming would be less frequent under Alternative 1, while snowcoach use could affect road quality under Alternative 2, so the effects of road surface quality from either alternative on employee and visitor health and safety would be about the same. Alternative 2's provision to keep Sylvan Pass open would result in major impacts if it were not for the fact that NPS will strictly adhere to a safety-based risk reduction program. Consequently, the effects of implementing either alternative on visitor and employee health and safety in Yellowstone will be moderate, long-term, direct, and adverse, and minor, direct, long-term, and adverse in Grand Teton and the Parkway.

Effects on Visitor Access and Circulation

Methodology

Although NPS policies for Yellowstone and Grand Teton have tended to emphasize visitor experiences based on the quality of park resources rather than the mode of transport used to access them, the mode of travel that a visitor prefers is not necessarily related to intrinsic park values. The modes of travel include snowmobile and snowcoach access. This section therefore addresses the impact of changes in mode of access and the places in the parks that are accessible separately from impacts relating specifically to visitor experience.

Impact Threshold Definitions

Negligible: Changes in the modes of transportation (snowmobile and snowcoach) and in the areas accessible (as compared to current conditions) affect small areas of the parks and are imperceptible to most visitors.

Minor: Changes in the modes of transportation and in the areas accessible (as compared to current conditions) affect a few areas of the parks and are noticeable to many visitors.

Moderate: Changes in the mode of transportation and in the areas accessible (as compared to current conditions) affect a number of areas of the parks and are evident to most visitors.

Major: Changes in the mode of transportation and in the areas accessible (as compared to current conditions) affect a majority of the parks and are evident to virtually all visitors.

Impacts Common to Both Alternatives

Wheeled vehicle access from Yellowstone's North Entrance to Mammoth Hot Springs and to the Northeast Entrance and Cooke City would occur under both alternatives, as would wheeled

vehicle access in Grand Teton National Park from the South Entrance to Moran Junction and to Flagg Ranch.

Effects of Alternative 1

Under this alternative, all oversnow roads in Yellowstone would be closed to public oversnow vehicle access, although non-motorized access would be allowed. This alternative would have a major adverse impact on visitors wishing to access the parks via oversnow vehicles in the winter because changes in the modes of transport would affect most of the park and would displace nearly all visitors from the interior portions of Yellowstone where oversnow vehicle access has been the predominant means of access for several decades.

Some of those desiring non-motorized experiences would benefit, because the parks would remain open for these activities. However, accessing non-motorized trails within Yellowstone's interior would be difficult for most skiers and snowshoers. Also, for visitors who prefer to visit the park without snowmobiles present, the impact of this alternative would be beneficial.

In Yellowstone, the effects of alternative 1 on visitor access and circulation would be long-term, direct, major, and adverse because of the highly restricted nature of the access, although effects on the minority of the public desiring to see oversnow access terminated would be beneficial.

For Grand Teton and the Parkway, snowmobile access to the large expanse of Jackson Lake would no longer be available for anglers that enjoy the ice fishing opportunities. While it is possible to access some areas of the lake that are close to shore, the vast majority of the lake would be inaccessible due to the large distances involved. Lack of access to the lake would be a considerable adverse affect for the subset of park visitors for whom ice fishing is important, but this group of visitors represents only a very small fraction of the park's overall winter visitation.

Similarly, snowmobile prohibition on the Grassy Lake Road between Flagg Ranch and the Targhee National Forest would deny some visitors the opportunity to complete a long-distance snowmobile tour, or to simply access the national forest from the Flagg Ranch area. While the closure of the Grassy Lake Road within the Parkway would have important adverse effects for those visitors that wished to use it, the number of visitors affected would be very small in proportion to the overall amount of winter visitation.

Overall, the effects of Alternative 1 on visitor access and circulation for Grand Teton and the Parkway would be long-term, direct, minor, and adverse.

Effects of Alternative 2

All usual oversnow roads, including the East Entrance Road/Sylvan Pass, would remain open under alternative 2. Visitors would continue to have access to the park's major features, and visitor circulation through the parks would remain largely unchanged from current conditions. The Cave Falls Road would also be designated open for snowmobile use, making the Cave Falls feature accessible.

This alternative offers visitors several choices in experiencing the parks: guided snowmobile, guided snowcoach, cross-country skiing, and snowshoeing.

Some people for whom the experience of traveling independently (that is, without a guide) on a snowmobile is important may choose not to visit the parks because the type of access and experience they prefer is not available. The impact of this alternative would be adverse for these potential visitors.

Some visitors who would prefer to visit by snowmobile but are unable to do so because of the low daily snowmobile entry limits may choose instead to visit by snowcoach. Although these people would still have access to the park, they may be adversely affected because the snowcoach tour was not their preference. Some people may opt instead to visit the park on a less busy day, travel to a different entrance where the daily snowmobile limit has not been reached (although the driving distance between the park entrances in the winter would make this impractical in most cases), or decide not to visit the park at all. For these visitors, the effects of implementing this alternative would be adverse.

Because of the lower daily limit on snowmobiles (318 per day), visitors who desire fewer snowmobiles might find this alternative attractive. Others may still be dissatisfied that any snowmobiles are present, so the number of snowmobiles permitted under alternative 2 may be a deterrent to their visit, and the impact of this alternative on those visitors' access would be adverse.

A winter visit to Yellowstone has always been expensive; in recent years, with the advent of restrictions on use to address the concerns related to historic snowmobile use, the cost has risen further. This has been especially true for residents near the parks who previously brought their private snowmobiles in the parks and for park employees who do not live in the park's interior. With the BAT restrictions imposed in the last four winters, residents and others who do not own BAT machines can no longer bring their own sleds into Yellowstone. The guiding requirements are an additional burden for some, both financially and logistically. Further, some guides and outfitters have chosen not to operate during the Temporary Plan implementation, limiting use more. The uncertainties brought on by court decisions and the short duration of the temporary plan have prevented the NPS from offering a business opportunity to other companies who might be interested in operating and providing guide services in the winter. If and when a long-term and sustainable decision is reached, business opportunities commensurate with the decision of that plan can be offered, and businesses will be chosen though a competitive process.

In Yellowstone, the effects of alternative 2 on visitor access and circulation would be long-term, direct, minor, and adverse because the lower visitation limit could impact some visitors who would prefer to tour via snowmobile. The effects on the minority of the public desiring to see oversnow access terminated (and/or snowmobile use specifically) would be adverse, minor, direct, andlong-term.

For Grand Teton and the Parkway, visitors would continue to have the opportunity to access Jackson Lake and the Grassy Lake Road by snowmobile. This would allow anglers to access the large expanse of Jackson Lake to enjoy ice fishing opportunities, and would also allow snowmobile touring opportunities that involved the Targhee National Forest and other public lands. The opportunities provided under Alternative 2 would be important to the visitors for whom those activities are important, but that would be a very small portion of the park's overall winter visitation.

Overall, the effects of Alternative 2 on visitor access and circulation for Grand Teton and the Parkway would be long-term, direct, minor, and beneficial.

Cumulative Effects

The parks are one component of the GYA, which includes several national forests, wildlife refuges, and communities such as Jackson and Cody, Wyoming; West Yellowstone and Gardiner, Montana; and Island Park and Ashton, Idaho. Visits to the parks are often combined with visits to a wide variety of destinations elsewhere in the region and the three-state area.

Opportunities to snowmobile abound on the public lands around the parks, with both on-and off-trail access available at a variety of skill levels. Forest and/or travel planning are underway in some of the national forests around the park, but these plans are in process and it cannot be predicted how they may affect oversnow travel in the region. The USFS has begun implementation of the Gallatin National Forest Travel Plan, with varying effects around Yellowstone. Although some motorized trails will be lost, others are being formalized, and non-motorized opportunities are being strengthened as well. Opportunities to ride a snowcoach are generally limited to the parks, because snowcoaches are, for the most part, restricted from using forest trails.

The effects of these actions on visitor access and circulation in the parks, or effects in the reverse direction, are difficult to predict. As indicated in the *Environmental Consequences, Socioeconomics* discussion, use of the parks and surrounding lands does not always correlate. Some outside areas have observed decreases in use in recent years, but not at the same rate or magnitude as the parks.

Population growth through the GYA, rural land subdivision and reduction of public land access, changing demographics, improving snowmobile technologies, and increasing outfitter/guide activity may all influence visitor access and circulation in various ways. It is very difficult to predict how any one of these trends, or the interactive effects of more than one or all of them together, will influence visitor access and circulation. In general, though, the effects of these trends on park access and circulation will be indirect, at least as compared to the actual guidance provided under the two alternatives in this EA.

New or rehabilitated visitor centers with greatly improved exhibits and interpretation are underway (Canyon opened August 2005, the Craig Thomas Discovery and Visitor Center and the Laurance S. Rockefeller Plan Preserve in Grand Teton both recently opened, and Old Faithful is under construction). A new West Entrance Station and improved facilities at the West Yellowstone Interagency Visitor Center were recently completed in Yellowstone. Road improvements may eventually widen the underlying snow roads from Norris to Mammoth and Grant Village to South Entrance in Yellowstone. The Togwotee Pass Highway is also being improved and widened. Completion of the Grand Teton Transportation and Teton Pathways plans may improve non-motorized access in the Jackson/Grand Teton area, as will Rendezvous Ski Trail planning in West Yellowstone. These projects will improve access in the parks through enhanced interpretation and better facilities.

The cumulative effects of no snowmobile and snowcoach access may displace all variety of winter users to the surrounding lands, creating substantial effects there. Fewer visitors might travel to the Greater Yellowstone Area in the absence of oversnow vehicle access opportunities in the parks. Conversely, the lack of snowmobiles may attract other visitors who will recreate in other ways on the surrounding lands as part of their visit. For those who prefer to visit the parks with snowmobiles eliminated entirely, Alternative 1 may encourage these visitors to visit the GYA.

Past, present, and foreseeable actions occurring within and around the parks that could affect visitor access and circulation are the same for alternative 2 as those for alternative 1. The cumulative effects of alternative 2 may be higher than alternative 1 due to the allowance of recreational snowmobile and snowcoach use in the parks, which may result in increased use of the surrounding lands as more snowmobile-oriented visitors may travel to the Greater Yellowstone Area. For those who prefer to visit with snowmobile numbers reduced or

snowmobiles eliminated entirely, the lower number of allowed snowmobiles may encourage these visitors to visit the GYA.

Conclusions

The effects of alternative 1 on visitor access and circulation would be long-term, major, adverse (or beneficial for those visitors who don't want snowmobiles in the parks and would visit the parks only if and/or more often if no snowmobiles were present), and direct in Yellowstone and minor, adverse, long-term, and direct in Grand Teton and the Parkway because all current routes would be closed to oversnow vehicle travel.

In terms of cumulative effects, the long-term, major, adverse (or beneficial for those desiring no snowmobiles in the parks) impacts resulting from direct and indirect actions described for alternative 1 would contribute a major, long-term, adverse impact to past, present, and foreseeable actions and impacts on visitor access and circulation.

The effects of alternative 2 on visitor access and circulation would be long-term, minor, adverse (or beneficial for those who don't like as many snowmobiles in the parks), and direct because all current routes would be open to oversnow (both snowmobiles and snowcoaches) vehicle travel, including the East Entrance road/Sylvan Pass. The number of snowmobiles allowed in the parks would be similar to current conditions; therefore, on busy days, due to the daily limit of 318 snowmobiles, some visitors desiring to snowmobile would not be able to access the parks.

In terms of cumulative effects, the long-term, minor, adverse (or beneficial for those who want snowmobiles eliminated), and park-wide impacts resulting from direct and indirect actions described in Alternative 2 would contribute a long-term, minor, adverse impact to past, present, and foreseeable actions and impacts on visitor access and circulation.

Effects on Visitor Experience

Methodology

The area of analysis for visitor experience is the three parks. This section includes an analysis of quality opportunities to view and experience park resources in a minimally affected environment. Resources considered in the analysis include: opportunities to view wildlife and scenery, the safe behavior of others, quality of road surfaces, availability of information, quiet and solitude, clean air, and stakeholder values. Visitor access was separately analyzed in the foregoing section.

To evaluate the level of impact to the visitor experience for each alternative, the following types of information were used:

- Visitor surveys
- Assessment of visitation patterns
- Assessment of opportunities historically available

Impact Threshold Definitions

Negligible: Visitors have quality opportunities to view and experience the parks in a minimally-affected environment, with safe and comfortable touring conditions, ready availability to information, good opportunities to view wildlife and scenery, and easy access to quiet, solitude, and clean air.

Minor: The impact to visitor experience is slight, without appreciably limiting or enhancing critical characteristics of the experience. Although visitors may have slight difficulties finding safe and comfortable touring conditions, ready availability to information, good opportunities to view wildlife and scenery, and/or easy access to quiet, solitude, and clean air, their visits remain high quality with a high degree of satisfaction.

Moderate: The impact to visitor experience is noticeable and may be measurable, changing critical characteristics of the desired experience, or reducing or increasing the number of visitors. Visitors will occasionally have some difficulty finding safe and comfortable touring conditions, ready availability to information, good opportunities to view wildlife and scenery, and/or easy access to quiet, solitude, and clean air. Their visits are good quality with generally good degrees of satisfaction.

Major: The impact to visitor experience is substantial and measurable, eliminating, detracting from, or greatly enhancing multiple critical characteristics of the desired experience, or greatly reducing or increasing visitation. Visitors will frequently have substantial difficulty finding safe and comfortable touring conditions, ready availability to information, good opportunities to view wildlife and scenery, and/or easy access to quiet, solitude, and clean air. Their visits are fair quality with fair degrees of satisfaction.

Effects of Alternative 1

For visitors travelling in wheeled vehicles to visit the northern tier of Yellowstone, visitor access and experiences would remain unchanged. The restriction for the rest of the park to ski and snowshoe access only, however, would have substantial effects upon the visitor experience. Only a handful of visitors capable of skiing or snowshoeing many miles would be able to enjoy the wildlife, scenery, silence, solitude, and clean air in the park interior. Guides would no longer be needed and the Visitor Center at Old Faithful would be closed; both changes would diminish information availability in Yellowstone.

Compared to current conditions, this alternative's effects upon the visitor experience in Yellowstone would be adverse and substantial. Most of the park would be closed, eliminating any possible experience for most visitors (skiers and snowshoers could still use the park). In Yellowstone, the effects of Alternative 1 on visitor experience would be major, adverse, direct, and long-term.

