August 2004

Economic Analysis of Temporary Regulations on Snowmobile Use in the Greater Yellowstone Area

Final Report

Prepared for

National Park Service
Environmental Quality Division
Dr. Bruce Peacock
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RTI International
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*RTI International is a trade name of Research Triangle Institute.

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Acknowledgments

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1 Introduction

NPS has been assessing winter use issues within the parks located in the Greater Yellowstone Area for several decades. As a result of rulings by federal courts, NPS will issue a temporary winter use rule. This report describes the results of an economic analysis of the proposed alternatives for regulating snowmobile use in Yellowstone National Park (YNP), Grand Teton National Park (GTNP), and the John D. Rockefeller, Jr., Memorial Parkway (the Parkway) during the next 3 winters.

The National Park Service (NPS) has been assessing winter use issues within the parks located in the Greater Yellowstone Area (GYA) (Yellowstone National Park [YNP], Grand Teton National Park [GTNP], and the John D. Rockefeller, Jr., Memorial Parkway [the Parkway]) for several decades. This assessment has resulted in intensive study and public involvement and in 1990 a winter use plan (NPS, 1990) was completed for GYA. In 1997, the Fund for Animals filed suit against NPS alleging that NPS had failed to conduct adequate analysis under the National Environmental Policy Act (NEPA) when developing its winter use plan for the areas, failed to consult with the U.S. Fish and Wildlife Service on the effects of winter use on threatened and endangered species, and failed to evaluate the effects of trail grooming on wildlife and other park resources. In 1997, the Department of the Interior (DOI) and the plaintiffs reached a settlement agreement in which NPS agreed to produce an environmental impact statement (EIS). The final environmental impact statement (FEIS) was published and the record of decision (ROD) was subsequently signed on November 22, 2000. The new rule was published in the *Code of Federal Regulations* (CFR) on January 22, 2001 (36 CFR Part 7).[1] The regulation eliminated recreational snowmobile and snowplane use from the parks by the winter of 2003–2004.

On December 6, 2000, a lawsuit filed by the International Snowmobile Manufacturers Association (ISMA) asked for the

[1]The rule became effective February 21, 2001.

pending decision, reflected in the ROD and final rule, to be set aside on the basis of NEPA process infractions. The Office of the Secretary of the Interior negotiated a procedural settlement that became final on June 29, 2001. Through the terms of the settlement, NPS prepared a Supplemental Environmental Impact Statement (SEIS). In accordance with the settlement, the SEIS incorporated "any significant new or additional information or data submitted with respect to a winter use plan." Additionally, NPS provided the opportunity for additional public participation in furtherance of the purposes of NEPA. A Notice of Intent to prepare an SEIS was published in the *Federal Register* on July 27, 2001. The draft SEIS was published on March 29, 2002, and distributed to interested and affected parties. The draft SEIS examined two alternatives to allow some form of snowmobile access to continue, a no-action alternative that would implement the November 2000 ROD and another alternative that would implement the no-action alternative 1 year later to allow additional time for phasing in snowcoach-only travel.

On November 18, 2002, NPS published a final rule (67 FR 69473) based on the FEIS, which generally postponed for 1 year implementation of the phase-out of snowmobiles in the parks pursuant to the January 2001 final rule (66 FR 7260). This "delay rule" allowed for additional time to plan and implement the NPS-managed mass-transit, snowcoach-only system outlined in the SEIS. In addition, this rule allowed for NPS to complete the SEIS and prepare a new ROD. The delay rule allowed for snowmobile use to continue through the end of the 2003–2004 winter use season and delayed the implementation of the daily entry limits on snowmobiles until 2003–2004. The requirement that snowmobiles use an NPS-permitted guide was also delayed until the 2003–2004 winter use season. Additional regulations concerning licensing, hours of operation, and snowplane use remained effective for the winter use season of 2002–2003. The existing regulations prohibit the use of snowplanes in GTNP after the winter season of 2001–2002. Those provisions were not addressed in, or affected by, the SEIS.

The Notice of Availability for final SEIS (FSEIS) was published on February 24, 2003. The FSEIS included a new alternative, Alternative 4, which was identified as the preferred alternative. A ROD for the FSEIS was signed on March 25, 2003. The ROD selected FSEIS Alternative 4 for implementation, and it enumerated additional modifications to that alternative. The FSEIS and ROD found that implementation of the FSEIS Alternatives 1a, 1b, 3, or 4 would not be likely to impair park resources or values resulting from motorized oversnow recreation.

On December 11, 2003, NPS published a final rule based on the FSEIS Alternative 4. However, on December 16, 2003, a DC District Court judge ordered NPS to implement the 2001 rule. In February 2004, a Wyoming federal judge temporarily halted implementation of the 2001 rule. These early and mid-winter rule changes resulted in much uncertainty about the status of snowmobile use during the 2003–2004 winter season and beyond.

This report describes the results of an analysis of the economic impacts of five temporary winter use alternatives for regulating snowmobile use in the GYA during the winters of 2004–2005, 2005–2006, and 2006–2007. For a proposed change in regulation, federal statutes, including Executive Order (EO) 12866, require NPS to conduct a benefit-cost analysis of the proposed regulation and an analysis of the impact of the regulation on small businesses under the Regulatory Flexibility Act (RFA) of 1980. Following a description of the current and proposed regulations, this report presents baseline information about all portions of the GYA and the current status of snowmobile activity.

Because the recent court orders described above provide conflicting decisions regarding the rule that will be implemented in the GYA, the Department of the Interior is uncertain how to characterize baseline conditions in the absence of the proposed regulation. Thus, for the purposes of evaluating the effects of the regulatory alternatives considered, the analysis was conducted using two different baselines. One baseline reflects conditions expected under the January 2001 final rule (the Alternative 1 baseline). Under this rule, snowmobiles would be

prohibited in both YNP and GTNP during the 3 years covered by this analysis (2004–2005, 2005–2006, and 2006–2007). The other baseline (the historical baseline) assumes snowmobile use would be permitted to continue at historical levels during the 3 years of this analysis (i.e., snowmobile use would be managed as it was prior to the January 2001 rule). From these baselines, benefit-cost and small business impact analyses were conducted to determine the impacts of changing snowmobile regulations. Benefit-cost and regulatory flexibility analyses in support of the January 2001, November 2002, and November 2003 rulemakings provide additional background for the analysis provided in this report (NPS, 2001; 2002; 2003b).

The quantitative results of the benefit-cost analysis are summarized in sections 3.3 and 4.2 for the Alternative 1 baseline and the historical baseline, respectively. It is important to note that this analysis could not account for all costs or benefits due to limitations in available data. For example, the costs associated with adverse impacts to park resources and with law enforcement incidents are not reflected in the quantified net benefits presented in this report. It is also important to note that the benefit-cost analysis addresses the economic efficiency of the different alternatives and not their distributive equity (i.e., does not identify the sectors or groups on which the majority of impacts fall). Therefore, additional explanation is required when interpreting the results of this benefit-cost analysis.

Alternative 4 was selected as the preferred alternative because it best balances winter use with the protection of park resources. Monitoring during the 2003–2004 winter season demonstrated that a feature of this alternative, 100 percent commercial guiding, was very successful in protecting park resources and in reducing law enforcement incidents. Alternative 4 also substantially mitigates distributive equity concerns associated with some of the other alternatives. This balance is explained below relative to the other alternatives considered.

- Alternative 1 is similar to the conditions expected under the January 2001 final rule, which was enjoined by the Wyoming District Court. While protective of park

resources, this alternative would not promote viable business opportunities in the local communities. The quantified net benefits in Sections 3 and 4 do not reflect the potentially significant distributive impacts on this sector.

- Alternative 2 similarly reflects the levels of winter use that were of concern to the Wyoming District Court. Those levels of use raise potentially significant distributive equity concerns. The quantified net benefits in Sections 3 and 4 do not reflect the potentially significant distributive impacts to local businesses.
- Alternative 3 would permit 20 percent unguided snowmobiles in Yellowstone. While mitigating some of the distributive impacts on local businesses, this alternative was not considered to be properly protective of park resources, as indicated by the results of the 2003–2004 winter season monitoring. The quantified net benefits in Sections 3 and 4 do not reflect the potentially significant impacts to park resources resulting from unguided snowmobiles.
- Alternative 5 would permit 20 percent noncommercially guided snowmobiles in Yellowstone. This alternative is also similar to the conditions expected under the December 2003 final rule, which was vacated by the DC District Court. While mitigating some of the distributive impacts on local businesses, this alternative was not considered to be properly protective of park resources, as indicated by the results of the 2003–2004 winter season monitoring. The quantified net benefits in Sections 3 and 4 do not reflect the potentially significant impacts to park resources resulting from unguided snowmobiles.

Alternative 4 achieves a balance by providing viable business opportunities in the local communities with its permitted use levels and by requiring 100 percent commercial guiding in Yellowstone to protect park resources. Alternative 4 also substantially mitigates impacts to small businesses. The August 2004 Temporary Winter Use Plans Environmental Assessment indicates that Alternative 4 imposes the second smallest reduction in business output relative to historical use, and the second largest increase in business output relative to Alternative 1. Only Alternative 5 had more favorable business output impacts; however, it is not considered to be sufficiently protective of park resources, and conditions similar to it (the

December 2003 final rule) were found to be unacceptable by the DC District Court.

The business output impacts presented in the Environmental Assessment reflect all businesses; however, 69 of the 74 snowmobile rental shops and guided tour operators with available revenue estimates were classified as small businesses in Section 5 of this report. Therefore, these business output impacts are considered to be strongly indicative of the impacts to small businesses. Additionally, 88 percent of the business output impacts estimated in the Environmental Assessment for all of Wyoming, Montana, and Idaho were concentrated in the immediate five counties surrounding the parks. Therefore, these business output impacts are also considered to be strongly indicative of the distributive equity impacts to the local communities.

1.1 ORGANIZATION OF REPORT

This report is organized as follows. Section 1 describes the reason for the regulation and the current and proposed regulations in YNP, GTNP, and the Parkway. Baseline visitation, environmental conditions, and economic activity in and around these parks are described in Section 2. Section 3 describes the methodology for assessing the impacts of the alternatives on social welfare and presents a benefit-cost analysis of Alternatives 2 through 5 relative to the Alternative 1 baseline. Section 4 presents the benefit-cost analysis of Alternatives 1 through 5 relative to the historical baseline. Section 5 provides an analysis of the impacts of the alternatives on small businesses under each baseline. In addition, there are two appendices.