In Grand Teton and the Parkway, there would generally be no change in terms of roads that have traditionally been plowed for wheeled vehicles, nor to the facilities that have traditionally been available to park visitors. Opportunities for a wide variety of winter activities would remain, and most visitors would be unaffected by the prohibition on the use of snowmobiles on either Jackson Lake or the Grassy Lake Road. The absence of noise associated with snowmobiles might enhance the experience of some visitors by improving opportunities for quiet and solitude. Outstanding opportunities for cross-country skiing, snowshoeing, mountaineering, wildlife viewing, and enjoyment of the scenery would continue to be available throughout the park. The experience of visitors for whom snowmobile access to Jackson Lake or the Grassy Lake Road is important would be diminished, although these visitors represent only a small portion of the park's visitation.

Overall, the effects of Alternative 1 on visitor experience for Grand Teton and the Parkway would be direct, long-term, minor, and adverse, although some visitors might characterize the effect as beneficial due to the absence of snowmobiles.

Regarding values-based responses of visitors to the rules under this alternative, adherents to recreation and tourism resource values would likely find these rules to be quite burdensome because most of the parks would have limited, non-motorized access. Some adherents to natural values would likely be encouraged by the elimination of snowmobiles and snowcoaches from the parks and other adherents to this view would likely be pleased at the clean air, quiet conditions, which would prevail under this alternative. However, some adherents to natural values would regret the lack of access possible and reduced information availability under this alternative.

Effects of Alternative 2

As summarized in *Affected Environment,* the 2008 visitor surveys indicate widespread visitor satisfaction with soundscape conditions found in the park last winter, as well as bison viewing opportunities. The continued ability to tour the parks by OSV would offer good opportunities to have an enjoyable visitor experience, especially in Yellowstone where many park attractions would not otherwise be accessible to most visitors. The requirements to use commercial guides and BAT snowmobiles under this alternative would enable good opportunities to view wildlife and scenery, generally safe touring conditions, ready availability of information, good opportunities for quiet and solitude, and clean air, similar to the conditions that have prevailed in the parks in the last four winters. Guides are familiar with typical wildlife viewing locations and routinely make impromptu stops to view wildlife and park scenery. They enforce proper touring behavior and usually provide informative commentary to their clients; other information would continue to be available at warming huts, contact stations, visitor centers and entrance stations. Because guided groups travel together and because most such groups adhere to schedules that leave large periods of time free from OSV noise, periods of quiet and opportunities for solitude will remain. Additionally, the requirement to use BAT technology will continue to mean the parks will have pristine air quality. Finally, although OSV travel may somewhat degrade the quality of groomed surfaces, most visitors would experience the parks on roads that are well-groomed on a regular basis.

The limits on snowmobile numbers will be restrictive, especially on holidays and weekends and some visitors may not be able to have the experience they desire. Although some capacity is available on snowcoaches, if visitors are willing and able to shift modes of transportation, snowcoaches could also reach capacity on traditionally busier periods.

For visitors travelling in wheeled vehicles to visit the northern tier of Yellowstone, visitor access and experiences would remain unchanged.

Compared to the no-action alternative, this alternative would offer a significantly better visitor experience (except for the small minority who could ski the long distances between park attractions under the no-action alternative) since it would allow motorized access to the parks to continue. Effects of implementing this alternative in Yellowstone would be minor, adverse, long-term, and direct because the low visitation limits under this alternative could preclude trips into Yellowstone for some visitors.

For Grand Teton and the Parkway, visitors would have the opportunity to enjoy ice fishing on Jackson Lake, and have access to snowmobiling opportunities along the Grassy Lake Road and in the Targhee National Forest. Opportunities for ice fishing on Jackson Lake would be

enhanced since snowmobiles would make the entire lake available, rather than only those areas within walking distance of the shore. Visitors would continue to enjoy outstanding opportunities for cross-country skiing, snowshoeing, mountaineering, wildlife viewing, and enjoyment of the scenery throughout the park. The snowmobile access on Jackson Lake would benefit only a small percentage of the park's overall winter visitation, although the sounds of snowmobiles could also be viewed as an adverse effect on other visitors.

Overall, the effects of Alternative 2 on visitor use and experience for Grand Teton and the Parkway would be long-term, direct, beneficial, and minor, however, some visitors might characterize the effect as adverse.

Some generalizations regarding the values-based responses of visitors to the rules under this alternative are possible. Using the characterizations of the two main values groups provided by Borrie, Freimund, and Davenport (2002), adherents to "recreation and tourism resource values" may find the guiding requirement to be burdensome, although other adherents to this perspective will be satisfied that basic motorized park access is available. Adherents to "natural values" may be discouraged at the continued use of snowmobiles in the parks, although other adherents to this view will be pleased at the clean air, quiet conditions, orderly and safe visitor behavior, and information availability that would prevail under this alternative.

Mitigating Measures

No measureable impacts on sound, wildlife, air quality and other natural resources would be expected to occur under alternative 1. The monitoring and adaptive management program would be implemented to ensure that ski and snowshoe use does not create concerns. The closure of much of the parks to visitor access would have substantial impacts upon the visitor experience, impacts not easily mitigated.

Monitoring of many aspects of the visitor experience will continue (such as air quality, sound, and wildlife) under alternative 2. The NPS will use the adaptive management plan presented in the appendices to remedy any impacts that would arise under this plan. The use of guides and BAT technology are also mitigations for the visitor experience. As discussed above, these provisions significantly improve the visitor experience for many visitors.

Cumulative Effects

The area considered for cumulative impact assessment is that within the boundaries of the three park units along with those trends, projects, and actions in the region that may influence a visitor's experience.

The parks are one component of the GYA, which includes several national forests, wildlife refuges, and communities such as Jackson and Cody, Wyoming; West Yellowstone and Gardiner, Montana; and Island Park and Ashton, Idaho. Visits to the parks are often combined with visits to a wide variety of destinations elsewhere in the region and the three-state area. Opportunities to snowmobile abound on the public lands around the parks, with both on-and off-trail access available at a variety of skill levels. As indicated in the *Environmental Consequences, Socioeconomics* discussion, use of the parks and surrounding lands does not always correlate. Some areas have observed decreases in use in recent years, but the relationship of such declines to park visitation is unclear.

Completion of the NPS visitor centers at Old Faithful, Canyon, and Moose, and the Laurance S. Rockefeller Preserve will improve (or are already improving) the visitor experience for many.

Similarly, further reclamation of the abandoned mines above Cooke City would improve the experience for visitors, some of whom snowmobile or ski in that area.

Actions taken by the U.S. Forest Service on national forest lands outside the parks may alter opportunities for snow-based recreation. The increase or decrease in these opportunities may add to or diminish the quality of the visitor experience that park visitors may have. Changes in current activities outside the park may be included in revisions to the forest plans and/or travel plans being contemplated by many of the surrounding national forests. Although most of those changes are unknown at this time, with uncertain effects on visitor experience, the national forests have all amended their forest plans for grizzly bear and lynx conservation. These amendments may affect visitor experience indirectly, because the forests may be less able to respond to changing recreation trends than they would otherwise be.

Regional population growth, rural land subdivision/reduction of public land access, changing demographics, and increasing outfitter/guide activity may also affect visitor experience. Population growth and changing demographics may lead to increased demand for recreation in finite areas, with rural land subdivision also possibly limiting the availability of public land. Some visitors may enjoy the increased outfitter and guide activity (particularly the ability to learn from knowledgeable guides).

When added to the potential actions of other agencies adjacent to Yellowstone or within the park which would act to restrict access, Alternative 1 could have the effect of dramatically and adversely affecting the visitor experience. Alternative 2 would have only minor effects, because visitors would still have motorized access to the parks and would not be displaced (to the degree that Alternative 1 would cause) to other national parks.

Conclusions

Closure of Yellowstone park roads, Jackson Lake, and the Grassy Lake Road to OSV travel would mean that most visitors would not be able to enjoy the wildlife, scenery, silence, solitude, clean air, or information on those roads. Therefore, the effects of implementing alternative 1 on the visitor experience would be major, adverse, long-term, and direct in Yellowstone and minor, adverse, direct, and long-term in Grand Teton and the Parkway. However, visitors could ski or snowshoe in the parks and this alternative would result in no unacceptable impacts to the visitor experience (many other national parks have major portions limited to non-motorized access in the winter).

In terms of cumulative effects, the major, adverse, long-term impacts resulting from direct and indirect actions described in alternative 1 would contribute a moderate, adverse, long-term impact to past, present, and foreseeable actions and impacts on visitor experience in Yellowstone. In Grand Teton and the Parkway, the minor, adverse, long-term impacts resulting from direct and indirect actions described in alternative 1 would contribute a minor, adverse, long-term impact to past, present, and foreseeable actions and impacts on visitor experience.

Under Alternative 2, visitors will continue to be able to view and experience the parks in a natural setting, enjoying good access to park attractions through their guides and the new and existing visitor centers. The current high level of satisfaction (as indicated by the 2008 visitor surveys discussed in *Affected Environment*) would continue. Visitor numbers will be limited, so that especially on holidays and some weekend days, people will not be able to access the park via snowmobiles. Some snowmobilers may choose to ride snowcoaches instead, although on holidays, coach capacity may also be reached. Opportunities to view wildlife and scenery will abound and access to quiet, solitude, and clean air will be abundant. However, OSV roads could

be rough at times under this alternative, so the overall effects of this alternative on the visitor experience in Yellowstone would be minor, adverse, long-term, and direct. In Grand Teton and the Parkway, the overall effects of Alternative 2 would be minor, beneficial, long-term and direct. This alternative would result in no unacceptable impacts to the visitor experience.

In terms of cumulative effects, the minor, adverse (for Yellowstone) and beneficial (for Grand Teton and the Parkway), short-term impacts resulting from direct and indirect actions described in this alternative would contribute a minor, adverse, short-term impact to past, present, and foreseeable actions and impacts on visitor experience.

Unacceptable Impacts and Impairment

As previously described, unacceptable impacts are those that fall short of impairment, but are still not acceptable within a particular park's environment. As defined in §8.2 of 2006 *Management Policies,* unacceptable impacts are those that would:

- Be inconsistent with a park's purposes or values, or
- Impede the attainment of a park's desired future conditions for natural and cultural resources as identified through the park's planning process, or
- Create an unsafe or unhealthful environment for visitors or employees, or
- Diminish opportunities for current or future generations to enjoy, learn about, or be inspired by park resources or values, or
- Unreasonably interfere with
    - Park programs or activities, or
    - An appropriate use, or
    - The atmosphere of peace and tranquility, or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations within the park.
    - NPS concessioner or contractor operations or services.

Neither alternative is inconsistent with either Yellowstone nor Grand Teton's purposes and values. Both parks were established for resource protection and visitor enjoyment and both alternatives protect resources and provide opportunities for visitor enjoyment. Neither alternative impedes the attainment of the parks' desired future conditions; in fact the desired conditions from previous park planning documents are reproduced as objectives and desired conditions for this temporary plan.

The analysis of effects on employee and visitor health and safety indicated that there are no major adverse effects under either alternative; effects were analyzed as minor to moderate.

Under either alternative, visitors continue to have opportunities to enjoy, learn about, or be inspired by park resources and values.

Implementation of alternative 1 would have adverse effects on the NPS concessioner, but there is no unreasonable interference.

Regarding soundscapes, implementation of Alternative 1 would result in negligible impacts to natural soundscapes because no oversnow motorized visitor use would be permitted. Under Alternative 2, impacts to natural soundscapes were identified and resulted in negligible to

moderate direct, short-term, and adverse impacts, due to audibility and maximum sound levels. Because there are no major adverse effects to natural soundscapes, implementation of either alternative would not unreasonably interfere with the natural soundscape. The effects on soundscapes estimated under either alternative will not be unacceptable because winter silence will be predominant away from developed areas and road corridors and present at certain times of day and in certain places even in those areas. The soundscapes impacts are also acceptable because some non-natural sounds are expected in developed areas and road corridors (people use motorized vehicles to access Yellowstone and Grand Teton's widely spaced wonders), and the levels of such sound under that alternative are at only moderate levels. Finally, maximum sound levels under both alternatives are expected to remain below levels that are acceptable to most visitors as snowcoaches are retrofitted to be BAT.

The effects on wildlife are expected to be acceptable because wildlife populations are expected to remain healthy and abundant. Although monitoring reveals some disturbance to individual animals, no wildlife populations are declining due to winter use (swan populations are declining, but this decline is being experienced regionally, not just in Yellowstone). Few, if any, animals are expected to be killed as a result of vehicle collisions, displacement and behavioral and physiological effects are expected to be minor and of little consequence to wildlife populations (with potential moderate effects on swans and eagles), and only negligible population effects are expected. Visitors will continue to find wildlife to be both wild and easily viewed; they will all travel with commercial guides or in snowcoaches, learning about and enjoying the abundant wildlife sightings.

Under either alternative, air quality in the parks is expected to remain pristine, at less than 24% of the federal NAAQS. This small a percentage indicates how clean the winter air in the parks is at either alternative in this EA: in a word, excellent. Unacceptable impacts would be levels of pollutants that are considerably closer to violations of the federal NAAQS. With the conservative use limits and Best Available Technology restrictions for snowmobiles and the move towards cleaner snowcoaches, the NPS expects implementation of either alternative to preserve excellent air quality in the parks, air that is far removed from being unacceptable in quality or being impaired.

As described in *Purpose and Need*, the NPS's threshold for considering whether there could be an impairment is based on *major* (or significant) effects. This EA identifies less than major effects on wildlife, natural soundscapes, and air quality for Alternatives 1 and 2. Guided by this analysis and the Superintendent's professional judgment, there would be no impairment of park resources and values from implementation of Alternative 1 or 2.

CHAPTER 5: CONSULTATION, COORDINATION, AND BIBLIOGRAPHY

Public Involvement

As described in Chapter 1, due to the extensive public involvement and public comment received over the past decade on the winter issue, scoping was not conducted on this EA.

This EA will be posted for public review on the NPS Planning, Environment and Public Involvement (PEPC) web site (http://parkplanning.nps.gov) and on the Yellowstone winter web site (http://www.nps.gov/yell/planyourvisit/winteruse.htm). A news release will be issued, and an email notification will be sent to an extensive (400+) list of agencies and individuals notifying them that the EA is available for review and comment.

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APPENDICES

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APPENDIX A. POLICIES AND MANDATES

The Organic Act

The NPS gets its basic mandate from the NPS Organic Act (16 USC 1, 2–4) and the General Authorities Act (16 USC 1a–1 through 1a–8). The NPS Organic Act provides:

"The Service thus established shall promote and regulate the use of the Federal areas known as National Parks…by such means and measures as to conform to the fundamental purposes of the said Parks…which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

The direction provided by the Organic Act was the subject of many comments on the 1999 Draft Environmental Impact Statement (Draft EIS) and these are discussed in the 2000 Final EIS (NPS 2000b:3).

The General Authorities Act

The General Authorities Act, as amended by the Redwood Act (March 27, 1978, P.L. 95–250, 92 Stat. 163, 16 USC 1a–1) affirms the basic tenets of the Organic Act and provides additional guidance on National Park System management:

"The authorization of activities shall be construed, and the protection, management and administration of these areas shall be conducted in light of the high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established…."

The restatement of these principles of park management in the Redwood Act is intended to serve as the basis for any judicial resolution of competing private and public values and interests in the National Park System (Senate Report No. 95–528 on S. 1976 pg. 7). The Senate committee report stated that under the Redwood amendment:

"The Secretary of the Interior has an absolute duty, which is not to be compromised, to fulfill the mandate of the 1916 Act to take whatever actions and seek whatever relief as will safeguard the units of the National Park System."

Consideration of these principles gives rise to the concept of "impairment" discussed on page 3 of the Final EIS, and below under Management Policies 2006.

Park-Specific Legislation

The Yellowstone National Park Act (16 USC 21, et seq.), the Grand Teton National Park Act (16 USC 406d–1 et seq.), and the John D. Rockefeller, Jr., Memorial Parkway Act (P.L. 92-404) provide authority and direction for management of each park. The establishment legislation is included in Appendix C of the 2000 EIS.

Other Laws

Because one of the primary issues about snowmobile use is that of air quality, the Clean Air Act (as amended, P.L. Chapter 360, 69 Stat. 322, 42 U.S.C. 7401 et seq.) is a primary focus in both the

2000 Final EIS and in the 2003 Final SEIS. Other laws that are generally pertinent to national park management are listed on page 3 of the 2000 Final EIS.

The Clean Air Act

The Clean Air Act provides both for the prevention of significant deterioration of areas where air is cleaner than National Ambient Air Quality Standards (NAAQS), and for an affirmative responsibility by the federal land manager to protect air quality-related values, including visibility. The federal land manager, in this case the NPS, has an affirmative responsibility to protect these resources, which is a separate issue from air quality vis-à-vis the NAAQS.

The Prevention of Significant Deterioration (PSD) provisions of the Clean Air Act are intended, in part, to preserve, protect, and enhance the air quality in national parks. The legislative history of the PSD provisions (S. Rep 95–127, 95th Cong., 1st Sess., 1977) indicates that federal land managers are to "assume an aggressive role in protecting the air quality values of land areas under his jurisdiction" and to "err on the side of protecting the air quality-related values for future generations." The Act also requires the prevention of any future impairment and the remedying of any existing impairment in Class I federal areas, which includes Yellowstone and Grand Teton National Parks. Additionally, the John D. Rockefeller, Jr., Memorial Parkway (a Class II area) abuts Class I federal areas, including the two national parks and the Jedediah Smith and Teton Wilderness Areas.

Executive Orders

EO 11644, Use of Off-Road Vehicles on the Public Lands, issued by President Nixon in 1972, states, "The widespread use of such vehicles on the public lands—often for legitimate purposes but also in frequent conflict with wise land and resource management practices, environmental values, and other types of recreational activity—has demonstrated the need for a unified federal policy…that will ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of these lands, to promote the safety of all users of those lands, and to minimize conflicts among the various users of those lands." Further, the order directs federal land managers that "[a]reas and trails shall be located to minimize harassment of wildlife or significant disruption of wildlife habitats" and "areas and trails shall be located to minimize conflicts between off-road vehicle use and other existing or proposed recreational uses of the same or neighboring public lands…." Additionally, "Areas and trails shall be located in areas of the National Park System…only if the respective agency head determines that off-road vehicle use in such locations will not adversely affect their natural, aesthetic, or scenic values." Finally, "The respective agency head shall monitor the effects of the use of off-road vehicles on lands under their jurisdictions. On the basis of the information gathered, they shall from time to time amend or rescind designation of areas or other actions taken pursuant to this order as necessary to further the policy of this order."

Under the Executive Orders, the term "off-road vehicle" specifically excludes "any vehicle whose use is expressly authorized by the respective agency head under a permit, lease, license, or contract." Executive Order No. 11644 § 2(3(C).

This order is amended by EO 11989, issued by President Carter in 1978, which adds:

"…the respective agency head shall, whenever he determines that the use of off-road vehicles will cause or is causing considerable adverse effects on the soil, vegetation, wildlife, wildlife habitat or cultural or historic resources of particular areas or trails of the public lands, immediately close such areas or trails to the type of off-road vehicle causing such effects, until

such time as he determines that such adverse effects have been eliminated and that measures have been implemented to prevent future recurrence."

EO 13266, Activities to Promote Personal Fitness, issued by President George W. Bush in 2002, promotes health and personal fitness opportunities of the general public. Opportunities for non-motorized recreation in the parks are appropriate; many of these opportunities are only accessible via motorized access.

Regulations

36 CFR 2.18 Snowmobiles

General provisions in NPS regulations address snowmobile use (36 CFR 2.18). Snowmobiling is generally prohibited except on designated routes and water surfaces available for motorized use at other times. In addition, snowmobiles are prohibited except where designated and "only when their use is consistent with the park's natural, cultural, scenic and aesthetic values, safety considerations, park management objectives, and will not disturb wildlife or damage park resources" (36 CFR 2.18 (c)). Section (d) of this regulation lists additional limitations and prohibitions that apply where snowmobiles are allowed, including noise limits, speed limits, operator requirements, and machine appurtenances.

36 CFR 1.2 Applicability and Scope

"(c) The regulations contained in part 7 and part 13 of this chapter are special regulations prescribed for specific park areas. Those regulations may amend, modify, relax or make more stringent the regulations contained in parts 1 through 5 and part 12 of this chapter.

36 CFR 1.5 Closures and public use limits

"(a) Consistent with applicable legislation and Federal administrative policies, and based upon a determination that such action is necessary for the maintenance of public health and safety, protection of environmental or scenic values, protection of natural or cultural resources, aid to scientific research, implementation of management responsibilities, equitable allocation and use of facilities, or the avoidance of conflict among visitor use activities, the superintendent may:

(1) Establish, for all or a portion of a park area, a reasonable schedule of visiting hours, impose public use limits, or close all or a portion of a park area to all public use or to a specific use or activity.

(2) Designate areas for a specific use or activity, or impose conditions or restrictions on a use or activity.

(3) Terminate a restriction, limit, closure, designation, condition, or visiting hour restriction imposed under paragraph (a)(1) or (2) of this section.

(b) Except in emergency situations, a closure, designation, use or activity restriction or condition, or the termination or relaxation of such, which is of a nature, magnitude and duration that will result in a significant alteration in the public use pattern of the park area, adversely affect the park's natural, aesthetic, scenic or cultural values, require a long-term or significant modification in the resource management objectives of the unit, or is of a highly controversial nature, shall be published as rulemaking in the Federal Register."

36 CFR 1.7 Public Notice

"(a) Whenever the authority of §1.5(a) is invoked to restrict or control a public use or activity, to relax or revoke an existing restriction or control, to designate all or a portion of a park area as open or closed, or to require a permit to implement a public use limit, the public shall be notified by one or more . . .methods. . ."

NPS Management Policies

Current policy guidance for the NPS is published in Management Policies 2006 (August 31, 2006; available on the Internet at www.nps.gov/policy/mp/policies.html). The policies interpret the laws, regulations, and Executive Orders governing management of National Park System units. The policies most applicable to this EIS are summarized or abstracted here. The parenthetical numbers below refer to the portions of the Management Policies 2006 that are the sources for the text.

The NPS Obligation to Conserve and Provide for Enjoyment of Park Resources and Values (1.4.3)

"The fundamental purpose of the national park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. This mandate is independent of the separate prohibition on impairment and applies all the time with respect to all park resources and values, even when there is no risk that any park resources or values may be impaired. NPS managers must always seek ways to avoid, or to minimize to the greatest extent practicable, adverse impacts on park resources and values. However, the laws do give the Service the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, so long as the impact does not constitute impairment of the affected resources and values.

"The fundamental purpose of all parks also includes providing for the enjoyment of park resources and values by the people of the United States. The enjoyment that is contemplated by the statute is broad; it is the enjoyment of all the people of the United States and includes enjoyment both by people who visit parks and by those who appreciate them from afar. It also includes deriving benefit (including scientific knowledge) and inspiration from parks, as well as other forms of enjoyment and inspiration. Congress, recognizing that the enjoyment by future generations of the national parks can be ensured only if the superb quality of park resources and values is left unimpaired, has provided that when there is a conflict between conserving resources and values and providing for enjoyment of them, conservation is to be predominant. This is how courts have consistently interpreted the Organic Act."

The Prohibition on Impairment of Park Resources and Values (1.4.4)

"While Congress has given the Service the management discretion to allow impacts within parks, that discretion is limited by the statutory requirement (generally enforceable by the federal courts) that the Park Service must leave park resources and values unimpaired unless a particular law directly and specifically provides otherwise. This, the cornerstone of the Organic Act, establishes the primary responsibility of the National Park Service. It ensures that park resources and values will continue to exist in a condition that will allow the American people to have present and future opportunities for enjoyment of them.

"The impairment of park resources and values may not be allowed by the Service unless directly and specifically provided for by legislation or by the proclamation establishing the park. The relevant legislation or proclamation must provide explicitly (not by implication or inference) for

the activity, in terms that keep the Service from having the authority to manage the activity so as to avoid the impairment."

What Constitutes Impairment of Park Resources and Values (1.4.5)

"The impairment that is prohibited by the Organic Act and the General Authorities Act is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values. Whether an impact meets this definition depends on the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts.

"An impact to any park resource or value may, but does not necessarily, constitute an impairment. An impact would be more likely to constitute impairment to the extent that it affects a resource or value whose conservation is:

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, or
- key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or
- identified in the park's general management plan or other relevant NPS planning documents as being of significance.

"An impact would be less likely to constitute an impairment if it is an unavoidable result of an action necessary to preserve or restore the integrity of park resources or values and it cannot be further mitigated.

"An impact that may, but would not necessarily, lead to impairment may result from visitor activities; NPS administrative activities; or activities undertaken by concessioners, contractors, and others operating in the park. Impairment may also result from sources or activities outside the park."

What Constitutes Park Resources and Values (1.4.6)

"The 'park resources and values' that are subject to the no-impairment standard include:

- 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;
- appropriate opportunities to experience enjoyment of the above resources, to the extent that can be done without impairing 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 the park was established."

Decision-making Requirements to Avoid Impairments (1.4.7)

"Before approving a proposed action that could lead to an impairment of park resources and values, an NPS decision-maker must consider the impacts of the proposed action and determine, in writing, that the activity will not lead to an impairment of park resources and values. If there would be an impairment, the action must not be approved.

"In making a determination of whether there would be an impairment, an NPS decision-maker must use his or her professional judgment. This means that the decision-maker must consider any environmental assessments or environmental impact statements required by the National Environmental Policy Act of 1969 (NEPA); consultations required under section 106 of the National Historic Preservation Act (NHPA), relevant scientific and scholarly studies; advice or insights offered by subject matter experts and others who have relevant knowledge or experience; and the results of civic engagement and public involvement activities relating to the decision. The same application of professional judgment applies when reaching conclusions about "unacceptable impacts."

"When an NPS decision-maker becomes aware that an ongoing activity might have led or might be leading to an impairment of park resources or values, he or she must investigate and determine if there is or will be an impairment. This investigation and determination may be made independent of, or as part of, a park planning process undertaken for other purposes. If it is determined that there is, or will be, an impairment, the decision-maker must take appropriate action, to the extent possible within the Service's authorities and available resources, to eliminate the impairment. The action must eliminate the impairment as soon as reasonably possible, taking into consideration the nature, duration, magnitude, and other characteristics of the impacts on park resources and values, as well as the requirements of the National Environmental Policy Act, National Historic Preservation Act, the Administrative Procedure Act, and other applicable laws."

Unacceptable Impacts (1.4.7.1)

"The impact threshold at which impairment occurs is not always readily apparent. Therefore, the Service will apply a standard that offers greater assurance that impairment will not occur. The Service will do this by avoiding impacts that it determines to be unacceptable. These are impacts that fall short of impairment, but are still not acceptable within a particular park's environment. Park managers must not allow uses that would cause unacceptable impacts; they must evaluate existing or proposed uses and determine whether the associated impacts on park resources and values are acceptable.

"Virtually every form of human activity that takes place within a park has some degree of effect on park resources or values, but that does not mean the impact is unacceptable or that a particular use must be disallowed. Therefore, for the purposes of these policies, unacceptable impacts are impacts that, individually or cumulatively, would:

- be inconsistent with a park's purposes or values, or
- impede the attainment of a park's desired future conditions for natural and cultural resources as identified through the park's planning process, or
- create an unsafe or unhealthful environment for visitors or employees, or
- diminish opportunities for current or future generations to enjoy, learn about, or be inspired by park resources or values, or unreasonably interfere with

- park programs or activities, or
- an appropriate use, or
- the atmosphere of peace and tranquility, or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations within the park.
- NPS concessioner or contractor operations or services."

Air Quality (4.7.1)

"The National Park Service has a responsibility to protect air quality under both the 1916 Organic Act and the Clean Air Act (CAA). Accordingly, the Service will seek to perpetuate the best possible air quality in parks to (1) preserve natural resources and systems; (2) preserve cultural resources; and (3) sustain visitor enjoyment, human health, and scenic vistas. Vegetation, visibility, water quality, wildlife, historic and prehistoric structures and objects, cultural landscapes, and most other elements of a park environment are sensitive to air pollution and are referred to as "air quality-related values." The Service will actively promote and pursue measures to protect these values from the adverse impacts of air pollution. In cases of doubt as to the impacts of existing or potential air pollution on park resources, the Service will err on the side of protecting air quality and related values for future generations.