During the winter of 2002–2003, a survey of visitors to YNP and the Taggart Lake parking lot in GTNP was conducted (NPS, 2003a). The survey design was reviewed by three nationally recognized experts in the design and use of surveys for benefit-cost analysis—Dr. John Loomis (Colorado State University), Dr. V. Kerry Smith (North Carolina State University), and Dr. F. Reed Johnson (RTI International). The reviewers' recommendations were incorporated into the final survey design. In addition, the entire survey report was independently

peer reviewed by survey experts Dr. John Loomis and Dr. Joffre Swait (Advanis, Inc.), and the survey report was revised as appropriate in response to their comments. The results of the survey, presented in Appendix 1, were used to inform the benefit-cost analysis. Appendix 2 includes a detailed theoretical discussion of the types of benefits and costs associated with snowmobile restrictions in national parks and the methods used in their estimation.

1.2 PROBLEM ADDRESSED BY REGULATION

In general, regulations should be imposed only where a market failure exists that cannot be resolved efficiently by measures other than federal regulation. The justification for restricting snowmobile use in YNP, GTNP, and the Parkway is based on externalities associated with their use.

The U.S. Office of Management and Budget (OMB) directs regulatory agencies to demonstrate the need for their rules (OMB, 2000). In general, regulations should be imposed only where a market failure exists that cannot be resolved efficiently by measures other than federal regulation. If each producer and consumer has complete information on his or her actions and makes decisions based on the full costs of those actions, resources will be allocated in a socially efficient manner. However, when the market's allocation of resources diverges from socially optimal values, a market failure exists. A defining feature of a market failure is the inequality between the social consequences of an action and a purely private perception of benefits and costs. The major causes of market failure identified in OMB guidance on EO 12866 are externalities, natural monopolies, market power, and inadequate or asymmetric information. For environmental problems resulting from market failures, this divergence between private and social perspectives is normally referred to as an externality. Such divergences occur when the actions of one economic entity impose costs on parties that are external to, or not accounted for in, a market transaction or activity.

The justification for restricting snowmobile use in YNP, GTNP, and the Parkway is based on externalities associated with their use. For instance, the operation of snowmobiles imposes costs on other park visitors associated with noise emissions, air pollution emissions, congestion, and health and safety risks. Because snowmobile users have little incentive to consider these external costs, they are likely to make decisions about

their snowmobile use without considering these impacts on other people.

If these externalities are internalized to the snowmobile users generating them, the problem can be mitigated. For example, if snowmobilers were required to pay for the marginal external costs they impose on others, they would begin to take those costs into account when making decisions, and the market failure would be corrected. However, accurately assigning costs associated with each individual snowmobiler's actions and enforcing payment is infeasible at this time. Other regulatory options to address the externalities associated with snowmobile use in YNP, GTNP, and the Parkway are far easier to implement and enforce. Some of the potential options include geographic restrictions, time-of-use restrictions, and restrictions on snowmobile engine type.

The extent to which social welfare improves because of snowmobile regulation in YNP, GTNP, and the Parkway depends on the relative benefits and costs associated with the regulations. Although nonsnowmobilers may gain, the snowmobilers and local businesses that serve them experience welfare losses if snowmobile use is restricted.

The extent to which social welfare improves because of snowmobile regulation in YNP, GTNP, and the Parkway depends on the relative benefits and costs associated with such restrictions. Although nonsnowmobilers may gain from restrictions due to reductions in congestion, pollution, and noise, the snowmobilers and local businesses that serve them experience welfare losses. Thus, whether a particular regulatory option will improve social welfare depends on numerous factors that influence the level of benefits and costs.

Based on earlier analysis, NPS had decided that snowmobiles should be banned from YNP, GTNP, and the Parkway and published a rule that would eliminate recreational snowmobile and snowplane use in the parks by the winter of 2003–2004. However, in creating the SEIS, NPS identified additional preferred alternatives and reevaluated the existing alternatives. Alternatives 2, 3, and 4 in the FSEIS were developed to address concerns about the negative externalities associated with snowmobile use in the parks, while mitigating the welfare losses to snowmobile riders and the businesses that serve them that would result from implementing the delay rule. Although snowplane use will remain banned from the parks beginning the winter of 2003–2004, through the SEIS process NPS identified a different preferred alternative, and the March 2003 ROD selected FSEIS Alternative 4 for implementation (and

enumerated additional modifications to that alternative). The critical elements of the ROD include increasing the number of snowmobiles relative to the delay rule through daily limits, implementing the air and sound emissions requirements that are consistent with best available technology (BAT) for snowmobiles, implementing an adaptive management program that will look at short- and long-term effects of the selected winter management plan, calling for a reasonable phase-in period, developing a new generation of snowcoaches, and funding to effectively manage the winter use program.

The new temporary winter use alternatives are similar to those in the FSEIS, except that all or most snowmobile use in YNP must be guided in all the alternatives that allow snowmobiles. Again, Alternative 1 would prohibit snowmobile use, while Alternatives 2 though 5 allow use under daily limits and requirements for guiding in YNP. As with the alternatives considered in the FSEIS, Alternatives 2 through 5 attempt to balance concerns about the externalities associated with snowmobile use against the concerns about the economic impacts on the local economy from reductions in visitation if snowmobiles are prohibited.

1.3 CURRENT SNOWMOBILE REGULATIONS

As discussed above, court actions have left current regulations uncertain. This report evaluates the alternatives relative to two baselines: the Alternative 1 baseline (which prohibits snowmobile use in the parks based on the 2001 rule) and the historical baseline (which continues management of snowmobiles as it was in the 2002–2003 season and previous seasons).

1.4 PROPOSED REGULATIONS

NPS considered five temporary snowmobile management alternatives for GYA. Table 1-1 outlines the five alternatives. Alternative 1 prohibits snowmobile use in the parks. As stated above, Alternative 1 is considered one of the baselines for this report. The other four alternatives allow snowmobile use subject to daily entrance limits and guided tour requirements. Under Alternatives 2 and 4, 100 percent of the snowmobiles in

Table 1-1. Temporary Winter Use Plan Environmental Assessment (June 28, 2004)

	Alternative 1: Snowcoaches Only	Alternative 2	Alternative 3	Alternative 4	Alternative 5: December 11, 2003, Final Rule
Highlights	This alternative emphasizes snowcoach access to Yellowstone in the winter. All snow roads would be open. This alternative most closely matches the November 2000 decision.	This alternative is roughly comparable to the winter of 2003–2004, and emphasizes snowcoach access while allowing some snowmobile use.	Alternative 3balances snowmobile and snowcoach access and accommodates visitors who wish to have an unguided experience. Growth would occur in snowcoach access.	Alternative 4 allows additional snowmobile use, while relying on commercial guiding for snowmobile access to Yellowstone. Modest growth in snowmobile access would occur.	This alternative calls for both snowmobile and snowcoach access to the parks. Moderate growth in snowmobile access would occur.
Daily entry limits	Snowcoach only	West: 160 South: 121 East: 22 North: 15 Old Faithful: 0 YNP Total: 318 Continental Divide Snowmobile Trail (CDST): 25 Grassy Lake: 25 Jackson Lake: 0 GTNP Total: 50	West: 290: 240 com'l; 50 unguided South: 146: 121 com'l; 25 unguided East: 50: 40 com'l; 10 unguided North: 32: 22 com'l; 10 unguided Old Faithful: 22 com'l YNP Total: 540: 445 com'l; 95 unguided CDST: 25 Grassy Lake: 25 Jackson Lake: 25 GTNP Total: 75	West: 400 South: 220 East: 40 North: 30 Old Faithful: 30 YNP Total: 720 CDST: 50 Grassy Lake: 50 Jackson Lake: 40 GTNP Total: 140	West: 550: 440 com'l; 110 noncom'l South: 250: 200 com'l; 50 noncom'l East: 100: 80 com'l; 20 noncom'l North: 20: 16 com'l; 4 noncom'l Old Faithful: 30: 24 com'l; 6 noncom'l YNP Total: 950: 760 com'l; 190 noncom'l CDST: 75 Grassy Lake: 75 Jackson Lake: 40 GTNP Total: 190

(continued)

Table 1-1. Temporary Winter Use Plan Environmental Assessment (June 28, 2004) (continued)

	Alternative 1: Snowcoaches Only	Alternative 2	Alternative 3	Alternative 4	Alternative 5: December 11, 2003, Final Rule
Snowmobile guiding requirements	NA	100 percent commercially guided in YNP Guides not required in GTNP or the Parkway	Appx. 80 percent commercially guided/20 percent unguided in YNP Guides not required in GTNP or the Parkway	100 percent commercially guided in YNP Guides not required in GTNP or the Parkway	80 percent commercially guided/20 percent noncommercially guided in YNP Guides not required in GTNP or the Parkway
Group size requirements	NA	No more than 11 snowmobiles	No more than 11 snowmobiles	No more than 11 snowmobiles	No more than 11 snowmobiles
Phase-in of Requirements	Immediately	Immediately	Unguided entries would be phased-in beginning with winter of 2005–2006. Unguided entries during 2004–2005 would not be permitted and this portion of the entry limits would be allocated to commercial guides. Concessionaire would manage the unguided program through a management and service contract.	Immediately	Noncommercial training program would be phased-in during winter of 2005–2006 (this portion of the allocations would be unguided during 2004–2005 season). In cooperation with gateway communities, businesses, counties, and state tourism organizations, develop a reservation system for the effective use of the 20 percent daily noncommercial entry limits.

YNP must be guided. Alternative 2 has the lowest daily limits. Alternative 3 calls for 80 percent of the snowmobiles to be on commercially guided tours and, starting in the winter of 2005–2006, 20 percent can be unguided. Finally, Alternative 5 calls for 80 percent of the snowmobiles to be commercially guided and 20 percent to be guided by noncommercial guides. Under Alternative 5, NPS will design a certification course for visitors to become noncommercial guides. Alternative 5 was the final rule selected from the alternatives in the FSEIS and published on December 11, 2003. This rule was set aside by a federal judge on December 16, 2003.

To facilitate comparisons between the current temporary winter use alternatives and the FSEIS alternatives, Table 1-2 presents their key similarities and differences.