"Superintendents will take actions consistent with their affirmative responsibilities under the Clean Air Act to protect air quality-related values in Class I areas. Class I areas are national parks over 6, 000 acres and national wilderness areas over 5,000 acres that were in existence on August 7, 1977. The act establishes a national goal of preventing any future and remedying any existing human-made visibility impairment in Class I areas. The Service supports that goal and will take advantage of opportunities created by the act to help achieve it. The federal land manager shares the responsibility to protect air quality-related values in Class I areas. As the federal land manager for the department, the Secretary of the Interior has delegated this responsibility to the Assistant Secretary for Fish and Wildlife and Parks.

"The Clean Air Act also recognizes the importance of integral vistas, which are those views perceived from within Class I areas of a specific landmark or panorama located outside the boundary of the Class I area. Integral vistas have been identified by the Service and are listed in Natural Resources Reference Manual 77. There are no regulations requiring special protection of these integral vistas, but the Service will strive to protect these park-related resources through cooperative means.

"Although the Clean Air Act gives the highest level of air quality protection to Class I areas, it provides many opportunities for the Service to participate in the development of pollution control programs to preserve, protect, and enhance the air quality of all units of the national park system. Regardless of Class I designation, the Service will take advantage of these opportunities.

"Air resource management requirements will be integrated into NPS operations and planning, and all air pollution sources within parks—including prescribed fire management and visitor use activities—will comply with all federal, state, and local air quality regulations and permitting requirements. Superintendents will make reasonable efforts to notify visitors and employees when air pollution concentrations within an area exceed the national or state air quality standards established to protect public health. Furthermore, because the current and future quality of park air resources depends heavily on the actions of others, the Service will acquire

the information needed to effectively participate in decision-making that affects park air quality. The Service will:

- inventory the air quality-related values associated with each park;
- monitor and document the condition of air quality and related values;
- evaluate air pollution impacts and identify causes;
- minimize air quality pollution emissions associated with park operations, including the use of prescribed fire and visitor use activities; and
- ensure healthful indoor air quality in NPS facilities.

"External programs needed to remedy existing and prevent future impacts on park resources and values from human-caused air pollution will be aggressively pursued by NPS participation in the development of federal, state, and local air pollution control plans and regulations. Permit applications for major new air pollution sources will be reviewed, and potential impacts will be assessed. If it is determined that any such new source might cause or contribute to an adverse impact on air quality-related values, the Park Service will recommend to the permitting authority that the construction permit be denied or modified to eliminate adverse impacts.

"The public's understanding of park air quality issues and the positive role and efforts of the Service toward improving the air quality in parks will be promoted through educational and interpretive programs."

Soundscape Management (4.9)

"Park natural soundscape resources encompass all the natural sounds that occur in parks, including the physical capacity for transmitting those natural sounds and the interrelationships among park natural sounds of different frequencies and volumes. Natural sounds occur within and beyond the range of sounds that humans can perceive, and they can be transmitted through air, water, or solid materials. The National Park Service will preserve, to the greatest extent possible, the natural soundscapes of parks.

"Some natural sounds in the natural soundscape are also part of the biological or other physical resource components of the park. Examples of such natural sounds include:

- sounds produced by birds, frogs, or katydids to define territories or aid in attracting mates
- sounds produced by bats or porpoises to locate prey or navigate
- sounds received by mice or deer to detect and avoid predators or other danger
- sounds produced by physical processes, such as wind in the trees, claps of thunder, or falling water.

"The Service will restore to the natural condition wherever possible those park soundscapes that have become degraded by unnatural sounds (noise), and will protect natural soundscapes from unacceptable impacts.

"Using appropriate management planning, superintendents will identify what levels and types of unnatural sound constitute acceptable impacts on park natural soundscapes. The frequencies, magnitudes, and durations of acceptable levels of unnatural sound will vary throughout a park, being generally greater in developed areas. In and adjacent to parks, the Service will monitor human activities that generate noise that adversely affects park soundscapes, including noise caused by mechanical or electronic devices. The Service will take action to prevent or minimize

all noise that through frequency, magnitude, or duration adversely affects the natural soundscape or other park resources or values, or that exceeds levels that have been identified through monitoring as being acceptable to or appropriate for visitor uses at the sites being monitored."

Visitor Use (8.2)

"Enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks. The Service is committed to providing appropriate, high quality opportunities for visitors to enjoy the parks, and the Service will maintain within the parks an atmosphere that is open, inviting, and accessible to every segment of American society. However, many forms of recreation enjoyed by the public do not require a national park setting and are more appropriate to other venues. The Service will therefore:

provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the parks;

defer to local, state, tribal, and other federal agencies; private industry; and non-governmental organizations to meet the broader spectrum of recreational needs and demands.

"To provide for enjoyment of the parks, the National Park Service will encourage visitor activities that:

are appropriate to the purpose for which the park was established; and

are inspirational, educational, or healthful, and otherwise appropriate to the park

environment; and

will foster an understanding of and appreciation for park resources and values, or will

promote enjoyment through a direct association with, interaction with, or relation to park resources; and

can be sustained without causing unacceptable impacts to park resources or values.

"The primary means by which the Service will actively foster and provide activities that meet these criteria will be through its interpretive and educational programs, which are described in detail in chapter 7. The Service will also welcome the efforts of nongovernmental organizations, tour companies, guides, outfitters, and other private sector entities to provide structured activities that meet these criteria. In addition to structured activities, the Service will, to the extent practicable, afford visitors ample opportunity for inspiration, appreciation, and enjoyment through their own personalized experiences—without the formality of program or structure.

"The Service may allow other visitor uses that do not meet all the above criteria if they are appropriate to the purpose for which the park was established and they can be sustained without causing unacceptable impacts to park resources or values. For the purposes of these policies, unacceptable impacts are impacts that, individually or cumulatively, would:

be inconsistent with a park's purposes or values, or

impede the attainment of a park's desired conditions for natural and cultural resources as identified through the park's planning process, or

create an unsafe or unhealthy environment for visitors or employees, or

diminish opportunities for current or future generations to enjoy, learn about, or be inspired by park resources or values, or unreasonably interfere with:

park programs or activities, or

an appropriate use, or

the atmosphere of peace and tranquility, or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations within the park, or NPS concessioner or contractor operations or services.

"Management controls and conditions must be established for all park uses to ensure that park resources and values are preserved and protected for the future. If and when a superintendent has a reasonable basis for believing that an ongoing or proposed public use would cause unacceptable impacts to park resources or values, the superintendent must make adjustments to the way the activity is conducted to eliminate the unacceptable impacts. If the adjustments do not succeed in eliminating the unacceptable impacts, the superintendent may (1) temporarily or permanently close a specific area, or (2) place limitations on the use, or (3) prohibit the use. Restrictions placed on recreational uses that have otherwise been found to be appropriate will be limited to the minimum necessary to protect park resources and values and promote visitor safety and enjoyment. Any closures or restrictions—other than those imposed by law—must be consistent with applicable laws, regulations, and policies, and (except in emergency situations) require a written determination by the superintendent that such measures are needed to:

protect public health and safety;

prevent unacceptable impacts to park resources or values;

carry out scientific research;

minimize visitor use conflicts; or

otherwise implement management responsibilities.

"When practicable, restrictions will be based on the results of study or research, including (when appropriate) research in the social sciences. Any restrictions imposed will be fully explained to visitors and the public. Visitors will be given appropriate information on how to keep adverse impacts to a minimum, and how to enjoy the safe and lawful use of the parks."

Use of Motorized Equipment (8.2.3)

"The variety of motorized equipment—including visitor vehicles, concessioner equipment, and NPS administrative or staff vehicles and equipment—that operates in national parks could adversely impact park resources, including the park's natural soundscape and the flow of natural chemical information and odors that are important to many living organisms. In addition to their natural values, natural sounds (such as waves breaking on the shore, the roar of a river, and the call of a loon), form a valued part of the visitor experience. Conversely, the sounds of motor vehicle traffic, an electric generator, or loud music can greatly diminish the solemnity of a visit to a national memorial, the effectiveness of a park interpretive program, or the ability of a visitor to hear a bird singing its territorial song. Many parks that appear as they did in historical context no longer sound the way they once did.

"The Service will strive to preserve or restore the natural quiet and natural sounds associated with the physical and biological resources of parks. To do this, superintendents will carefully evaluate and manage how, when, and where motorized equipment is used by all who operate

equipment in the parks, including park staff. Uses and impacts associated with the use of motorized equipment will be addressed in park planning processes. Where such use is necessary and appropriate, the least impacting equipment, vehicles, and transportation systems should be used, consistent with public and employee safety. The natural ambient sound level—that is, the environment of sound that exists in the absence of human-caused noise—is the baseline condition, and the standard against which current conditions in a soundscape will be measured and evaluated.

"To meet its responsibilities under Executive Order 13149 (Greening the Government through Federal Fleet and Transportation Efficiency), the Service will develop and implement a strategy to reduce its vehicle fleet's annual petroleum consumption."

Motorized Off-road Vehicle Use (8.2.3.1)

"Off-road motor vehicle use in national park units is governed by Executive Order 11644 (Use of Off-road Vehicles on Public Lands, as amended by Executive Order 11989), which defines off-road vehicles as "any motorized vehicle designed for or capable of cross-country travel on or immediately over land, water, sand, snow, ice, marsh, swampland, or other natural terrain" (except any registered motorboat or any vehicle used for emergency purposes). Unless otherwise provided by statute, any time there is a proposal to allow a motor vehicle meeting this description to be used in a park, the provisions of the executive order must be applied.

"In accordance with 36 CFR 4.10(b), routes and areas may be designated only in national recreation areas, national seashores, national lakeshores, and national preserves, and only by special regulation. In accordance with the executive order, they may be allowed only in locations where there will be no adverse impacts on the area's natural, cultural, scenic, and esthetic values, and in consideration of other existing or proposed recreational uses. The criteria for new uses, appropriate uses, and unacceptable impacts listed in sections 8.1 and 8.2 must also be applied to determine whether off-road vehicle use may be allowed. As required by the executive order and the Organic Act, superintendents must immediately close a designated off-road vehicle route whenever the use is causing or will cause unacceptable impacts on the soil, vegetation, wildlife, wildlife habitat, or cultural and historic resources.

"NPS administrative off-road motor vehicle use will be limited to what is necessary to manage the public use of designated off-road vehicle routes and areas; to conduct emergency operations; and to accomplish essential maintenance, construction, and resource protection activities that cannot be accomplished reasonably by other means."

Snowmobiles (8.2.3.2)

"Snowmobile use is a form of off-road vehicle use governed by Executive Order 11644 (Use of Off-road Vehicles on Public Lands, as amended by Executive Order 11989), and in Alaska also by provisions of the Alaska National Interest Lands Conservation Act (16 USC 3121 and 3170). Implementing regulations are published at 36 CFR 2.18, 36 CFR Part 13, and 43 CFR Part 36. Outside Alaska, routes and areas may be designated for snowmobile and oversnow vehicle use only by special regulation after it has first been determined through park planning to be an appropriate use that will meet the requirements of 36 CFR 2.18 and not otherwise result in unacceptable impacts. Such designations can occur only on routes and water surfaces that are used by motor vehicles or motorboats during other seasons. In Alaska, the Alaska National Interest Lands Conservation Act provides additional authorities and requirements governing snowmobile use.

"NPS administrative use of snowmobiles will be limited to what is necessary (1) to manage public use of snowmobile or oversnow vehicles routes and areas; (2) to conduct emergency operations; and (3) to accomplish essential maintenance, construction, and resource protection activities that cannot be accomplished reasonably by other means."

Director's Orders

Director's Order #75A: Civic Engagement And Public Involvement:

"The purpose of this Director's Order (DO) is to articulate our commitment to civic engagement, and to have all National Park Service units and offices embrace civic engagement as the essential foundation and framework for creating plans and developing programs. Civic engagement is a continuous, dynamic conversation with the public on many levels that reinforces public commitment to the preservation of heritage resources, both cultural and natural, and strengthens public understanding of the full meaning and contemporary relevance of these resources. The foundation of civic engagement is a commitment to building and sustaining relationships with neighbors and communities of interest.

The remainder of the Director's Order may be viewed at http://www.nps.gov/policy/DOrders/75A.htm.

U.S. Department of Interior Memorandum

February 17, 2004, memorandum from Assistant Secretary, Fish and Wildlife and Parks, to Director, National Park Service, addressing snowmobile use in national parks service wide:

"…it has become clear that a service-wide directive to prohibit all forms of recreational snowmobile use in the National Park System is no longer warranted and that, with requirements for monitoring and increased use of newer technology snowmobiles, recreational uses can continue to be a part of the NPS winter experience. This will also allow decisions to be made on a park-by-park basis, relying on the professional judgment of each parks' staff. They will be able to consider the lessons from Yellowstone, such as the use of Best Available Technology requirements, guiding requirements, and adaptive management, as well as overall technological improvements and any other new information, and will then be able to determine whether any review or revision of their special regulations is needed."

"Existing road grooming serves an important and sometimes essential role in guaranteeing winter access for both visitors and park staff. It is necessary not only for the operation of recreational snowmobiles, but also for snowcoaches and for snowmobile use by park staff. In some parks, eliminating road grooming would eliminate motorized access to many popular and developed areas. It would not necessarily serve the needs of most visitors or park staff, if it becomes necessary to walk, snowshoes, or cross-country ski over dozens of miles of ungroomed snow-covered roads or trails to reach such areas. Park staff needs to retain the flexibility to address these issues in their parks and make decisions regarding park resources, visitor needs, and administrative access needs."

"NPS also needs to lead by example when purchasing and operating snowmobiles for administrative purposes. Only snowmobiles that meet the BAT standards as outlined in the Winter Use SEIS should be used by the NPS for administrative purposes. All purchases of snowmobiles by NPS units must be limited to BAT-compliant models unless a justification for an exception based on operational needs is approved by the respective Regional Director. No approval of a non-BAT machine may be made on the grounds of cost. Parks with employees

who reside in the park during the winter months and use snowmobiles as a means of travel on and off duty should also develop a policy that promotes the use of BAT-compliant snowmobiles for these types of uses. Superintendents should encourage their employees, especially new hires, to use BAT-compliant personal snowmobiles as well. Through a deliberate process of converting to cleaner and quieter snowmobiles, the NPS can be the leader in reducing impacts to our national parks."

"Park superintendents with continued snowmobile use need to do some form of monitoring as outlined in Executive Orders 11644 and 11989. This kind of use must continue to be a part of an active monitoring program and impacts of the use must be assessed from time to time. The appropriate level of monitoring must be tailored to the actual level of use in a park, as determined by the superintendent and park staff. Park officials should use their best professional judgment in determining the level of monitoring that is required."

Secretarial Order

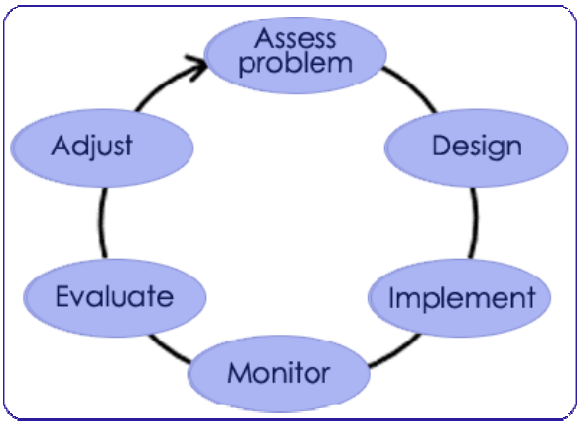
March 9, 2007 Order 3270 provides policy guidance and procedures for implementing adaptive management and transmits *Adaptive Management: The U.S. Department of the Interior Technical Guide* and website http://www.doi.gov/initiatives/AdaptiveManagement/.

APPENDIX B. MONITORING AND ADAPTIVE MANAGEMENT PROGRAM

Adaptive management helps science managers maintain flexibility in their decisions, knowing that uncertainties exist and provides managers the latitude to change direction. Adaptive management will improve understanding of ecological systems to achieve management objectives and is about taking action to improve progress towards desired outcomes.

The emphasis in an adaptive approach is first and foremost on resource management. The value of understanding, and the monitoring and analysis that produce understanding, is inherited from their contributions to the objectives of resource management. Although the focus is on learning, the ultimate goal of the effort is smart management. It is important to recognize that adaptive management is a complex endeavor that includes much more than simply following a sequence of steps. Properly executed, the process involves ongoing, real-time learning, both in a technical sense and in terms of process itself. Stakeholders need to be engaged at the stage of initial problem formulation and remain engaged throughout implementation (Williams et al. 2007). Williams identifies nine steps in adaptive management:

1. Stakeholder involvement
2. Objectives
3. Management actions
4. Models
5. Monitoring Plans
6. Decision making
7. Follow-up monitoring
8. Assessment, and
9. Iteration.



Through this and previous winter planning processes, steps 1-5 have been completed. The Finding of No Significant Impact is step 6.

Both alternatives include adaptive management provisions. An adaptive management plan is different from a monitoring plan in that it allows park managers to act when some information exists about a specific resource but conclusive data is currently unavailable. A key step in adaptive management is to develop and implement a management scenario based on the best available information. For example, in this document Alternative 2 proposes a specific limit on the number of winter visitors that can enter the park daily via snowmobile. The next step is to implement an evaluation program to assess the success of the management scenario relative to defined resource thresholds. This evaluation is critical within the framework of adaptive management because of the uncertain results of the initial predictions. Managers then review the results of the evaluation program and may adjust activities or use limits to mitigate unplanned or undesirable outcomes. For example, if the visitor limits set for a park entrance have a greater or lesser effect on resource thresholds than predicted, then the number of visitors allowed to enter the parks could be raised or lowered accordingly.

Monitoring is also a component of both alternatives. General resource monitoring applies when adequate information exists to make informed management decisions based on discrete and accepted thresholds. It is the process of collecting information to evaluate if the objectives of a management plan are being realized. Appropriate monitoring techniques will be used to assess impacts to air quality, natural soundscapes, public and employee health and safety; water quality and snowpack, geothermal features; wildlife; and some aspects of the visitor experience. The table in this appendix describes monitoring and adaptive management indicators, locations/zones, preliminary thresholds, methods, and monitoring intensity. The table also identifies possible management actions that will be implemented if thresholds are violated. Some non-emergency actions, such as the construction of a new facility, may require additional site-specific NEPA analysis, which includes public involvement. Other actions might be administrative in nature or could be implemented through application of a categorical exclusion under NEPA.

The preliminary thresholds are established to help a manager understand the results of monitoring programs and be one of many guides for possibly taking action if a problem is perceived. Exceeding a threshold does not mean that such a level would be unacceptable or result in impairment, but it does provide managers an early warning when conditions may be moving away from those that are desirable long before they reach an unacceptable level. Monitoring and adaptive management, and management action if these thresholds are violated, will ensure the parks' obligation to preserve resources and values in an unimpaired and acceptable condition is achieved, while allowing for winter use of the parks. Many of these thresholds were derived partly from the results of computational models, and they are preliminary in nature. Therefore, they could be adjusted depending on data resulting from monitoring programs.

These thresholds are the same as those found in the 2007 FEIS, with the exception of corrections to mistakes in the earlier thresholds. In gathering monitoring information, it may become necessary to examine adaptive management thresholds critically. Occasionally, the information gleaned from monitoring (as well as new research) may indicate that a threshold is actually inappropriate and should be adjusted upwards or downwards. For this reason, these thresholds could be adjusted in the future, based on monitoring information, research, and professional judgment.

Monitoring and Adaptive Management Indicators, Thresholds, and Methods

Resource or Value	Indicator	Location/ Management Zone	Preliminary Threshold	Preliminary Method	Initial Monitoring Intensity[1]	Possible Management Options if Threshold is Violated
Air Quality	Park employees and visitors exposure to CO, particulate matter, and volatile organic compounds. For comparison purposes, monitoring data for air quality may be found in Chapter 3 of this EA.	Developed Area	1-hr maximum CO (w/bkgd): 8 ppm 8-hr maximum CO (w/bkgd): 3 ppm 24-hr maximum PM_{10} (w/bkgd): 23 $\mu g/m^3$ No observed employee health problems due to air quality ATSDR (Agency for Toxic Substances and Disease Registry) Minimal Risk Levels	Fixed site monitoring or personal sampling for PM and CO Personal samples, cartridges, or canisters for VOCs (air toxics)	High	Require new technologies Adjust number of daily vehicle entries permitted Establish timed-entry requirements Medically monitor employees if necessary
		Road corridor	1-hr maximum CO (w/bkgd): 1 ppm 8-hr maximum CO (w/bkgd): 1 ppm 24-hr maximum PM_{10} (w/bkgd): 6 $\mu g/m^3$ No observed employee health problems due to air quality ATSDR (Agency for Toxic Substances and Disease Registry) Minimal Risk Levels	Fixed site monitoring or personal sampling for PM and CO Personal samples, cartridges, or canisters for VOCs (air toxics)	Moderate	

[1] High = daily to weekly or in accordance with standard protocol for parameter in question; Moderate = monthly to seasonally and during peak days or use periods; Low = annually during peak use periods or at the end of the season.

Resource or Value	Indicator	Location/ Management Zone	Preliminary Threshold	Preliminary Method	Initial Monitoring Intensity[1]	Possible Management Options if Threshold is Violated
		Transition and Backcountry	1-hr maximum CO (w/bkgd): 1 ppm 8-hr maximum CO (w/bkgd): 1 ppm 24-hr maximum PM_{10}: 5 µg/m^3	Fixed site monitoring or personal sampling for PM and CO	Low	
	Visibility	Development Area and Road corridor	No perceptible localized visibility impacts	Photo Survey, time lapse video and nephelometer	High	
		Transition and Backcountry	No perceptible localized visibility impacts		Low	
	Odor	Developed Area and Road Corridor	Area free of any noticeable odor resulting from motorized recreation at least 90% of the daytime hours of park operation (8 A.M. – 4 P.M.)	Park visitor survey	High	
		Transition and Backcountry	Area free of any noticeable odor resulting from motorized recreation		Low	

Resource or Value	Indicator(s)	Location/ Management Zone	Preliminary Threshold	Preliminary Method	Initial Monitoring Intensity[1]	Possible Management Options if Threshold is Violated
Natural Soundscapes	Distance and time OSV sound is audible; maximum sound level (dBA) Note: A rare event that exceeds these thresholds may not trigger management action. For comparison purposes, monitoring data for sound may be found in Chapter 3 of this EA.	Developed Area	Measured during daytime hours of park operation (8 A.M.– 4 P.M.) and 100 feet from sound sources: Audibility[2]: not to exceed (NTE) 75% OSV sound: NTE 70 dB(A)	Audibility logging, digital recordings, and sound pressure level measurement	High	Require new technologies Adjust number of daily vehicle entries permitted Establish timed-entry requirements
		Road Corridor	Measured during daytime hours of park operation (8 A.M.– 4 P.M.) and 100 feet from sound sources: Audibility: NTE 50% OSV sound: NTE 70 dB(A)		High	
		Transition Zone	Measured during daytime hours of park operation (8 A.M. – 4 P.M.) at selected index sites for the zone. Audibility: NTE 25% OSV sound: NTE 65 dB(A)		Moderate	

[2]Audibility is the percent of time OSV are audible to a person with normal hearing. A NTE 50% threshold means that OSV will not be audible more than 50% of the time during daytime hours of park operation.

Resource or Value	Indicator(s)	Location/ Management Zone	Preliminary Threshold	Preliminary Method	Initial Monitoring Intensity[1]	Possible Management Options if Threshold is Violated
		Backcountry	Measured during daytime hours of park operation (8 A.M. – 4 P.M.) at selected index sites for the zone. Audibility: NTE 10% OSV sound: NTE Lnat (natural ambient sound levels) Note: Vehicle noise, even at 6 dB(A) less than natural ambient, is usually audible due to the lower frequencies of OSV sound. Additionally, since natural and non-natural sounds tend to be in different frequencies, both can be audible at the same time, even at very low levels.		Moderate	

Resource or Value	Indicator(s)	Location/ Management Zone	Preliminary Threshold	Preliminary Method	Initial Monitoring Intensity[1]	Possible Management Options if Threshold is Violated
Public and Employee Health and Safety	Motor vehicle accidents Exposure to noise For comparison purposes, monitoring data for noise exposure may be found in Chapter 3 of this EA.	Developed Area and Road Corridor	Continual improvement of three-year moving average 8-hour time-weighted noise levels exceed 85 dBA and peak noise levels exceed 90 dBA. [See Air Quality for other health and safety thresholds.]	Incident descriptions and GIS mapping Personal exposure monitoring	High	Alter or implement commercial and non-commercial guiding requirements and/or ratio Increase signage and reduce speed limits in areas of recurring incidents Increase law enforcement and educational information Adjust number of daily vehicle entries permitted Require use of personal protection equipment; issue PPE; improve PPE

Resource or Value	Indicator	Location/ Management Zone	Preliminary Threshold	Preliminary Method	Initial Monitoring Intensity[1]	Possible Management Options if Threshold is Violated
Water/Snowpack	Water quality: VOCs, pH, hydrogen, ammonium, calcium, sulfate, nitrate, and NOx	Developed Area and Road Corridor	Ref: Ingersoll (1999) compared his water quality findings for snowmelt runoff to drinking water standards. Benzene: EPA maximum limit for drinking water 0.005 mg/L. OSHA permissible exposure in workplace (8-hour day, 40-hour weeks) 1 ppm Toluene: EPA maximum limit for drinking water 1 mg/L. OSHA permissible exposure in workplace 200 ppm Ethylbenzene: EPA maximum limit for drinking water .7 mg/L. OSHA permissible exposure in workplace 100 ppm Xylene: EPA maximum limit for drinking water 10 ppm. OSHA permissible exposure in workplace 100 ppm	Snowpack sampling, snowmelt runoff, stream runoff, snowmelt/rain event	Low or as needed by changing conditions	Require new technologies Determination and application of best management practices Adjust number of daily vehicle entries permitted

Resource or Value	Indicator	Location/ Management Zone	Preliminary Threshold	Preliminary Method	Initial Monitoring Intensity[1]	Possible Management Options if Threshold is Violated
		Backcountry	Benzene: EPA maximum limit for drinking water 0.005 mg/L. OSHA permissible exposure in workplace (8-hour day, 40-hour weeks) 1 ppm Toluene: EPA maximum limit for drinking water 1 mg/L. OSHA permissible exposure in workplace 200 ppm Ethylbenzene: EPA maximum limit for drinking water .7 mg/L. OSHA permissible exposure in workplace 100 ppm Xylene: EPA maximum limit for drinking water 10 ppm. OSHA permissible exposure in workplace 100 ppm	Snowpack sampling, snowmelt runoff, stream runoff, snowmelt/rain event	Low	
Geothermal Features	Human-caused damage to geothermal areas	Developed Area	No degradation of geothermal resources	Remote sensing and visual observation	High	Increase law enforcement and educational information Restrict travel

Resource or Value	Indicator	Location/ Management Zone	Preliminary Threshold	Preliminary Method	Initial Monitoring Intensity[1]	Possible Management Options if Threshold is Violated
Visitor Experience	Smoothness of the groomed surface	Travel Corridor	No worse than fair 20% of the daytime hours of park operation (8 A.M. – 4 P.M.)	Visual observation	High	Increase grooming Adjust vehicle numbers when threshold temperature and/or snow conditions are forecasted or reached
	Visitor satisfaction levels with opportunities to experience and view wildlife, scenery, and clean air and solitude.	Developed Area, Road Corridor, Transition, and Backcountry	Visitors are highly satisfied (+90%) with their park experience	Visitor Survey	High	Establish carrying capacity/adjust visitor numbers Determine unsatisfactory conditions and rectify
	Visitor perception and assessment of important park resources and values	Developed Area, Road Corridor, Transition, and Backcountry	Visitors are able to see, smell, and hear the natural environment at roadside pullouts and interpretive trails 90% of daytime hours during park operation (8 A.M. – 4 P.M.)	Visitor survey Encounter rates Time lapse photos Travel simulation models Observations	High	Establish carrying capacity/adjust visitor numbers Require new technologies

Resource or Value	Indicator	Location/ Management Zone	Preliminary Threshold	Preliminary Method	Initial Monitoring Intensity[1]	Possible Management Options if Threshold is Violated
Wildlife	Bird and mammal habituation and effectiveness of garbage facilities	Developed Area	Garbage, human food and other attractants unavailable to wildlife	Observations and monitoring	High	Improve or redesign facilities Alter or implement commercial guiding requirements and allocations
	Ungulate (e.g., bison and elk) movements on plowed roads	Travel Corridor	No unacceptable adverse effects. Unacceptable effects are those considered greater than "adverse moderate."	Continue bison monitoring and flights	High	Evaluate alternative transportation systems Close roads (by road segment or seasonally) Lower speed limits and increase enforcement
	Vehicle caused wildlife mortality	Travel Corridor	No unacceptable adverse effects	Incident reports, roadside surveys, GIS, and visual observations	High	Alter or implement commercial guiding requirements and allocations Evaluate alternative transportation systems Increase law enforcement and educational information Reduce speed limits