Table 1-2. Comparison of Temporary Winter Use Management Alternatives and FSEIS Management Alternatives

Temporary Winter Use Alternative	Most Similar FSEIS Alternative	Key Similarities	Key Differences
Alternative 1	Alternative 1a, 1b	Snowmobiles prohibited starting winter of 2004–2005	
Alternative 2	Alternative 3	Daily limits on snowmobiles 100 percent of snowmobiles in YNP on commercially guided tours BAT required for all snowmobiles	Daily limits for temporary winter use Alternative 2 in YNP and GTNP are less than 50 percent of daily limits in FSEIS Alternative 3. Temporary winter use alternative 2 does not require guided tours in GTNP, while FSEIS Alternative 3 does.
Alternative 3	Alternative 4	Daily limits on snowmobiles, limits in GTNP the same in both alternatives 80 percent of snowmobiles in YNP on commercially guided tours BAT required for commercially guided snowmobiles	Temporary winter use Alternative 3 allows for 20 percent of snowmobiles to be unguided starting in 2005–2006. FSEIS Alternative 4 allows for 20 percent of snowmobiles to be noncommercially guided starting in 2004–2005. Temporary winter use Alternative 3 requires 100 percent of snowmobiles in YNP in 2004–2005 to be commercially guided. Temporary winter use Alternative 3 daily limits for YNP less than 50 percent of daily limits for FSEIS Alternative 4.
Alternative 4	Alternative 3	Daily limits on snowmobiles 100 percent of snowmobiles in YNP on commercially guided tours BAT required for all snowmobiles	Daily limits for Temporary winter use Alternative 4 are lower for both parks as a whole than the daily limits in FSEIS Alternative 3 and lower for the North, East, and South Entrances, but higher for the West entrance. Temporary winter use Alternative 4 does not require guided tours in GTNP, while FSEIS Alternative 3 does.

(continued)

Table 1-2. Comparison of Temporary Winter Use Management Alternatives and FSEIS Management Alternatives (continued)

Temporary Winter Use Alternative	Most Similar FSEIS Alternative	Key Similarities	Key Differences
Alternative 5	Alternative 4	Daily limits on snowmobiles same in both parks 80 percent of snowmobiles in YNP on commercially guided tours, 20 percent on noncommercially guided tours BAT required for commercially guided snowmobiles	Temporary winter use Alternative 5 specifies daily limits for snowmobiles of 30 at Old Faithful and 20 at the North entrance. FSEIS Alternative 4 specifies a daily limit of 50 at the North Entrance, and does not discuss Old Faithful. Temporary winter use Alternative 5 specifies that noncommercially guided snowmobiles need BAT as of 2005–2006, while FSEIS Alternative 4 requires BAT in 2004–2005. Temporary winter use Alternative 5 specifies that the noncommercial guiding program begins in 2005–2006, with 20 percent unguided in 2004–2005.

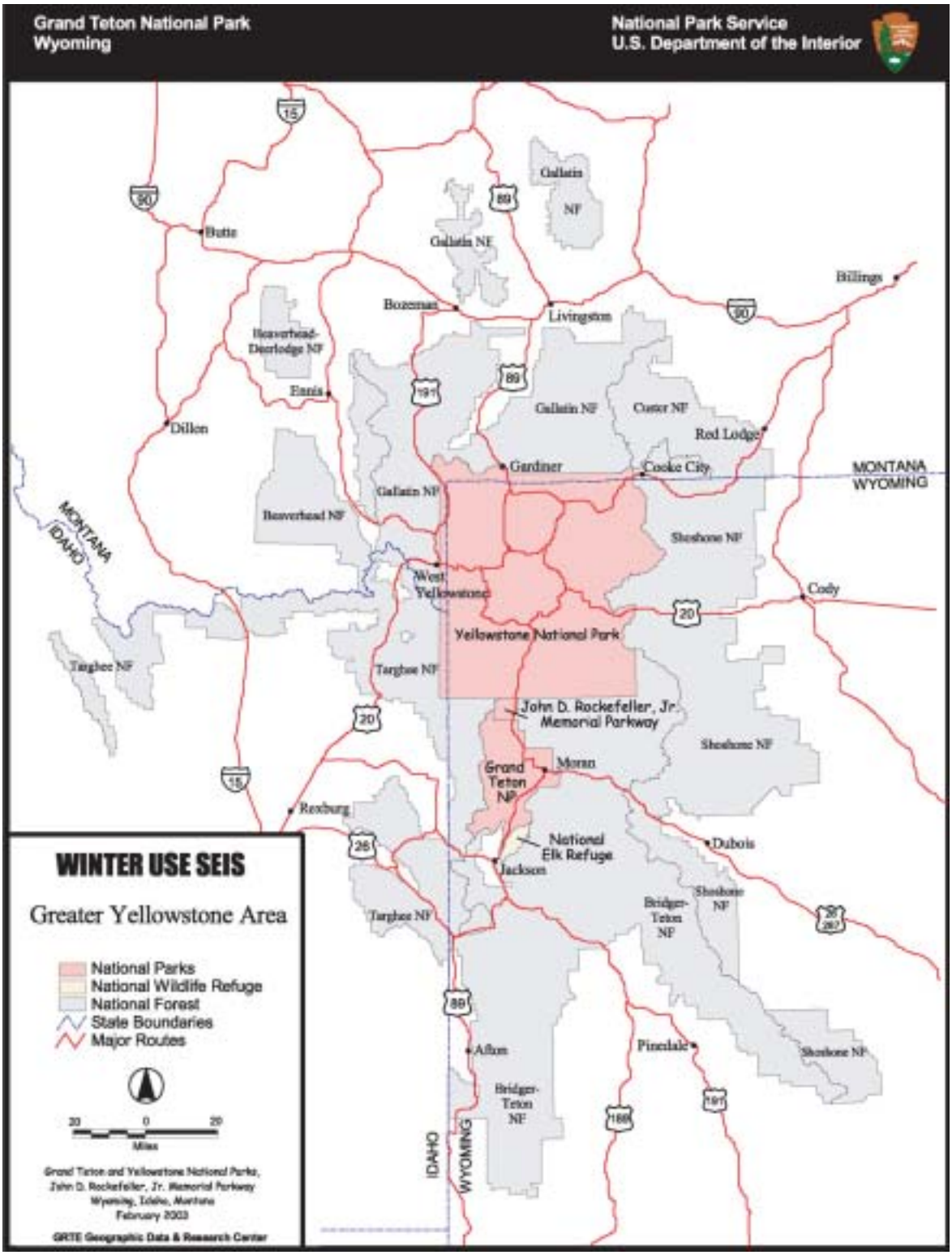
2 Baseline Description of Snowmobile Use in the Greater Yellowstone Area

2.1 THE GREATER YELLOWSTONE AREA

Section 2 describes the baseline conditions against which changes brought about by the proposed regulations.

The GYA encompasses over 11 million acres and is considered one of the few remaining intact temperate ecosystems on earth (see Figure 2-1). Within the GYA, YNP comprises 2.22 million acres, primarily in northwestern Wyoming and extending into south-central Montana and eastern Idaho. GTNP encompasses an additional 310,000 acres, the Parkway includes 24,000 acres, and both are located in Wyoming. YNP and GTNP comprise the strategic core of an upland plateau called the GYA. Portions of six national forests—Gallatin, Custer, Shoshone, Bridger-Teton, Caribou-Targhee, and the Beaverhead-Deerlodge—border the parks and are within the GYA, as are the National Elk Refuge and Red Rocks National Wildlife Refuge. Public lands make up most of the area (69 percent). Private lands comprise 24 percent of the GYA, Indian reservations comprise 4 percent, and 3 percent of the lands in the GYA are state lands. The GYA extends across 17 counties in three states. Cooperative agreements and interagency planning and coordination aid in managing the entire area as an ecological unit, while at the same time recognizing the different mandates of the land management agencies.

Figure 2-1. Map of Greater Yellowstone Area



Source: National Park Service (NPS). 2003b. *Winter Use Plans: Final Supplemental Environmental Impact Statement: Yellowstone and Grand Teton National Parks and the John D. Rockefeller, Jr., Memorial Parkway*. <http://www.nps.gov/grte/winteruse/fseis/vol1/4-chap1.pdf>.

2.1.1 Yellowstone National Park

YNP was "dedicated and set apart as a public park or pleasuring ground for the benefit and enjoyment of the people" and "for the preservation, from injury or spoilation, of all timber, mineral deposits, natural curiosities, or wonders … and their retention in their natural condition" by an Act of Congress on March 1, 1872. Yellowstone is the first and oldest national park in the world.

The commanding features that initially attracted interest and led to the preservation of Yellowstone as a national park were geological: the geothermal phenomena (there are more geysers and hot springs there than in the rest of the world combined), the colorful Grand Canyon of the Yellowstone River, fossil forests, and the size and elevation of Yellowstone Lake.

The gateway communities surrounding the park and park entrances serve as local access to the park in the winter:

- The North Entrance of the park provides direct access from Gardiner, Montana, via U.S. Highway 89, and is located 54 miles south of Livingston, Montana.
- The Northeast Entrance, near the gateway community of Cooke City, Montana, is open year-round for wheeled vehicle access to Cooke City through Gardiner, Montana and the North Entrance. Opening dates for roads east of Cooke City vary from year to year, depending on the weather.
- The East Entrance connects the park with Cody, Wyoming, 53 miles to the east via U.S. Highway 16.
- The John D. Rockefeller, Jr., Memorial Parkway (U.S. Highway 89/287) provides access to the park from the south and connects the park to Jackson, Wyoming, 64 miles from the South Entrance.
- U.S. Highways 20 and 287 serve access to the West Entrance through West Yellowstone, Montana.

Only the roads connecting the North and Northeast Entrances are plowed for passenger wheeled-vehicular traffic during the winter. The remaining entrance roads are among those groomed for oversnow travel.

Only the roads connecting the North and Northeast Entrances are plowed for passenger wheeled-vehicular traffic during the winter. The remaining entrance roads are among those groomed for oversnow travel.

2.1.2 Grand Teton National Park

Towering more than a mile above the valley known as Jackson Hole, the Grand Teton rises to 13,770 feet above sea level. Twelve Teton peaks reach above 12,000 feet elevation, high enough to support a dozen mountain glaciers. In contrast to the abrupt eastern face, the west side of the range slopes gently, showing the angle of tilt of the earth's crust. Youngest of the mountains in the Rocky Mountain system, the Teton Range displays some of North America's oldest rocks. The region was first designated a national park in 1929.

GTNP is located immediately south of the Parkway and is bounded on the south by the National Elk Refuge. The primary gateway community for GTNP—Jackson, Wyoming—is located about 3 miles south of the park boundary and is connected to the park via the Parkway (U.S. Highway 26/89 and 191). Additional regional access to GTNP is provided at the East Entrance, near Moran, Wyoming, which connects the area with Wyoming cities to the east, including Dubois, 50 miles from the park via U.S. Highway 26/287. This route also connects regions east of GTNP to YNP, via the Parkway (U.S. Highway 89 and 191/287) from Moran, through the Parkway boundary to the South Entrance of YNP. The entire Parkway within GTNP, as well as U.S. Highway 26/287 from the eastern park border to Moran Junction, is maintained for wheeled-vehicle use throughout the year.

2.1.3 John D. Rockefeller, Jr., Memorial Parkway

The Parkway encompasses 24,000 acres directly between YNP and GTNP and is also a roadway through GTNP. The Parkway was established in 1972 and is administered by GTNP. Within the Parkway boundary, the roadway itself traverses 7.5 miles between the northern boundary of GTNP and the South Entrance of YNP. The Parkway in its entirety is an 82-mile scenic corridor linking the West Thumb in YNP with the South Entrance of GTNP. The Parkway is open year-round between the northern border of GTNP and Flagg Ranch but closed in winter to wheeled vehicles from Flagg Ranch to the West Thumb in YNP. Flagg Ranch is the major visitor destination within the Parkway boundary, and it serves as a principal winter staging area for oversnow access to YNP.

2.2 SNOWMOBILE TRAILS

2.2.1 Yellowstone National Park

Snowmobiling within YNP can be described as both recreational and destination oriented in nature. Many of the routes lead to particular geothermal or other natural features and scenic vistas and/or provide opportunities for wildlife viewing. Some of the routes also provide access to winter lodging facilities within the park boundary. Twelve paved road segments, totaling 184.6 miles, are closed to passenger vehicles during the winter and are groomed by the Park Service for oversnow motorized vehicle use between mid-December and mid-March. The 12 segments together provide snowmobilers with the opportunity to travel the entire Grand Loop Road from each of the four entrances to YNP. Typical snowmobile staging areas for trips into YNP are near Mammoth Hot Springs in the north, in West Yellowstone near the West Entrance, at a parking area at Flagg Ranch in the Parkway near the South Entrance, and at Pahaska Teepee in the Shoshone National Forest near the East Entrance.

Typical snowmobile staging areas for trips into YNP are near Mammoth Hot Springs in the north, in West Yellowstone near the West Entrance, at a parking area at Flagg Ranch in the Parkway near the South Entrance, and at Pahaska Teepee in the Shoshone National Forest near the East Entrance.

2.2.2 Grand Teton National Park

The CDST is a groomed snowmobile trail constructed in GTNP and the Parkway during the winter and is the primary designated route in GTNP. It provides access to NPS lands from trail systems on the adjacent Shoshone and Bridger-Teton National Forests out of Jackson and Dubois. The CDST is located immediately adjacent to the plowed road, following U.S. Highway 26/287 from the east park boundary to Moran Junction, and then following the Parkway road north through the Parkway to Flagg Ranch. Snowmobiling has also been permitted on the frozen surface of Jackson Lake in GTNP.

Designated routes that provide access to public lands where snowmobiling is permitted or private property within or adjacent to the park will remain open to snowmobiles under any regulation, including the proposed ban. Numerous short routes designated within GTNP provide access between the park and nearby national forest lands.

Snowmobiling through the Parkway is generally transit oriented as people use Parkway snowmobile routes as access routes to YNP from routes outside the park boundary.

2.2.3 John D. Rockefeller, Jr., Memorial Parkway

Snowmobiling through the Parkway is generally transit oriented because people use Parkway snowmobile routes as access routes to YNP from routes outside the park boundary. Within the Parkway boundary, three snowmobile routes are groomed for oversnow travel.

2.3 SNOWMOBILE TRAIL ACCESS, MAINTENANCE, AND ENFORCEMENT IN THE GYA

2.3.1 Yellowstone National Park

This section describes snowmobile trail access, maintenance, and enforcement in YNP during the 2002–2003 winter use season and in previous winter seasons.

Snowmobiles are permitted on the designated routes in YNP after these areas have been closed to other vehicular traffic. Roads are officially opened by the park to snowmobiling between mid-December and mid-March, depending on snow conditions. Up-to-date access information is posted in several places, including the park's Web site, local news releases and information boards, local chambers of commerce, and an automated park information phone line. Winter closures are implemented in mid-March to allow plowing of park roads in preparation for the summer season (so that, weather permitting, all roads are passable by Memorial Day weekend) and to protect grizzly bears as they emerge from their dens.

Park operations and maintenance personnel groom 184.6 miles of park roads and plow 56 miles in YNP. About 37 miles of groomed nonmotorized trails are provided in the park. These trails are near Mammoth, Canyon Tower, Virginia Cascades, Blacktail Plateau, East Entrance, and Old Faithful.

As part of their regular activities, park rangers provide a range of emergency services to park visitors, including providing fuel, equipment repairs, minor first aid or directions, medical services, and search and rescue. Park rangers also provide agency assists, incidents in which NPS employees are contacted by the public safety departments from surrounding jurisdictions outside the park to provide assistance with situations such as

search and rescue or incidents involving wildlife associated with the park.

Incidents in YNP that involve either general ranger support or law enforcement incidents involve a disproportionate number of snowmobilers relative to total winter visitors.

During the winter of 2001–2002, YNP initiated a pilot program to address winter use-related issues. The pilot program actions specifically related to employee health and safety, including

- advanced purchase of entrance permits in the town of West Yellowstone, Montana, to reduce idle time at the West Entrance;
- increased grooming to reduce repetitive motion injuries; and
- reduced speed from 45 mph to 35 mph between the West Entrance and Old Faithful.

Incidents in the park that involve either general ranger support or law enforcement incidents involve a disproportionate number of snowmobilers relative to total winter visitors. Eighty-eight percent of the citations issued in YNP between December and March from 1995 to 2001 were issued to snowmobilers. The general categories of citations issued to snowmobilers in the park, from most to least common, were for speeding, driving without a license or allowing another to do so, off-road travel, unsafe operations, traffic violations, and entering closed areas. In the same time period, 90 percent of case incident reports (CIR), which are submitted for some law enforcement violations as well as other general ranger support, involved snowmobiles, whereas snowmobiles accounted for only 62 percent of overall winter use. Unlike citations and CIRs, emergency medical services over the same period of time indicate that aid to snowmobilers was close to proportional to their overall numbers—62 percent of all reports were for snowmobilers, (NPS, 2002). The increase in motorized and nonmotorized winter use over the past 10 years has been accompanied by an increase in reported accidents. Generally, the number of snowmobile accidents in YNP has increased as snowmobile visitation has increased, but the incidence of motor vehicle accidents between December and March from 1995 to 2001 involving snowmobiles (65 percent) was close to proportional to their overall numbers (NPS, 2002).[1] In the winter seasons

[1]This percentage excludes motor vehicle accidents that occurred on U.S. Highway 191.

between 1991 and 2001, eight fatalities from snowmobile accidents occurred; two of these were in 1999.

Park staff members have reported that snowmobile trespass occurs in the southwest side of the park adjacent to national forest land. Because this area is remote to the more visible and highly staffed areas of the park, enforcing no-enter zones is difficult in that area. Park staff anticipates that trespassing will continue in that area if snowmobile access in other parts of the park is restricted.

Implementation of snowmobile regulations requiring increased interpretative staff to provide for improved visitor services would require more resources. Otherwise, staffing is not expected to increase over present levels.

2.3.2 Grand Teton National Park and John D. Rockefeller, Jr., Memorial Parkway

This section describes snowmobile trail access, maintenance, and enforcement in GTNP and the Parkway during the 2002–2003 winter use season and in previous winter seasons.

Snowmobiles are permitted on the designated routes in GTNP after these areas have been closed to other vehicular traffic (with the exception of the CDST). Roads are officially opened by the park to snowmobiling between mid-December and mid-March, depending on snow conditions. Up-to-date access information is posted in several places, including the park's Web site, local new releases and information boards, local chambers of commerce, and an automated park information phone line. The CDST is a groomed snowmobile trail constructed during winter that parallels the roadway from Moran to the northern edge of the park and further north to Flagg Ranch (approximately 28 miles). All other oversnow trails in GTNP are ungroomed.

Approximately 10 miles of road within the Parkway boundary comprise the groomed routes open to oversnow vehicles in the Parkway but closed to other vehicles: Grassy Lake Road and the 2-mile section of the Parkway (U.S. Highway 89-287) connecting Flagg Ranch with the south boundary of YNP. The roadway is plowed south of Flagg Ranch to GTNP, and groomed snowmobile traffic is allowed adjacent to the road on the CDST.

As part of their regular activities, park rangers provide a range of services to park visitors including providing fuel, equipment repairs, minor first aid or directions, emergency medical services, and search and rescue and agency assists.

Twenty-three percent of the violations involved snowmobiles.

Unlike in YNP, there are a great many more wheeled vehicles in the GTNP and the Parkway than snowmobiles. Accordingly, the relative number of incidents in the park involving wheeled vehicles is much higher. A total of 299 citations were issued to winter recreationalists, including wheeled-vehicle touring and snowmobiling in the GTNP and the Parkway during the winter seasons from 1995–2001. Twenty-three percent of the violations involved snowmobiles. The general categories of incidents that were cited, from most to least common, were off-road travel or entering closed areas, unsafe operation, traffic violations, speeding, and allowing a driver to operate without a license. In the same time period, only approximately 12 percent of CIRs involved snowmobiles. Of the Emergency Management System reports filed between December and March 1995 and December and March 2001, 27 percent were for snowmobiles (NPS, 2002).

2.4 VISITATION DATA

An analysis of the social benefits and costs of snowmobile use under the proposed management alternatives relative to baseline in YNP, GTNP, and the Parkway are presented in Sections 3 and 4. As discussed in Section 1, the exact nature of the baseline is uncertain. This report presents analysis relative to two alternative baselines. The first baseline is Alternative 1, which prohibits snowmobiles in the parks. Section 3 contains an analysis of Alternatives 2 through 5 relative to this baseline. The second baseline is historical use. Section 4 presents an analysis of Alternatives 1 through 5 relative to this baseline. To support the development of these analyses, this section presents historical data and projected baseline winter use and discusses the methodology used to generate the projections. This section presents historical data for winter use visitation to YNP, GTNP, and the Parkway. In addition, baseline future visitation projections are presented as

expected by NPS after Alternative 1 is implemented, which will ban snowmobile use.