Resource or Value	Indicator	Location/ Management Zone	Preliminary Threshold	Preliminary Method	Initial Monitoring Intensity[1]	Possible Management Options if Threshold is Violated
	Wildlife harassment or displacement due to vehicle sounds or movements	Travel Corridor	No unacceptable adverse effects	Incident reports and visual observations	High	Increase law enforcement and educational information Require new technologies Adjust number of daily vehicle entries permitted Alter or implement commercial guiding requirements and allocations Establish additional no-stopping zones Adjust group size requirements Establish timed-entry requirements Close roads (by road segment or seasonally)
	Wildlife trapped by snow berms in road corridor	Travel Corridor	No unacceptable adverse effects	Incident reports, roadside surveys, and visual observations	High	Increase number of exit berms and re-evaluate location of existing exits Evaluate alternative transportation systems

Resource or Value	Indicator	Location/ Management Zone	Preliminary Threshold	Preliminary Method	Initial Monitoring Intensity[1]	Possible Management Options if Threshold is Violated
	Ungulate (e.g., bison and elk) use of groomed surfaces	Travel Corridor	No unacceptable adverse effects	Visual observations, air surveys, and telemetry. Continue bison monitoring	High	Close roads or eliminate grooming operations (by road segment or seasonally) Adjust grooming intensity
	Carnivore (e.g., wolves and lynx) displacement and habitat effectiveness	Transition and Backcountry	Insignificant, discountable, or beneficial effects only	Monitoring and air surveys	High	Mitigate effects or close area Increase law enforcement and educational information Require new technologies Adjust number of daily vehicle entries permitted Alter or implement commercial guiding requirements and allocations Establish additional no-stopping zones Adjust group size requirements Establish timed-entry requirements Consult with USFWS for appropriate mitigation strategies

Resource or Value	Indicator	Location/ Management Zone	Preliminary Threshold	Preliminary Method	Initial Monitoring Intensity[1]	Possible Management Options if Threshold is Violated
	Wildlife harassment or displacement as a result of visitor activities	Transition and Backcountry	No unacceptable adverse effects	Incident reports and visual observations	High	Increase law enforcement and educational information Require use of designated trails only Close areas to use seasonally
	Human-bear conflicts during pre- and post-denning periods	Transition and Backcountry	No unacceptable adverse effects	Mapping of denning areas and visitor use patterns and trends. Incident Reports	Moderate	

Appendix C. SUMMARY OF RECENT BISON AND ELK STUDIES

Borkowski et al. 2006: This study utilized multinomial logits models in more than 6500 interactions of bison and elk with groups of OSVs during five recent winters in YNP to identify conditions leading to behavioral responses. Borkowski et al. found that elk responded three times as often (52%) as bison (19%) during interactions with OSVs due to increased vigilance responses. However, the frequency of higher-intensity movement responses by bison and elk were similar (6–7%, travel; 1–2%, flight; 1%, defense) and relatively low compared to other studies of ungulates and snowmobile disturbance. The likelihood of active responses by bison and elk increased if animals were on or near roads, groups of animals were smaller, or humans approached. The likelihood of an active response by bison decreased within winters having the largest visitation, suggesting some habituation to snowmobiles and snowcoaches. Also, using data from the past 35 years, the authors found no evidence that snowmobile use has affected the population dynamics or demography of bison or elk. They suggest that the regulations restricting levels and travel routes of OSVs have been effective at reducing disturbances to bison and elk below a level that would cause measurable fitness effects and further recommend that park managers consider maintaining OSV traffic levels at or below those observed during the study. Borkowski and his colleagues suggest that differing interpretations of the behavioral and physiological response data will continue to exist because of the diverse social values of the various constituencies concerned with YNP.

Bruggeman et al. 2008a: The authors used aerial and ground data collected during 1970-71 through 2005-06 to quantify annual variations in the magnitude and timing of migration by central herd bison, identify potential factors driving this variation, and evaluate the "domino effect" hypothesis (Meagher 1998) that (a) significant migration to the Madison headwaters area did not occur until bison had fully occupied the Hayden and Pelican valleys, and (b) more animals migrated earlier as numbers increasingly exceeded this limit. Bison from the central herd in Yellowstone National Park were partially migratory, with a portion of the animals migrating to the lower-elevation Madison headwaters area during winter while some remained year-round in or near the Hayden and Pelican valleys. Contrary to the "domino effect" hypothesis, there was significant bison migration to the Madison headwaters area before the Hayden and Pelican valleys were fully occupied and abundance approached the food-limiting carrying capacity of these valleys. However, after the central herd exceeded 2350 animals the number of bison wintering in the Hayden and Pelican valleys appeared to stabilize, while bison continued to migrate to the Madison headwaters area. Also, more bison migrated earlier as density increased (as hypothesized by Meagher 1998). The results suggest some bison migrated outside the west-central portion of the park between the summer and winter counts each year when the central herd exceeded 2350 bison, perhaps relocating to northern range as hypothesized by Meagher (1998) and Fuller et al. (2007). Some of the annual variability in the proportion of bison migrating each winter was explained by density-independent climate covariates. The timing and magnitude of bison migration were accentuated during years of severe snow pack that limited access to food.

Bruggeman et al. 2008b: The effects of road grooming on bison distribution and movements in Yellowstone National Park have been debated since the early 1990s. Opponents claim energy saved by bison traveling on packed snow, in combination with better access to foraging habitat, results in enhanced population growth and increased movements to

boundary areas. We collected spatial and temporal data on bison travel on and off roads during the winters of 1997-98 through 2005-06 to evaluate if road travel was facilitated by road grooming or a manifestation of general bison travel patterns throughout the landscape. Road travel was negatively correlated with road grooming, suggesting grooming did not facilitate bison travel during winter. Temporal trends in road travel were likely a manifestation of general travel patterns because travel on and off roads was driven by factors affecting resource availability, including bison density, snow pack heterogeneity, and cohesion of snow-free patches. Bison use of roads varied depending on habitat attributes and topography surrounding road segments, with certain segments acting as travel corridors. Topography and distances to streams, forested habitats, and foraging areas were significant influences on the amount of bison road travel, with more travel occurring on road segments closer to streams and unburned forest, farther from foraging areas, and passing through canyons. Foraging was the most time-intensive activity (67%) by bison during winter. Traveling comprised a small amount (11%) of bison activity, with the majority (79%) of travel occurring off road. Thirty-one percent of foraging bison displaced snow, compared to only 7% of traveling animals. The ecological effects of road grooming on current bison travel patterns appear minimal, with no evidence that grooming facilitates bison movements beyond park boundaries.

Bruggeman et al. 2008c: The influence of winter road grooming on bison travel patterns in Yellowstone National Park has been debated for more than two decades. The authors radio collared 30 adult, female bison from the central herd during three winters to quantify how snow, topography, habitat attributes, and roads influenced bison travel patterns and non-traveling activities (i.e., foraging, resting). Bison were less likely to use a point on the landscape for traveling or feeding as snow pack increased. However, bison used local areas with deeper snow as the overall snow pack increased on the landscape. Distance to stream was the most influential habitat covariate, with the spatial travel network of bison being largely defined by streams connecting foraging areas. Distances to foraging areas and streams also significantly influenced non-traveling activities, being negatively correlated with the odds of bison foraging or resting. Topography significantly affected bison travel patterns, with the probability of travel being higher in areas of variable topography that constrained movements (e.g., canyons). Distance to road had a significant, negative effect on bison travel, but was nine times less influential compared to the impact of streams. Road grooming has a minimal influence on bison travel and habitat use given the importance of natural dynamic and static landscape characteristics such as snow pack, topography, and habitat attributes on bison choice of travel routes and habitat use for foraging and resting.

Bruggeman, J. E. 2006, Bruggeman et al. 2006, and Bruggeman et al. 2007: Based on data gathered from 1997-2005 using field methods, Bruggeman used statistical modeling and information theoretic techniques to examine spatial and temporal patterns in bison migration, road and off-road travel, and foraging behavior in relation to abiotic and biotic factors. Numbers of bison migrating were related to density and drought severity, while snow, drought, and density affected timing of migration. The probability of bison travel and spatial distribution of travel corridors were affected by topographic and habitat attributes including slope, landscape roughness, habitat, and distances to streams, foraging areas, and forested habitats. Streams were the most influential landscape feature affecting travel and results suggest the bison travel network is defined largely by the presence of streams. Probability of travel was higher in regions of variable topography (i.e., canyons). Pronounced travel corridors existed both in close association with roads and distant from any roads, and

results indicate roads may facilitate bison travel in areas. Multiple effects influenced temporal bison travel patterns. Road travel was negatively correlated with road grooming and Bruggeman found no evidence that bison preferentially used groomed roads during winter. Snowpack, density, and springtime melt were correlated with bison road and off-road travel. Bison foraging area residence times were affected by the ratio of local to landscape scale snowpack, previous foraging experiences, and local and landscape scale competition. Bison patch scale foraging behavior was predominantly affected by snowpack, with biomass and competition having minimal influence. The results indicated that bison spatio-temporal dynamics are affected by multiple, interacting, scale-dependent mechanisms. Overall, factors influencing resource availability provide the primary impetus for variability in bison distribution, movements, and foraging behavior.

Coughenour 2005: Michael Coughenour at Colorado State University evaluated if Yellowstone bison had reached a food-limited carrying capacity by using a spatially-explicit ecosystem simulation model for the Yellowstone ecosystem that integrated data from site water balance, plant biomass production, plant population dynamics, litter decomposition and nitrogen cycling, ungulate herbivory, ungulate spatial distribution, ungulate energy balance, ungulate population dynamics, predation, and predator population dynamics submodels. The overarching model simulated the two Yellowstone bison herds, two resident wintering elk herds, and the summer immigrant elk, and included GIS data for soils, vegetation, topography, and other variables. The model was driven by weather data from 29 different climatological and SNOTEL sites located in and near the park. Precipitation and temperature maps were generated using elevation-corrected spatial interpolation, and a validated snow model simulated the accumulation and melting of snow. When the model was run for 50 years without removals or migrations outside the park, the northern herd increased to a mean of 2417 bison (range = 1820-3530) over 8 simulations using stochastic weather. The central herd increased to a mean of 3776 bison (range = 2430-5630). Maximum counts of Yellowstone bison were 3531 bison in the central herd and 1484 bison in the northern herd during summer 2005. According to this model, neither the central or northern bison herds have yet reached their theoretical food-limited carrying capacities in the park.

After culling in the park ceased (1968), the central bison herd grew to a density where nutritional stress elicited increased competition for key resources and subsequent behavioral responses to search for additional range. Carrying capacity increased once new ranges were found, which resulted in a positive feedback cycle of increased bison numbers, nutritional stress, and further range expansion. Grooming snow-covered roads for snowmobiles may have contributed to the rate at which this process occurred because an increased proportion of travel on packed snow could provide minor energetic savings that, cumulatively over the course of many winters, could compound to accelerate population growth. In addition, there could be an effect on instantaneous decision-making by bison because individual animals decide to travel or not based upon the immediate stress imposed by deep snow conditions. However, bison also reached levels of increased nutritional stress when they were limited to their historical Hayden and Pelican valley winter ranges within the interior of the park. This intolerable nutritional stress, combined with their nomadic nature and ability to travel through deep snow, makes it likely that migration to the upper Madison drainage and beyond was an inevitable outcome whether roads were groomed for OSVs or not.

Fuller et al. 2007a: Fuller and her co-authors examined a 99-year time series of annual counts and removals for 2 bison (*Bison bison*) herds occupying northern and central Yellowstone National Park in the western United States. Yellowstone's aggressive

management intervention effectively recovered bison from 46 animals in 1902 to >1,500 animals in 1954. Supplemental feeding of the northern herd facilitated rapid growth during 1902 to 1952. Augmentation of the central herd with 71 animals also led to rapid growth over 1936 to 1954. In 1969, manipulative management ceased in the park, and the authors detected evidence of density-dependent changes in population growth rates for both herds during 1970 to 2000 as numbers increased to 3,000 animals. The central herd showed evidence of a constant density-dependent response over 1970 to 2000. In contrast, density dependence had a stronger effect on the northern herd's growth rate during 1970 to 1981 than during 1982 to 2000. The authors found evidence to suggest that these trends resulted from pulses of emigration from the central herd to the northern range beginning in 1982 in response to resource limitation generated by an interaction between density and severe snow pack. Corroborative evidence supporting this interpretation included 1) the annual growth of the central herd was negatively correlated with snow pack but that of the northern herd was not, 2) growth rates of the central and northern herds were uncorrelated during 1970 to 1981 but significantly and negatively correlated during 1982 to 2000, and 3) the northern herd could not have sustained the high removals experienced during 1984 to 2000 without immigration. Density-related emigration from the central herd to the northern range may be fueling bison emigration onto private and public lands where large-scale removals occur.

Fuller et al. 2007b: The conservation of bison (*Bison bison*) from near extinction to >4,000 animals in Yellowstone National Park has led to conflict regarding overabundance and potential transmission of brucellosis (*Brucella abortus*) to cattle. We estimated survival and birth rates from 53 radiocollared adult female bison during 1995–2001, and we used calf:adult (C:A) ratios to estimate reproduction with the combined effects of pregnancy, fetal loss, and neonatal mortality during 1970–1997. Annual survival of adult females was high and constant. Birth rates differed by brucellosis status and age. Birth rates were 0.40 calves per female for brucellosis-positive 3 year olds, 0.63 for individuals testing negative, and 0.10 for individuals contracting brucellosis that birth year (sero-converters). Birth rates were 0.64 for brucellosis-positive individuals $\geq$4 years old, 0.81 for brucellosis-negative individuals, and 0.22 for sero-converters. Spring C:A ratios were negatively correlated with snow pack. Growth rate was highly elastic to adult survival (0.51), and juvenile survival (0.36) was 3 times more elastic than fecundity (0.12). Simulations suggested brucellosis eradication via vaccination would result in increased birth rates and a 29% increase in population growth, possibly leading to more bison movements outside the park. Our results will help park managers evaluate bison population dynamics and explore consequences of management actions and disease control programs.