Winter visitation data from the 2003–2004 winter season will be reported where it is available; however, these data were not used to create the visitation projections. Visitation during this season was much lower than in previous seasons. Many visitors make reservations months in advance for their winter trips to the parks. NPS believes that the uncertainty about whether and under what conditions there would be snowmobile access to the parks affected visitors' plans in 2003–2004.

2.4.1 YNP, GTNP, and the Parkway Total Visitation Data

Total annual recreational visitation in 2002 to YNP was 2,973,677, 2,612,629 in GTNP, and 1,144,220 on the Parkway. Annual visitation for 2003 was actually higher than in 2002, despite significantly lower visitation in the winter months. Table 2-1 provides a month-by-month breakdown of visitation for recreational visits for the 2 years.[2] Table 2-2 presents the figures for winter use for the four winter entrances to YNP and for GTNP (which includes the Parkway), where winter is defined as December to March. Comparable figures were not available for the 2003–2004 winter season. The majority of winter users in YNP enter through the North and West Entrances (the towns of Gardiner and West Yellowstone, Montana, respectively).

In 2002–2003, winter use was 112,736 in YNP and 227,964 in GTNP. This represents a significant drop in winter use at YNP compared to previous years (see Table 2-3). This decline is due in part to a lack of snowfall, which caused a delay in the opening of the park to oversnow travel. The figures available for the 2003–2004 winter season show an even larger decline in visitation by snowmobile riders but an increase in the number of visitors on snowcoaches. NPS believes much of this decline was due to the regulatory uncertainty that surrounded the season. Data for other winter activities were not available for 2003–2004.

[2] A recreational visit is defined as the "entry of a person onto lands or waters administrated by NPS for recreational purposes" (NPS, 1999). Recreational visits do not include "nonrecreational" visits (defined as "through traffic, trades people with business in the park, and government personnel [including NPS employees] with business in the park") (NPS, 1999).

Table 2-1. Recreational Visitation to YNP, GTNP, and the Parkway, 2002 and 2003

Month	YNP 2002	YNP 2003	GTNP 2002	GTNP 2003	The Parkway 2002	The Parkway 2003
January	40,465	36,387	56,314	61,043	11,436	13,929
February	52,002	39,494	56,764	57,583	14,743	7,673
March	23,305	17,718	57,923	48,717	12,532	4,304
April	15,904	28,877	47,955	64,112	3,354	2,926
May	228,642	206,245	164,065	90,174	73,737	72,791
June	568,144	580,919	458,491	480,739	238,666	203,702
July	794,929	809,689	619,451	570,488	282,617	306,769
August	663,266	698,753	549,234	550,815	257,332	292,565
September	413,960	404,498	360,557	300,997	175,466	158,122
October	142,702	175,877	122,602	44,268	59,251	66,455
November	11,235	7,967	58,652	42,495	7,226	3,747
December	19,123	12,951	60,621	44,262	7,860	2,681
Total	2,973,677	3,019,375	2,612,629	2,355,693	1,144,220	1,135,664

Source: NPS visitation records.

Table 2-2. Winter Recreational Visitors in YNP and GTNP, 1996–2003

	YNP					
Winter	North	West	South	East	Total	GTNP
1996–97	34,902	56,069	19,272	3,212	113,455	162,627
1997–98	40,497	54,859	20,486	3,432	119,274	176,601
1998–99	41,007	59,928	20,385	2,889	124,209	180,367
1999–00	42,903	58,154	22,957	3,366	127,380	223,944
2000–01	43,226	66,468	24,718	4,380	138,792	211,700
2001–02	48,388	70,392	20,432	4,300	143,512	217,999
2002–03	42,743	49,718	17,378	2,897	112,736	227,964

Source: NPS visitation records.

Table 2-3. Combined Winter Use Activities for All Four Entrances in YNP

	Auto[a]	RV	Bus	Skiers through Gate[b]	Snowmobile	Snowcoach	Total
1992–93	36,202	164	378	464	91,196	14,340	142,744
1993–94	41,041	308	751	998	87,682	12,743	143,523
1994–95	39,329	177	432	684	86,286	12,729	139,637
1995–96	33,719	123	280	1,081	75,265	9,071	119,539
1996–97	30,432	129	429	485	71,759	10,221	113,455
1997–98	35,704	81	305	453	72,834	9,897	119,274
1998–99	36,450	90	173	446	76,271	10,779	124,209
1999–00	37,872	140	747	351	76,571	11,699	127,380
2000–01	38,538	139	3,071	390	84,971	11,683	138,792
2001–02	44,514	215	417	307	86,227	11,832	143,512
2002–03	38,779	277	796	303	60,427	12,154	112,736
2003–04	NA	NA	NA	NA	30,619	14,916	NA

[a]Statistics for automobile visitors use for the entire months of December and March. For skiers, snowmobile riders, and snowcoach passengers, the winter season usually begins between December 15 and 20 and ends between March 10 and 15.

[b]Numbers of skiers reflect the number of visitors that actually skied through the entrance gate. It does not reflect the number of visitors that access the park via another mode of transportation and then ski in the park interior. The *Winter 2002–2003 Visitor Survey* indicates that about 6 percent of visitors participated in cross-country skiing.

Source: NPS visitation records.

2.4.2 Winter Use Activities Data

In Table 2-3, winter visitation in 1992–1993 through 2003–2004 is broken down by activity for YNP. Snowmobile passengers made up at least 60 percent of winter users in YNP in four of the five winter seasons prior to 2002-2003. However, in 2002–2003, snowmobile passengers made up only 54 percent of winter season use. Visitation figures for other winter activities were not available for 2003–2004. Tables 2-4 through 2-7 present the figures for each entrance individually. In the winter in YNP, only the North Entrance is open to cars (see Table 2-4). At this entrance, only about 2 percent of winter visitors arrived on snowmobiles in 2002–2003, and over 90 percent arrived by car. In contrast, at the other entrances the majority of visitors arrived by snowmobile. As indicated in Table 2-5, 64,084 snowmobile riders entered YNP through the

Table 2-4. Winter Use Activities in YNP—North Entrance

Winter Season	Visitors by Auto[a]	Recreational Vehicle Passengers	Bus Passengers	Skiers[b]	Snowmobile Passengers	Snowcoach Passengers	Total Visitors
1997–98	35,704	81	305	10	2,119	2,278	40,497
1998–99	36,450	90	173	17	2,196	2,081	41,007
1999–00	37,872	140	747	21	1,617	2,506	42,903
2000–01	38,538	139	543	7	1,758	2,241	43,226
2001–02	44,514	215	417	5	1,225	2,012	48,388
2002–03	38,764	277	796	4	899	2,003	42,743
2003–04	NA	NA	NA	NA	1,094	2,496	NA

[a]Statistics for automobile visitors use for the entire months of December and March. For skiers, snowmobile riders, and snowcoach passengers, the winter season usually begins between December 15 and 20 and ends between March 10 and 15.

[b]Numbers of skiers reflect the number of visitors that actually skied through the entrance gate. It does not reflect the number of visitors that access the park via another mode of transportation and then ski in the park interior. The *Winter 2002–2003 Visitor Survey* indicates that about 6 percent of visitors participated in cross-country skiing.

Source: NPS visitation records.

Table 2-5. Winter Use Activities in YNP—West Entrance

Winter Season	Skiers[a]	Snowmobile Passengers	Snowcoach Passengers	Total Visitors
1996–97	21	50,296	5,752	56,069
1997–98	18	49,776	5,065	54,859
1998–99	27	53,980	5,921	59,928
1999–00	21	52,575	5,558	58,154
2000–01	67	58,292	8,109[b]	66,468
2001–02	6	64,084	6,302	70,392
2002–03	69	42,540	7,094	49,718
2003–04	NA	20,028	8,749	NA

[a]Numbers of skiers reflect the number of visitors that actually skied through the entrance gate. It does not reflect the number of visitors who access the park via another mode of transportation and then ski in the park interior. The *Winter 2002–2003 Visitor Survey* indicates that about 6 percent of visitors participated in cross-country skiing.

[b]This number includes 2,528 bus passengers from March (the road opened to mass transit vehicles on March 1, 2001).

Source: NPS visitation records.

Table 2-6. Winter Use Activities in YNP—East Entrance

Winter Season	Skiers[a]	Snowmobile Passengers	Snowcoach Passengers	Total Visitors
1996–97	355	2,857	0	3,212
1997–98	346	3,077	9	3,432
1998–99	263	2,620	6	2,889
1999–00	204	3,105	57	3,366
2000–01	197	4,183	0	4,380
2001–02	236	4,064	0	4,300
2002–03	177	2,720	0	2,897
2003–04	NA	1,006	159	NA

[a]Numbers of skiers reflect the number of visitors that actually skied through the entrance gate. It does not reflect the number of visitors that access the park via another mode of transportation and then ski in the park interior. The *Winter 2002–2003 Visitor Survey* indicates that about 6 percent of visitors participated in cross-country skiing.

Source: NPS visitation records.

Table 2-7. Winter Use Activities in YNP—South Entrance

Winter Season	Skiers[a]	Snowmobile Passengers	Snowcoach Passengers	Total Visitors
1996–97	88	16,526	2,658	19,272
1997–98	79	17,862	2,545	20,486
1998–99	139	17,475	2,771	20,385
1999–00	105	19,274	3,578	22,957
2000–01	119	20,738	3,861	24,718
2001–02	60	16,854	3,518	20,432
2002–03	53	14,268	3,057	17,378
2003–04	NA	8,491	3,512	NA

[a]Numbers of skiers reflect the number of visitors that actually skied through the entrance gate. It does not reflect the number of visitors that access the park via another mode of transportation and then ski in the park interior. The *Winter 2002–2003 Visitor Survey* indicates that about 6 percent of visitors participated in cross-country skiing.

Source: NPS visitation records.

West Entrance in 2001–2002, over 74 percent of the total number of snowmobile passengers entering YNP that year. In 2002–2003, the number of snowmobile passengers using the West Entrance declined to 42,540, largely because the entrance was closed to snowmobiles until December 28, 2002, due to the lack of snow. The East Entrance was the least used of the four winter entrances.

As indicated in Table 2-6, only 2,897 people entered from the east in the winter of 2002–2003, and 94 percent of these visitors (2,720 people) were riding snowmobiles. Finally, as indicated in Table 2-7, the South Entrance received the second highest number of snowmobile riders entering the park during the winter season of 2002–2003. There were 14,268 people, or 24 percent of the total number of snowmobile riders in YNP, who entered through the South Entrance. At all the entrances except North, there was a large reduction in the number of snowmobile visitors and a smaller increase in the number of snowcoach passengers in 2003–2004.

Estimating the annual number of cross-country skiers in YNP is more difficult. Statistics from entrance booths only count the number of skiers who ski into YNP. Most cross-country skiers use other means of transportation to reach trail heads within the park. Based on a survey conducted in winter 2002–2003, 5.85 percent of visitors to YNP are estimated to participate in cross-county skiing or snowshoeing as their primary activity in the park (NPS 2003a, see Appendix 1 for a copy of the survey report). This proportion reflects the use of the statistical analysis weights described in Appendix C of the survey report provided in Appendix 1 to adjust the unweighted survey results.

Of the 227,964 visitors who entered GTNP (including the Parkway) in winter 2002–2003, only 36,105 entered the park on a snowmobile or skis. The remainder entered the park in wheeled vehicles, primarily automobiles.

Table 2-8 provides the breakdown in winter activities for GTNP and the Parkway. Winter visitation figures were not available for 2003–2004. Of the 227,964 visitors who entered GTNP (including the Parkway) in winter 2002–2003 (see Table 2-2), only 36,105 entered the park on a snowmobile or skis. The remainder entered the park in wheeled vehicles, primarily automobiles. Snowplanes were banned from GTNP beginning the winter of 2002–2003. In the winter, GTNP is much more accessible to wheeled vehicles than YNP. In YNP, wheeled vehicles can only enter through the North Entrance. In GTNP, there are far more plowed roads, and wheeled vehicles can enter the park at several entrances. Total snowmobile use from the Parkway, the CDST, and GTNP was 26,278 visitors in the winter of 2002–2003. Note, however, that these visitors are not mutually exclusive of those counted entering YNP's South Entrance. Of the 26,278 snowmobile visitors in the Parkway, CDST, and GTNP, NPS estimates that the majority

Table 2-8. Winter Use Activities in GTNP and the Parkway For Visitors Entering on Snowmobile or Skis

Winter Season	The Parkway Snowmobile	CDST Snowmobile	GTNP Snowmobile	GTNP Snowplane	The Parkway Skiing	GTNP Skiing	Total Visitors[a]
1996–97	19,024	2,779	3,843	1,790	1,440	1,636	30,512
1997–98	17,589	2,318	4,051	1,685	1,373	1,577	28,593
1998–99	17,110	2,304	3,617	851	1,169	1,298	26,349
1999–00	23,399	1,329	2,867	1,091	1,581	5,387[b]	35,654
2000–01	31,011	1,307	2,618	1,148	1,987	4,774	42,845
2001–02	26,401	1,667	3,469	1,303	2,141	8,060	43,041
2002–03	23,062	943	2,273	0	2,428	7,399	36,105

[a]This total does not include those visitors entering GTNP in wheeled vehicles.

[b]The reason for large increase in skier numbers is unknown.

Source: NPS visitation records.

also entered YNP at the South Entrance. Based on an assumption that 100 percent of snowmobilers counted at the South Entrance of YNP were also included in visitation counts in GTNP or the Parkway, about 14,268 visitors in 2002–2003 would have been double-counted.

2.4.3 Projected Winter Use

The "historical case" refers to conditions that would have occurred in the absence of the 2001 ban and subsequent 2002 delay rule.

Historical use (i.e., in the absence of the ban promulgated by the January 2001 rule and subsequent November 2002 delay rule) is one of the baselines against which Alternatives 1 through 5 are evaluated. To project winter visitation that would have occurred through 2006–2007 in the historical case, average visitation in each visitation category over 5 years (1998–1999 through 2002–2003) was used as a starting point. As discussed above, visitation during the winter of 2003–2004 was significantly lower than in past season, due in part to uncertainty about snowmobile access both before and during the season. Because of the unusual circumstances, 2003–2004 visitation data were not used to calculate baseline visitation. NPS then used projected annual growth rates based on information obtained from YNP and GTNP park staff and a YNP transportation report projecting total park visitation through 2010 (BRW, 1997). Initially, NPS estimated regressions using

historical winter visitation data to project future visitation by winter use category. However, the time series available for winter season visitation is relatively short (12 years) and particularly variable, making it difficult to achieve a good fit to the data. Several different functional forms were estimated, but the results typically suggested visitation to YNP would be declining in the future while visitation to GTNP would be growing extremely rapidly. Regression results for both parks were determined to be unreasonable estimates of future visitation that were overly influenced by anomalous visitation patterns in recent years based on interviews with local stakeholders and professional judgment. Thus, average annual growth rates reflecting trends expected by park staff were used for visitation projections.

NPS combined all categories of winter use into four groups for the projections: snowmobiling, snowcoach riding (YNP only), cross-country skiing and snowshoeing, and other visitors.[3] The primary focus of the analysis is on the impacts to snowmobilers versus nonsnowmobilers, but it is useful to break winter use into additional categories to evaluate the impacts on local businesses providing different services and to reflect different valuations across winter activities.

Table 2-9 summarizes the winter use projections for YNP estimated in the absence of the January 2001 rule (historical baseline). The growth rate is assumed to be positive each year through 2006–2007, although declining in magnitude over time (BRW, 1997). The growth rate was assumed to be the same for each use category because there was insufficient information to estimate separate growth rates. Similarly, Table 2-10 summarizes projected winter visitation for GTNP (including the Parkway), prior to implementation of the January 2001 rule

[3]The number of visitors snowmobiling and riding snowcoaches reflects entrance counts. The number of cross-country skiers and snowshoers is based on the percentage of people in the winter 2002–2003 survey who indicated those activities were their primary activities in the park. Otherwise, only those who skied or snowshoed through the entrance would be counted. There may be some visitors who enter the parks on snowmobiles or snowcoaches for the primary purpose of skiing or snowshoeing, but this is a very small percentage based on survey results. Thus, all people with skiing or snowshoeing as their primary activity who were not counted as such at the gate were assumed to have entered the parks in wheeled vehicles. All visitors not in one of these three categories were placed in the "other visitors" category.

Table 2-9. Projected Historical Baseline Winter Use in YNP by Primary Activity, 2004–2005 through 2006–2007

Winter Season	Snowmobile	Snowcoach	Cross-Country Skiing or Snowshoeing[a]	Other Visitors	Total Visitors	Visitation Growth Rate[b]
2004–05	79,370	12,010	7,810	34,310	133,500	1.5%
2005–06	80,490	12,170	7,920	34,790	135,370	1.4%
2006–07	81,530	12,330	8,020	35,240	137,130	1.3%

[a]Based on survey data gathered winter 2002–2003 (see Appendix 1), NPS assumed that 5.85 percent of visitors to YNP had cross-country skiing or snowshoeing as their primary activity in the park rather than counting only those that skied or snowshoed through the entrance gates.

[b]The growth rates through 2006–2007 come from a YNP transportation study by BRW (1997).

Note: All visitation estimates have been rounded to the nearest 10. Rows may not sum to totals due to independent rounding.

Table 2-10. Projected Historical Baseline Winter Use in GTNP by Primary Activity, 2004–2005 through 2006–2007

Winter Season	Snowmobile	Snowcoach[a]	Cross-Country Skiing or Snowshoeing[b]	Other Visitors	Total Visitors	Growth Rate[c]
2004–05	28,560	0	74,330	144,870	247,750	4.2%
2005–06	29,730	0	77,370	150,810	257,910	4.1%
2006–07	30,920	0	80,470	156,840	268,230	4.0%

[a]Some snowcoaches originate from Flagg Ranch in the Parkway. However, all of these snowcoaches travel directly into YNP and are counted at the YNP South Entrance.

[b]Because visitors can more easily drive into GTNP than YNP and snowcoaches are not used in GTNP, it is much less likely that visitors would use transportation other than wheeled vehicles to reach their skiing destination in the park. Therefore, NPS assumed that those users counted as snowmobilers would not use their vehicles to reach a destination for skiing. Based on personal communication with GTNP staff, NPS assumed that 30 percent of all visitors go cross-country skiing in the park as their primary activity.

[c]The growth rates for GTNP are based on personal communication with park staff, who indicated that overall winter visitation growth in the park was likely to be in the neighborhood of 3 to 5 percent annually over the next 3 years, similar to the average annual increases that YNP experienced in the 1980s and early 1990s. NPS assumed that annual growth would be higher at the beginning of the period, with growth slowing slightly over time (although remaining fairly high). These growth rates were applied to cross-country skiers, snowmobilers, and total visitation. The other visitor category was calculated by subtracting cross-country skiers and snowmobilers from total visitation.

Note: All visitation estimates have been rounded to the nearest 10. Rows may not sum to totals due to independent rounding.

(historical baseline). The share of visitors with cross-country skiing or snowshoeing as their primary activity was estimated to be 30 percent of total visitation based on personal communication with GTNP staff. Also, the other visitor category is a much larger percentage of visitation for GTNP than YNP in part because GTNP is much more accessible to

wheeled vehicles. In addition, GTNP is a more popular destination than YNP for nonmotorized recreation.

The annual growth rate in winter visitation is expected to be higher for GTNP than YNP over the next 3 years based on information provided by park staff. GTNP staff estimate that growth will be between 3 to 5 percent annually, although the rate of growth is likely to trend downward over time. Thus, NPS assumed that the growth rate would decline in equal increments from 4.2 to 4.0 percent annual growth between 2004–2005 and 2006–2007.[4] The number of snowmobilers, cross-country skiers and snowshoers, and total visitors was projected for each year based on the assumed growth rates. As for YNP, the growth rate was assumed to be equal across use categories because there was insufficient information to develop separate growth estimates.

The number of visitors in the other visitor category was calculated by subtracting the number of snowmobilers and cross-country skiers from total visitation.

The projections in Tables 2-9 and 2-10 are used as the basis for estimating visitation under the other baseline condition (Alternative 1, in which snowmobiles are prohibited starting in 2004–2005).

To project visitation under Alternative 1 baseline conditions, the results of the YNP winter use survey conducted in the winter of 2002–2003 (NPS, 2003a) were used to estimate the proportionate changes in visitation by each of the four visitor categories. Survey results were used to estimate the proportion of snowmobile visitors who would continue to visit the park, the activities those visitors would engage in, and the change in visitation by nonsnowmobilers under various regulatory management alternatives, including a ban on snowmobiles.