Geremia et al. 2008: The authors monitored 80 adult female bison from the central herd in Yellowstone National Park during 1995-2006 to estimate vital rates that incorporated the effects of brucellosis and could be used to formulate appropriate management strategies (e.g., vaccination, culling). Animals testing positive for exposure to brucellosis had significantly lower pregnancy rates across all age classes compared to seronegative bison. The authors do not understand the causal mechanism for this finding, which is difficult to ascertain since shedding through reproductive events is believed to be the primary route of brucellosis transmission. Birth rates were high and consistent for seronegative animals, but lower for younger, seropositive bison. Seronegative bison that converted to seropositive while pregnant were likely to abort their first and second pregnancies. Thus, naïve seronegative adult bison may be highly susceptible compared to animals exposed before they were reproductively mature. The authors detected pronounced senescence in survival for animals

>12 years old. Also, brucellosis exposure indirectly lowered bison survival because more bison were culled over concerns about transmission to cattle when bison attempted to move to lower-elevation areas outside the park. The authors detected a significant decrease in adult female survival when the number of bison in the central herd exceeded 2000-2500 animals, which was exacerbated during winters with severe snow pack because more bison moved outside the park. Except during 1996-97, the vast majority of radio-collared bison culled at the northern and western boundaries during 1995-2006 came from the central herd. The findings suggest the combined effect of brucellosis on survival, pregnancy, and birth rates lowered the growth rate in the central herd. Thus, population growth rates will likely increase by more than 15% if vaccination plans are implemented and successful. Wildlife managers would then be challenged with greater numbers of disease-free bison dispersing or migrating outside of the park in response to density and climate effects.

Wagner (2006): This analysis of bison count data found no evidence supporting the prediction that road grooming contributed to increased survival or decreased energy expenditure. Wagner stated his agreement with similar conclusions from the National Research Council (Cheville et al. 1998): "the available evidence indicates there has not been such an effect" of groomed roadways upon bison populations and distribution (2006:157).

White et al. (2006): In a statistical analysis similar to Borkowski et al. (2006—the separate study summarized above), this study examined over 5500 records of interactions between OSVs and wildlife collected by the NPS during the last four winters (2002-2003 through 2005-2006) for bison, elk, trumpeter swans, bald eagles, and coyotes. Utilizing this data, multinominal logits models were evaluated to determine if variables related to winter recreation (for example, snowpack characteristics, levels of OSV traffic, distance of the wildlife group from the road, the number of animals in the group, habitat type, etc.) were associated with changes in the behavior of wildlife. This analysis is of particular value because of its robust statistical methodology, the consistent sampling methodology over those years, and the recognition of year-to-year variability. White et al. found that these animals exhibited varying behavioral responses to OSVs in association with human activities. Specifically, animals exhibited an increased vigilance response (in which they focused their attention on the human activities) or a movement response (in which they moved away from the human activity) when they were in close proximity to or on roads, and when groups of wildlife were smaller. White et al. found the same result for bison, elk, and swan groups when they were approached by humans and when their movements were impeded or hastened by vehicles. Overall, the intensity of wildlife group responses differed across the five species in this study, with the percentage of observing a response (either movement or vigilance) being 83.3% for bald eagles, 60.5% for coyote, 52.4% for elk, 42.5% for swans, and only 19.6% for bison. As stated previously, the variability in these percentages is fairly well correlated with the varying vigilance responses of each animal to human disturbance: eagle 72.8% (meaning that 72.8% of eagle responses to human presence were vigilance), coyote 36.7% elk 44.3%, swan 32.5%, and bison 12.5%.

In the original paper, White et al. recommended that park managers "continue to conduct winter recreational activities in a in predictable manner with OSV [over-snow vehicle] traffic levels at or below those observed during the last 3 years of our study (i.e., <50,000 over-snow visitors)." White et al. erred in stating winter use should be limited to 50,000 over-snow *visitors*. Rather, they intended that the phrase read "<50,000 over-snow vehicles" (White 2008). This change is significant, for it allows substantially more visitors to enter the parks;

previously, not even the snowcoach-only alternative from the 2007 FEIS would have accommodated fewer than 50,000 visitors.

Cormack Gates Study

In 2004, the NPS commissioned an interdisciplinary study to assess the science and literature of bison movement and dispersal in the Yellowstone ecosystem. This report, the Gates Report, was the result of a collaborative agreement between the University of Calgary, Faculty of Environmental Design and the Rocky Mountains Cooperative Ecosystems Studies Unit (RM-CESU) at the University of Montana, commissioned by the NPS. Led by Dr. Cormack Gates of the University of Calgary, Canada, the team included Brad Stelfox, Tyler Muhly, Tom Chowns, and Robert J. Hudson, all members of the Faculty of Environmental Design there. The team issued their report in April 2005, entitled "The Ecology of Bison Movements and Distribution in and Beyond Yellowstone National Park: A Critical Review with Implications for Winter Use and Transboundary Population Management." The report is available at: http://www.nps.gov/yell/parkmgmt/winterusetechnicaldocuments.htm under the heading, **Bison/Groomed Road Research**.

The goal of the report was to provide a thorough, independent assessment of the state of knowledge of the ecology of bison movements and distribution within the context of current published concepts and theories. Another important goal was to provide recommendations for adaptive management of uncertainties and gaps in reliable knowledge within an adaptive environmental assessment and management framework, which involves organizing people to link science to management.

The report drew exhaustively upon all known bison literature (including those of Mary Meagher), over 30 bison "informants" (including Mary Meagher, Robert Garrott, Mark Taper, and Dan Bjornlie, and almost 30 others), and extensive modeling efforts. The report began by summarizing the bison management history of YNP. In 1968, the park moved from a 33-year (1934-1967) period of culling ungulate populations to achieve predetermined stocking levels, to a regime of ecological management. Under this regime, populations of bison and other ungulates are allowed to fluctuate in the park without human intervention. Bison populations have grown continuously under this regime. With growing numbers of bison, management has become dominated by two major linked controversies:

- the perceived risk to livestock from brucellosis infection when bison move beyond the park boundary, a concern since the 1920's; and
- the debate over the effects of winter recreation (specifically, grooming roads for oversnow vehicle traffic) on bison ecology, including range expansion, transboundary movements, bison condition, and population dynamics.

The report entailed review of 1) literature on ungulate distribution, including YNP publications and planning documents, 2) key informant interviews for gaining rapid understanding of the system and unpublished knowledge, 3) development of a strategic level bison population and winter distribution model, and 4) key informant technical workshops to refine the model. In addition, a workshop was held with non-governmental organizations to review the concepts and knowledge upon which the assessment and model are based.

The report gives key findings derived from 1) informant knowledge and interpretation of empirical data on population and spatial ecology, and 2) a systems model. Additionally, the report outlines key uncertainties and data gaps that may be addressed through monitoring and basic research.

Key Findings Based on Interviews, Empirical Data, and Historical Records

History

Bison populations have been affected by widely varying influences in recent history including hunting and captive breeding. They are part of a larger system that is best understood at long time scales and at a spatial scale larger than YNP.

Ranges and Movement Corridors

Bison occupy five winter ranges in YNP. The Central herd uses Pelican Valley, Mary Mountain (e.g. Hayden/Madison-Firehole), and West Yellowstone. The Northern herd occupies Lamar Valley and Gardiner Basin. As defined by key informants, these ranges are interconnected by five primary movement corridors including Firehole to Mammoth, Firehole to West Yellowstone, Gardiner Basin to Lamar, Mirror Plateau, and Pelican to Hayden.

Range Expansion

In a finding highly applicable to the winter use debate, the Gates report stated that all YNP bison ranges provide environmental conditions supporting long term growth and persistence of bison populations. Furthermore, there was no evidence to suggest that groomed roads have changed population growth rates relative to what may have happened in the absence of road grooming.

As the number of bison increased, the area they utilized expanded and distributions eventually coalesced. Presently, the authors recognize that the Yellowstone population is composed of two subpopulations, the Central and Northern herds. These herds are defined by differences in ecological conditions and use of space between ranges, genetic differences, fetal growth rates, and tooth wear patterns. For both the Northern and Central bison ranges, mid-winter survey data and history provide strong evidence that range expansion is density driven; more bison require more resources.

It was suggested that groomed roads could promote energy savings and exploratory routes that caused the bison population to increase 'unnaturally.' The authors, however, suggest that bison distribute themselves in an attempt to maintain a certain level of resources per individual. Range expansion, then, is driven by an interaction between population size, forage production, and forage availability. Exploratory movements and knowledge of productive destinations also influence range expansion.

Population Ecology

Generally, YNP is a forage-limited system. Bison in YNP attempt to compensate for declining per capita food resources by range expansion, thus maintaining a relatively stable instantaneous density. However, compensation is not exact; population growth rate declines with density because high quality foraging patches are limited in overall area, are patchily distributed and depleted first, forcing bison to shift to poorer quality patches as density increases. Bison in different areas of YNP experience different ecological conditions, including but not limited to forage, climate, refugia, topography, and predation.

Key Findings Based On Systems Modeling

The Gates report clearly states that bison population and spatial dynamics are expressions of complex interactions best understood using a systems approach. Based on the systems

dynamics paradigm, a strategic-level model was developed to facilitate collaborative learning about bison population, range use dynamics, and management alternatives. Key informants were asked to rank the importance of the system model variables. Using the resulting stakeholder contributions, the model was refined into a 'majority average model' and used to model bison population change over time with varying inputs, including the inputs of winter road grooming and no winter road grooming. The model was also run using the inputs of "Key Informant Group #4," which included Mary Meagher and Mark Taper.

The model identifies key knowledge gaps and easily accommodates new empirical data and relationships emerging from existing and future research. Forage availability was a sensitive driver of bison movements in the model. In turn, the three key variables determining winter forage availability were previous summer precipitation, snowpack characteristics, and elk and bison density (i.e., forage demand).

Bison Road Use

The model indicated that inter-range movements of bison were generally not constrained by winter snowpack in non-road grooming scenarios during most winters. The notable exception to this rule was the Firehole-Mammoth corridor that was a barrier during all non-road grooming scenarios.

According to the modeling, road grooming had a greater influence on movement of bison between interior ranges (Lamar-Mary Mountain, Mary Mountain-Pelican) than to the boundary ranges (West Yellowstone, Gardiner Basin).

Modeling scenarios of bison movement between winter ranges projected from 100 to 4,000 animals, influenced most by per capita forage availability. An average movement of ~1,000 bison occurred in non-road grooming scenarios, and 1,200 in road-grooming scenarios.

Modeling found that cumulative culls during ten 100-year stochastic runs ranged between annual average culls of 50-90 bison for the non-grooming scenario and 60-100 for road grooming scenarios. On average, 75 bison would be culled each year from boundary ranges with or without road grooming. The model predicted maximum cull under current boundary management would periodically exceed 500 animals and rarely exceed 750 animals.

Of note was the finding that increasing bison habitat exterior to YNP is an effective strategy to increase the total regional population, but such a strategy would not reduce the number of bison that would need to be culled annually in the regional landscape surrounding the park. Unless the landscape is completely permeable to bison, management culling will always occur at the margins of bison ranges. In fact, more habitat would allow for bison population growth, which would eventually drive more bison range expansion. While the percentage of the bison population affected would likely decrease, the number of individual animals removed would increase with more habitat.

The issue of how frequently bison use groomed roads and how that use affects their population dynamics and distribution has been contentious. The Gates report, using historical records, interviews and systems modeling, strongly indicates that population growth and range expansion in the Central herd is driven primarily by biotic factors as opposed to the groomed roads. Specifically, the authors state that groomed road segments facilitate movements within the Central Range during winter, but the authors found that such movements would likely have developed in the absence of road grooming as the density of bison increased, because road segments are aligned with natural movement pathways.

However, the Gates report did draw attention to one groomed route that may not be aligned with natural movement pathways. Since the early 1990s Central Range bison have migrated in increasing numbers north to Blacktail Deer Plateau and the Gardiner basin in winter using the road between Madison Junction and Mammoth. The authors suggest that this migration of Central Range bison to the Northern Range might not have developed in the absence of the groomed road between Madison Junction and Mammoth. The suggestion was that snow conditions (depth, SWE, etc.), topography (particularly in the Gibbon Canyon) and other factors might prevent bison from moving from Madison to Mammoth if the groomed road surface was unavailable to them. Given the unique importance of this road corridor in the park's road system, the authors suggested that management manipulations on the Madison to Mammoth road could be used as a de facto experiment to test hypotheses about bison road use.

Key Uncertainties

The authors state that bison population and spatial dynamics are sensitive to variation in several key variables and interactions between variables. Among them is a subset for which the least amount of empirical data is available. They identified 'Key Uncertainties' deserving further research.

One such uncertainty is the extent of the interchange between the Northern and Central bison herds. This information is important for understanding how to conserve the spatial and genetic structuring of this population and maintenance of bison on the Northern Range under current boundary management.

Recommendations from the Gates Report

Monitoring and Science

Yellowstone National Park should implement an internally funded bison population monitoring program that collects and manages data on population size, vital rates, and winter distribution in the long-term. (Such bison monitoring is underway.)

Yellowstone National Park should define a minimum viable bison population for the Northern Range.

Yellowstone National Park should encourage and coordinate research focused on reducing key uncertainties over a full range of densities as the population fluctuates in response to environmental stochasticity or management actions (the workshop and research proposal by Garrott and White, discussed below, provided the foundation for this work).

An adaptive management experiment should be designed to test permeability of the Firehole to Mammoth corridor under variable snow conditions with a specific focus on the road section between the Madison Administrative Area and Norris Junction. (see discussion below).

Yellowstone National Park should install a SNOTEL or snow-course station in the Pelican Valley, monitor snow conditions in the Pelican-Hayden Corridor, and re-evaluate the two existing snow models. (These steps are underway.)

Yellowstone National Park should continue to utilize GPS collars to gather data concerning key questions about movement ecology to be addressed, including the timing and extent of movements in relation to plant phenology, snow conditions, forage production and utilization. (This is part of the monitoring being done as part of the first bullet above.)

Adaptive and Collaborative Management Structures and Processes

The NPS should engage the U.S. Institute for Environmental Conflict Resolution in an independent situation assessment that includes advice on designing an integrated agency and public planning strategy to represent the common interest. (The NPS did engage this group and used the services of Cadence, Inc., to foster and facilitate public engagement on the 2007 EIS.)