Based on survey responses, snowmobile users projected to continue visiting the park in 2004–2005 (25.1 percent of

[4]When growth rates were first estimated, it was assumed that the growth rate would decline from 4.5 percent in 2001–2002 to 3.5 percent by 2011–2012. The percentages implied for each year were maintained as the beginning year for the projections was moved back to 2004–2005, leading to the current range of 4.2 percent to 4.0 percent.

snowmobile renters and 28.7 percent of snowmobile owners[5]) were assumed to switch to snowcoach use in YNP. All former snowmobilers that continue to visit the parks for reasons other than snowmobiling were assumed to ride snowcoaches based on survey responses showing a strong preference among snowmobilers for snowcoaches over skiing, snowshoeing, and other nonmotorized activities.

Former snowmobilers that chose to stop visiting the parks were divided into those that would substitute snowmobiling in the GYA outside the parks and those that would reduce visitation to the GYA. Based on survey results, visitation to the GYA by snowmobile renters and owners would decline by 19.2 percent and 42.2 percent, respectively. The rest of the snowmobilers that said they would no longer visit the parks (20.3 percent of renters and 29.2 percent of owners) are assumed to switch to snowmobiling in the GYA outside the parks.

Among former snowmobilers who continue to visit the parks from 2004–2005 through 2006–2007, it was assumed that all would be using snowcoaches. Snowmobile renters were much more willing than snowmobile owners to participate in guided snowmobile tours. In 2004–2005 through 2006–2007, visitors who would have rented snowmobiles for use in the park in the absence of snowmobile restrictions were assumed to substitute snowmobiling in the GYA outside the parks for 40.6 percent of their park visits. They were also assumed to reduce visitation to the GYA by 34.3 percent based on survey results.

After snowmobiles are banned, which would occur in 2004–2005 under Alternative 1 baseline conditions, survey results indicate that nonsnowmobilers would increase their visitation. Snowcoach riders (YNP only)[6] and other visitors would increase their visitation by 4.2 percent and 13.2 percent, respectively,

[5]Based on their responses to the survey, snowmobile owners are generally unwilling to participate in guided snowmobile tours. Survey responses under a scenario allowing snowmobile use in the park as part of a guided tour were almost identical to those for a scenario where snowmobiles are banned from the park. Snowmobile renters, on the other hand, indicated a far greater willingness to visit the park with guided tours than under a ban on snowmobile use.

[6]This refers only to visitors that would have used snowcoaches in the parks in the absence of the January 2001 and delay rules. There will also be an increase in the number of people using snowcoaches in the park due to switching from snowmobiles to snowcoaches.

while cross-country skiers and snowshoers would increase visitation by 25.8 percent in YNP and 7.9 percent in GTNP.[7] Tables 2-11 and 2-12 summarize projected winter use in YNP and GTNP, respectively, under Alternative 1 baseline conditions that reflect these percentage changes in visitation. Figure 2-2 shows total projected visitation under the historical baseline and Alternative 1 baseline conditions.

Table 2-11. Projected Alternative 1 Baseline Winter Use in YNP by Primary Activity, 2004–2005 through 2006–2007

Winter Season	Snowmobile[a]	Snowcoach	Cross-Country Ski	Other Visitors	Total Visitors
2004–05	0	35,930	9,830	38,840	84,590
2005–06	0	36,630	9,960	39,380	85,980
2006–07	0	37,320	10,090	39,890	87,300

[a]There is double-counting of snowmobilers who travel from GTNP into the South Entrance of YNP. Therefore, the total number of snowmobilers affected by the regulation is less than the sum of snowmobilers counted in YNP and GTNP visitation statistics.

Note: All visitation estimates have been rounded to the nearest 10. Rows may not sum to totals due to independent rounding.

Table 2-12. Projected Alternative 1 Baseline Winter Use in GTNP by Primary Activity, 2004–2005 through 2006–2007

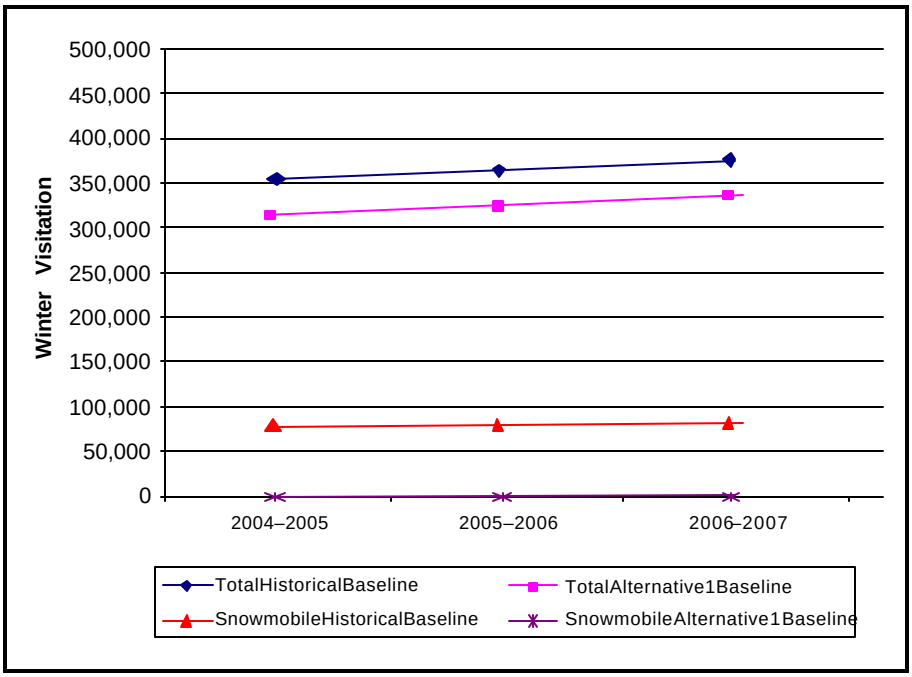
Winter Season	Snowmobile[a]	Snowcoach	Cross-Country Ski	Other Visitors	Total Visitors
2004–05	0	0	80,170	163,990	244,170
2005–06	0	0	83,460	170,720	254,180
2006–07	0	0	86,800	177,540	264,340

[a]There is double-counting of snowmobilers who travel from GTNP into the South Entrance of YNP. Therefore, the total number of snowmobilers affected by the regulation is less than the sum of snowmobilers counted in YNP and GTNP visitation statistics. The estimated percentage of GTNP snowmobilers who switch to each of the alternative visitation categories was applied to the estimated number of snowmobiles in GTNP that do not travel on to YNP (9,385).

Note: All visitation estimates have been rounded to the nearest 10. Rows may not sum to totals due to independent rounding.

[7]This reflects the change in visitation by people who visit in the absence of the January 2001 and delay rules. It does not include people who would not visit in the absence of restrictions on snowmobilers, but would visit under Alternative 1 baseline conditions because there is insufficient information to estimate their responsiveness to restrictions on snowmobile use.

Figure 2-2. Winter Use Projections for Both Baseline Conditions—Total YNP and GTNP



Note: Projections for the historical case reflect estimated visitation in the absence of the January 2001 rule based on information obtained from YNP and GTNP park staff and a YNP transportation report projecting total park visitation through 2010 (BRW, 1997). Alternative 1 baseline projections reflect the use of results from the YNP winter use survey conducted in 2002–2003 to estimate the proportionate changes in visitation.

2.4.4 Sources of Uncertainty in Visitation Projections

NPS estimates of winter visitation for the seasons 2004–2005 through 2006–2007 are based on the best information available from local park staff and preliminary winter park user survey results. However, a variety of unpredictable circumstances could affect visitation in any particular year. Visitation has displayed large variability from one year to the next. In general, visitation in a specific year will depend on many factors, including

- weather,
- economic conditions,
- natural resource conditions,
- national and state regulations that may affect snowmobile use or prices, and
- alternative recreational activities available.

It is also possible that publicity surrounding the proposed NPS snowmobile restrictions may have had an impact on snowmobile use in recent years. Snowmobile use in YNP

increased significantly from 1999–2000 to 2001–2002, possibly reflecting snowmobilers' desire to travel to YNP before any new restrictions on snowmobiles go into effect. However, partially because of a lack of snowfall, snowmobile use in YNP was down sharply in 2002–2003. Average visitation over the last 5 years (not including 2003–2004) was used as a starting point for projections to avoid placing too much weight on a single year, but it is possible that using recent years to project future visitation may overstate or understate average future snowmobile visitation, especially given the unusual events of the last few years.

In addition, it was necessary to make assumptions regarding the distribution of visitors between use types in future years. For instance, it was assumed that visitation would change at an equal rate across winter use categories. However, it is quite possible that some use categories would grow faster than others. Also, many ratios calculated using historical data or survey data (e.g., average number of people per snowmobile, percentage of visitors who cross-country ski) were assumed to remain constant in future years. To the extent that these ratios change over time, the projections may overstate or understate visitation by visitors in any particular winter use category.

Another source of uncertainty is that the visitation growth rates for both YNP and GTNP were assumed to be declining over time (although still positive). Although BRW (1997) and park staff at both YNP and GTNP indicated that visitation growth rates are expected to decrease, the actual growth rates may differ. It is possible that visitation growth rates would actually be increasing over time, in which case the daily visitation caps proposed in Alternatives 2 through 5 are more likely to be limiting. Finally, actual visitation will almost certainly not display the smooth growth pattern assumed for this analysis. However, the analysis reflects the expected visitation on average over the next 3 years.

2.5 ALTERNATE LOCATIONS FOR SNOWMOBILING NEARBY

Wyoming, Montana, and Idaho all have well-established recreational snowmobiling areas. In total, these three states

In addition to the three national park units, the GYA includes six national forests, all of which offer recreational snowmobiling opportunities.

offer more than 12,900 miles of groomed trails, as well as hundreds of miles of ungroomed trails and thousands of acres for off-trail riding. In addition to the three national park units, the GYA includes six national forests, all of which offer recreational snowmobiling opportunities: Gallatin, Beaverhead-Deerlodge, Caribou-Targhee, Bridger-Teton, Shoshone, and Custer. Snowmobiling in the neighboring forest areas and nearby communities is described in more detail below.

Custer National Forest abuts the northeast border of YNP. Only the Beartooth Ranger District of the Custer National Forest lies within the GYA. Portions of the Beartooth Ranger District of the Custer National Forest are open to oversnow motorized travel, particularly along the Beartooth highway. The Wyoming Division of State Parks and Historic Sites states that spectacular scenery highlights the link between Cooke City and Red Lodge, Montana.