The Yellowstone Center for Resources should play a lead role among agencies and researchers in coordinating data sharing, research, and monitoring of bison and other research relevant to bison ecology and management by developing a stable collaborative science and management framework.

The NPS should develop or refine appropriate systems models and other decision support tools to help agencies and other stakeholders to understand key uncertainties and system properties and to evaluate outcomes of management scenarios defined through value-based decision processes. (This research is underway, partly through the adaptive management experiment discussed above.)

The NPS should increase its support for the appropriate agencies to secure agreements for key winter range for bison and other wildlife adjacent to the park in the Northern Range.

Responses to Gates' Study

Acting upon Gates' suggestion, the NPS invited the Big Sky Institute at Montana State University to organize a workshop to evaluate the assertion that the Madison to Norris groomed road would serve as a barrier to bison movements between the Central and Northern winter ranges if grooming on that road were to cease. Held in January 2006, the group discussed an adaptive management experiment to evaluate that assertion: discontinuing road grooming on the road from Madison to Norris (and possibly from there to Mammoth as well) and measuring bison responses and predictor variables. However, the group noted that the proposed adaptive management experiment does not have a control area against which observational data could be compared. Consequently, the temporal change of terminating grooming can only provide observational data of a weak inferential nature on whether the advent of road grooming in the early 1970s has indeed altered bison distributions and migrations in YNP. Indeed, it is impossible to retrospectively determine if groomed roads initially facilitated increased abundance and range expansion by bison because no data on bison travel patterns existed prior to road grooming and bison are now familiar with destination ranges in their expanded range (Big Sky Institute 2006; Garrott and White 2007; see also Fuller 2006). While the workshop group suggested this and other experiments, it did not develop detailed experimental designs that would be necessary to fully implement a meaningful adaptive management experiment. Indeed, some believed that a scientific experiment is impossible because of the extreme number of variables (Big Sky Institute 2006).

Nevertheless, in spring 2007, the NPS contracted with Dr. Robert Garrott at Montana State University-Bozeman to develop a range of studies that could be used to test the key uncertainties identified at the Big Sky Institute workshop. Garrott, in combination with Dr. P.J. White, an NPS wildlife biologist at Yellowstone National Park, submitted "Evaluating Key Uncertainties Regarding Road Grooming and Bison Movements" to the NPS on May 15, 2007. The NPS sought peer review of the proposal from up to twelve wildlife experts, with two agreeing to perform the review. The NPS also posted the draft proposal on its website for

cooperators, stakeholders (including potential litigants) and other interested parties to review (the website is http://www.nps.gov/yell/parkmgmt/winterusetechnicaldocuments.htm). Peer review is now complete, with the final proposal, the peer reviews, and the author's response available at the same website. NPS anticipates further participation with stakeholders as it develops objectives, design, and analyses of a potential road closure experiment.

In their proposal, Garrott and White (2007) considered various types of study designs and statistical approaches to evaluate three overriding uncertainties regarding road grooming and bison movements in Yellowstone: 1) what is the influence of snow and terrain on bison movements; 2) what are the drivers of bison migration, re-distribution, and demography; and 3) what are the effects of road grooming on bison use of travel corridors? They developed testable predictions, proposed study designs and statistical analyses, and identified strengths of inference and potential pitfalls. They recommended a tiered approach to gain reliable knowledge regarding the effects of road grooming on bison movements. To evaluate the influence of snow and terrain on bison movements, they recommended using data from Global Positioning System (GPS) collars deployed on more than 30 bison during 2003-2007 to evaluate their odds of occupancy or movement given certain snow pack levels. To determine the drivers of bison spatial dynamics and population vital rates, they recommended integrating available data sets and formulating response variables describing variation in bison migration, foraging movements, adult survival, and calf survival with potential drivers of the variation evaluated within a multiple regression framework. To evaluate the effects of road grooming on bison travel, they recommended that a progression of studies be implemented during a succession of winters (these would be increasingly intrusive to park operations and visitors): 1) maintain a sample of 50-60 bison with GPS collars distributed between the central and northern breeding herds for at least five years to gain insights into the spatial and temporal factors influencing bison movements across the landscape; 2) deploy camera systems along the Firehole Canyon, Gibbon Canyon, and Mary Mountain trail to collect baseline data on the direction, frequency, magnitude, and timing of movement through major travel corridors; 3) perform experimental manipulations of bison movements through the Firehole Canyon by using metal gates or temporary cattle-guard bridges and fencing to deny bison access to the main groomed road and evaluate their use of alternate ungroomed routes; 4) manipulate bison movements through the Gibbon Canyon using gates/bridges and fencing to deny bison access to the new bridge and road (once construction is completed), while evaluating their use of an alternate ungroomed route; and 5) close the road between Madison and Norris junctions with no grooming of the roadway. The NPS has begun implementation of the research proposal by initiating the development and testing of a prototype camera system and placing radio collars on 30-40 bison (2008-09).

This study is intended to provide insights regarding key uncertainties about the bison-groomed road issue. The fact that the numerous studies into this concern have provided partial support for competing views, rather than the unambiguous rejection of one over another, is not surprising because ecological interactions are complex at the landscape scale (Hobbs and Hilborn 2006). The best available evidence now suggests that the observed changes in bison distribution over time were consequences of natural population growth and range expansion in a population recovering from near extirpation that would have occurred with or without access to snow-packed roads, though perhaps not at the same rate (Coughenour 2005, Gates et al. 2005, Bruggeman 2006) (see *Affected Environment: Wildlife)*.

Appendix D: SOCIOECONOMIC DATA

Comparison of Results to Other Studies

A number of other studies and documents were evaluated as a basis for alternative estimates or economic parameters for purposes of this analysis. These include: "Snowmobiling in Montana 2002" (Sylvester 2002); "2000-2001 Wyoming Snowmobile Survey" (McManus et al. 2001); "The Economic Impact of Travel & Tourism in Idaho" (Global Insight 2005); "Recreation Participation Patterns by Montana Residents" (Ellard et al. 1999); "Niche News: Winter Outdoor Enthusiasts" (Institute for Tourism and Recreation Research, 2003); "The Montana Trail Users Study" (McCool and Harris 1994); "Wyoming Travel Industry 2003 Impact Report" (Wyoming Travel and Tourism 2003), "Economic Trends in the Winter Season for Park County, Wyoming" (David T. Taylor 2007), "Wolves and People in Yellowstone: Impacts on the Regional Economy" (John Duffield, Chris Neher, and David Patterson 2006), "Turning On the Off-Season, Opportunities for Progress in the Yellowstone-Teton Region (Yellowstone Business Partnership 2007), and "The Park County Economy – Restructuring and Change in a Growing Region" (Swanson 2006). With the exception of Sylvester (2002) and McManus et al. (2001), the studies are too general to provide parameters or estimates for application in this analysis. Most of the studies are at the state level, for the entire year, and for all types of recreation. These studies are discussed below.

The Bureau of Business and Economic Research at The University of Montana prepared the report "Snowmobiling in Montana 2002" for the Montana Department of Fish, Wildlife, and Parks and the Montana Snowmobile Association (Sylvester 2002). The report updated previous evaluations of the economic contribution of snowmobiling in the State of Montana. This report concentrated on snowmobile expenditures in the West Yellowstone area. The authors estimated that nonresident snowmobilers spend about $225 per activity day, including food, lodging, and often, snowmobile rental costs.

The main focus of the Sylvester (2002) study is on a statewide overview of snowmobiling in Montana. However, Sylvester explored the reaction to the NPS proposal to limit snowmobiles in Yellowstone National Park. The study asked West Yellowstone respondents if they would return to the area even if they could not snowmobile in the park. Over 56% said they would return. Sylvester estimated that about $33 million of the total nonresident expenditures from snowmobiling occur in West Yellowstone. He also estimated that restricting the number of individuals in Yellowstone National Park may result in a decline of nonresident expenditures of between $10 million and $15 million in West Yellowstone. This decline assumed that some of the snowmobilers may be replaced by other winter users. Sylvester estimated that these expenditure estimates translate into losses of between $2 million and $4 million in labor income, affecting winter employment opportunities in West Yellowstone, that some full-time jobs may become part-time jobs, and that some part-time jobs may cease to exist. Based on this study, as many as 150 jobs in West Yellowstone could be affected if the NPS were to limit snowmobiling in the park. These results are comparable to some of the estimates reported above in this EA.

The results from the 2000-2001 Wyoming Snowmobile Survey provide information on trail usage, expenditure information and user satisfaction for snowmobiling in the State of Wyoming. The results represent resident, nonresident, and outfitter client snowmobile use of Wyoming

State trails during the season of 2000-2001. Trips to Yellowstone and Grand Teton National Parks trails accounted for 3.1% of resident, 4.6% of nonresident, and 33.2% of outfitter client snowmobile trips during the season. Daily per person trip expenditures in Wyoming ranged from $180.27 for outfitter clients to $98.99 for nonresidents and $68.50 for residents. Annual equipment expenditures in Wyoming ranged from $2,306.13 for residents to $329.94 for nonresidents, and $64.11 for outfitter clients (McManus et al. 2001). However, statewide information contained in the Wyoming survey is not directly comparable to survey data specific to the GYA.

In the 2000-2001 Wyoming Snowmobile Survey, the majority of residents (nearly 70%) preferred that there would be no ban on snowmobiles. Half of these preferred a requirement for cleaner and quieter machines and half wanted no additional requirements. About 20% of resident snowmobilers preferred a solution that limited snowmobile access by day or by season. Over 37% of nonresident respondents preferred no ban and no additional requirements. As a solution, 28% favored cleaner and quieter machines and almost 30% favored either a partial ban in highly sensitive areas or more limited access by day or by season. Half of resident Wyoming snowmobilers did not see a need for cleaner and quieter snowmobiles but 50% also said they would pay more to use them if these vehicles were available. A minority of nonresidents (28.2%) thought there was a need for cleaner and quieter snowmobiles, but 50.5% of all respondents said they would pay more to use them if these vehicles were available. A majority of outfitter clients (56%) thought there was a need for cleaner and quieter snowmobiles and over 64% said they would be willing to pay a higher price to use them (McManus et al. 2001).

The 2000-2001 Wyoming Snowmobile Survey also asked respondents (statewide) about behaviors that would result from a ban on snowmobile use in the parks. The study found that over 78% of outfitter clients, 89% of residents, and 97.3% of nonresidents indicated that snowmobiling was their primary purpose for traveling to Wyoming during their most recent visit. Trips to Yellowstone and Grand Teton national parks accounted for 3.1% of resident, 4.6% of nonresident, and 33.2% of outfitter client snowmobile trips during the 2000-2001 season. Outfitter clients would make the most changes of all Wyoming trail users if the parks were closed to snowmobile access; nonresidents and residents would also be affected but to a lesser degree. Resident, nonresident, and outfitter clients indicated they would decrease their annual overall total number of snowmobiling trips by 2.5%, 11.4%, and 34% respectively. Resident, nonresident, and outfitter clients indicated they would decrease their annual snowmobiling trips to Wyoming trails by 5%, 10.4%, and 52.3% respectively. However, the survey results do indicate some substitution to other trails within the region (Montana, Idaho, Colorado, South Dakota, and Utah) with the number of resident trips increasing by 52.1% and outfitter client trips increasing by 20.6%. Nonresident snowmobilers indicated their use of other regional trails would decrease by 10.4%. The majority of Wyoming snowmobile trail users (84.6% of outfitter clients, 91.2% of residents, and 93.2% of nonresidents) would not consider going to Yellowstone if their only mechanized access were by snowcoach tours (McManus et al. 2001).

The Wyoming study concludes from these data that there could be a loss of up to 938 jobs, $11.8 million in labor income, and $1.3 million in government revenue in the state if the NPS implemented a snowmobile ban in the parks. The estimated job losses in the McManus et al. study just for Wyoming are higher (938 jobs lost) than the estimated job losses for Wyoming, Montana, and Idaho, combined, in the results reported in this EIS (747 jobs). Additionally, the

community level analysis in this EIS indicates a much larger loss at West Yellowstone for a snowmobile ban (378 jobs) than at Jackson (144 jobs) and Cody (9 jobs) (McManus et al. 2001). This is consistent with the distribution of snowmobile visitors at the west, east, and south entrances. The Wyoming estimates may be high because snowmobilers were surveyed statewide and not all respondents actually would be reducing their use in the GYA in response to a ban.

The Global Insights (2005) study of the tourism industry in Idaho provides county by county estimates of the annual impacts of tourism for all types of activities. There is no specific analysis of winter use or snowmobiling.

The Ellard, Nickerson, and McMahon (1999) study is an analysis of participation patterns by Montana residents for all recreation activities and on an annual basis. The study shows that relative to other activities, snowmobiling has relatively low participation, at seven percent. However, there is no specific analysis of snowmobiling in any specific area (such as Yellowstone), expenditure analysis, or policy analysis for this sport.

The Niche News document (ITTR 2003) summarizes some facts about winter recreation in Montana. The reported data specific to snowmobiling are that 16 percent of nonresident visitors are attracted to this activity, compared to 59 percent for downhill skiing and 27 percent for Yellowstone.

McCool and Harris (1994) examined participation in Montana resident trail use for all kinds of activities including walking for pleasure, backpacking, ATV use, etc. Findings specific to snowmobiling are that 15 percent reported going snowmobiling in the fall through winter survey period, and that there is a slight preference for groomed trails.

The Wyoming Travel and Tourism report (2003) includes an overview of the economic impact of all types of tourism on an annual basis in Wyoming. One finding is that hiking creates 32 percent of "marketable trips," compared to 3 percent for snowmobiling.

The Economic Trends for Park County, Wyoming (Taylor 2007) summarized park visitation, lodging sales and lodging tax revenue, and accommodation and food service sector employment for the county. The report applies an inflation factor so that the reader can see the effect of rising lodging rates on tax revenue.

Wolves and People (Duffield, Neher and Patterson 2006) is a specific look at the role of wolf watching in Yellowstone on the economy of the Greater Yellowstone region.

The report "Turning On the Off Season" (Yellowstone Business Partnership 2007) presents the results of a research project to look at some of the characteristics and indicators that are relevant to understanding how the Greater Yellowstone region operates, especially in the fall, winter, and spring seasons.

Finally, the report "The Park County Economy – Restructuring and Change in a Growing Region" (Swanson 2006) is a focused look at the Park County, Wyoming economy and how it has changed in the last 15 years in comparison with similar counties in the West.