The Gallatin National Forest contains more than 135 miles of groomed trails that are directly accessible from West Yellowstone and provide numerous opportunities for wildlife viewing. The most renowned of all the West Yellowstone trails is the 110-mile Big Sky Trail north of West Yellowstone. Much of this trail is ungroomed with fields of snow up to 28 feet deep and numerous hill-climbing opportunities. In addition, routes originate from the Cooke City, Montana, area that provide access to snow play areas and connect to Custer Forest trails.

West Yellowstone, Montana, has been characterized as the "Snowmobiling Capital of the World" because it averages over 150 inches of snow each year; provides access to over 400 miles of groomed trails in the surrounding national forests (the Gallatin, Beaverhead-Deerlodge, and Targhee); and serves as a gateway for snowmobiling in YNP, GTNP, and the Parkway. Beaverhead-Deerlodge National Forest in southwest Montana is the largest national forest in the state and includes nearly 600 miles of groomed and ungroomed snowmobile trails. The Madison Ranger District of this forest near YNP includes over 100 miles of these trails and extensive backcountry snowmobiling areas. The Island Park District of the Targhee National Forest offers 391 miles of groomed trails and includes scenic highlights such as Upper and Lower Mesa Falls, offering

dramatic glimpses of the Island Park caldera's edge. Groomed snowmobile trails in the Island Park, Idaho, area total 500 miles, and the region also includes dozens of meadows, rolling hills, and hill-climbing opportunities. Trails in this area connect Ashton, Idaho, to West Yellowstone to the north, to St. Anthony to the south, and to Flagg Ranch in the Parkway to the east. The Dubois District of the Caribou-Targhee has no groomed trails, but portions of the district are open to snowmobiles.

The eastern borders of YNP and GTNP include the Shoshone and Bridger-Teton National Forests. Over 280 miles of scenic groomed and ungroomed trails, plus thousands of acres of off-trail riding, are open to snowmobiles in the Shoshone National Forest. In the Bridger-Teton, there are approximately 700 miles of groomed snowmobiles trails, as well as 100 miles of ungroomed trails and extensive backcountry areas open to snowmobiles. The Shoshone, with YNP on its western border, encompasses the area from the Montana state line south to Lander, Wyoming. The western boundary of the forest south of Yellowstone is the crest of the Continental Divide. Elevations on the Shoshone range from 4,600 feet at the mouth of Clarks Fork Canyon to 13,804 feet atop Gannett Peak, Wyoming's highest. In the Beartooth Mountains, in the northern half of the Shoshone Forest on the southeastern border of YNP, snowmobiles may travel approximately 36 miles of groomed and 34 miles of ungroomed trails. Historically the Buffalo Bill Scenic Byway, 50 miles west of Cody, has provided access from the forest to YNP.

A variety of snowmobile trails connect the southern portion of the Shoshone with the Bridger-Teton National Forest, including stretches of the CDST. The CDST generally parallels the Continental Divide between Lander, Wyoming, and YNP's South Entrance. The distance between Lander and the eastern border of GTNP is approximately 235 miles. The Lander area has 118 miles of groomed trails through scenic-forested mountains. The CDST between Lander and Pinedale, Wyoming, into the Bridger-Teton National Forest, is described as varied, with high mountains, scenic views, and visibilities of up to 150 miles. Snowmobiles are permitted in the town of Pinedale itself, through which the CDST travels. The Pinedale area trail system

through the Wind River and Wyoming Mountain Ranges includes 141 miles of trail through open country with numerous scenic mountain views. The CDST continues from Dubois and onto the eastern GTNP border just beyond Togwotee Pass. As described by the Wyoming Division of State Parks and Historic Sites, the "Dubois area boasts some of the best and most scenic riding in the world on 150 miles of beautiful trails and thousands of acres of off-trail riding." Beyond Dubois is the Togwotee area, described by some local retailers as a spectacular snowmobiling mecca, offering unparalleled terrain and powder made for snowmobiling.

The Gros Ventre Mountain Range area within the Bridger-Teton National Forest just southeast of GTNP has approximately 57 miles of groomed trail just east of the Tetons. This trail system provides access to the Togwotee, Dubois, and Pinedale snowmobiling areas from Jackson. Although snowmobiling in this area is restricted to the trail in most places because of wildlife concerns, it offers the possibility of viewing elk, moose, deer, mountain sheep, coyotes, or bobcats. In the southern portion of the Bridger-Teton National Forest, the Wyoming Range between Alpine and Kemmerer, Wyoming, has approximately 335 miles of groomed trails and numerous opportunities for off-trail riding.

2.6 OTHER MAJOR WINTER ACTIVITIES

2.6.1 Yellowstone National Park

Winter activities within YNP, other than snowmobiling, include auto-touring, snowcoach touring, wildlife viewing, cross-country and telemark skiing, snowboarding, snowshoeing, and winter camping. Ranger-led winter activities in YNP include interpretative programs, winter wildlife tours (via bus), and snowshoe walks.

Snowcoach tours in YNP operate from Mammoth Hot Springs, West Yellowstone, Old Faithful, and Flagg Ranch (in the Parkway). Snowcoaches provide access to cross-country skiing, snowshoeing tours, and sightseeing tours.

Nonmotorized travel, such as cross-country skiing and snowshoeing, is permitted throughout YNP except in the Grand

Canyon of the Yellowstone and McMinn Bench. Skiers and snowshoers are permitted on designated snowmobile routes within YNP. In addition, the park has approximately 37 miles of groomed nonmotorized trails located near Mammoth Hot Springs, Virginia Cascades east of Norris Junction, Old Faithful, the East Entrance, Canyon Village, Tower-Roosevelt, and the Blacktail Plateau.

2.6.2 Grand Teton National Park

Winter activities in GTNP other than snowmobiling include auto-touring and wildlife viewing, cross-country skiing, snowshoeing, and ice fishing. Until the 2002–2003 winter use season, snowplanes were permitted on Jackson Lake. The area around Jackson Lake was open to snowmobilers, snowplane operators, cross-country skiers, and snowshoers in the winter of 2001–2002 and in previous years. However, snowplanes were banned from the park for the winter of 2002–2003, and snowmobile access to the southernmost portion of Jackson Lake has also been restricted. Skiers and snowshoers are permitted on designated snowmobile routes within GTNP.

Nonmotorized travel, such as cross-country skiing and snowshoeing, is permitted throughout GTNP except in the Snake River bottom from Menor's Ferry at Moose north to Moran Junction; at the Buffalo Fork of the Snake River within the park; and within Willow Flats, Kelly Hill, Uhl Hill, and Wolf Ridge. Ungroomed ski and snowshoe trails, totaling approximately 26 miles, are available from Taggart Lake Trailhead to both Taggart and Jenny Lakes, along Antelope Flats Road, and near Moose, Death Canyon, Granite Canyon, Two Ocean Lake, and Colter Bay. Ski tours are periodically available from the Moose Visitor Center.

2.6.3 John D. Rockefeller, Jr., Memorial Parkway

Snowcoaches operate from the lodge at Flagg Ranch but are dedicated to running tours into YNP, as opposed to the Parkway or GTNP. There are approximately 5.2 miles of ungroomed ski and snowshoe trails in the vicinity of Flagg Ranch. Furthermore, ski tours are occasionally available from Flagg Ranch.

2.7 NATURAL RESOURCES AND LIKELY ECOLOGICAL IMPACTS OF SNOWMOBILE USE IN THE PARKS

Half of the known geothermal features in the world, including the largest concentration of geysers in the world, are located within the GYA. The parks protect the largest number and greatest variety of animal species in the lower 48 states. The following discussion provides an introduction to the potential ecological impacts resulting from snowmobile use and summarizes NPS's assessment of the likely impacts under each alternative.

2.7.1 Air Quality and Human Health

Typical snowmobiles currently used (e.g., with carbureted two-stroke engines) release substantial amounts of pollutants into the environment. Air quality and visibility can be affected by emissions from two-stroke engines such as snowmobile engines. The typical conventional (i.e., carbureted) two-stroke engine intakes a mixture of air, gasoline, and oil into the combustion chamber and expels exhaust gases from the combustion chamber. The three primary reasons for emission releases are

- up to one-third of the fuel delivered to the engine is expelled without being burned,
- lubricating oil is mixed with fuel and thus is expelled as part of the exhaust, and
- the combustion process results in high emissions of air pollutants (e.g., PM and CO).

Contaminants released into the environment due to snowmobile use include those present in the raw fuel itself and those that are formed during its combustion. Fuel used in conventional two-stroke engines contains many HCs, including volatile organic compounds (VOCs) such as benzene, toluene, ethylbenzene, and xylene (collectively referred to as BTEX); methyl tertiary butyl ether (MTBE) and polycyclic aromatic HCs (PAHs); nitrogen oxides (NO_x); particulate matter (PM); and CO (Kado et al., 2000). Unburned fuel does not contain appreciable levels of PAHs, but several PAHs are formed as a result of its combustion (i.e., phenanthrene, pyrene, chrysene/benzo(a)pyrene, and acenapthylene) (VanMouwerik

and Hagemann, 1999). Other HCs that are not present in fuel but are by-products of incomplete combustion include formaldehyde, acetaldehyde, diesel PM, and 1,3-butadiene (EPA, 1994). Two-stroke engines also contribute to the formation of ozone in the atmosphere, which is formed when HCs react with NO_x in the presence of sunlight (EPA, 1993).

Inhalation of many of these pollutants is associated with a wide variety of potential adverse health effects (Table 2-13). 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; and respiratory failure and death. Health effects from PM emissions may include reduced lung function, aggravation of respiratory ailments, development of respiratory problems, and increased risk of premature mortality.

The extent to which the health effects listed in Table 2-13 result from snowmobile emissions depends on the level and duration of exposure. There is too little data and too much uncertainty to reliably estimate the incidence of these health effects. NPS employees working in areas of high snowmobile use would be expected to be most at risk from exposure to these pollutants.

It should be noted that, in the final rule signed on September 13, 2002, EPA has adopted "fleet-averaged" CO and HC emissions standards for snowmobiles, effective in three phases. This rule will significantly reduce CO, HC, and PM emissions associated with snowmobile use. In Phase 1 of the EPA rule, 50 percent of new snowmobiles sold will be required to meet the following emissions standards in 2006: 275 g/kW-hr (205 g/hp-hr) for CO and 100 g/kW-hr (75 g/hp-hr) for HC. Phase 1 requires 100 percent compliance to these standards for new machines in the 2007 model year. In Phase 2 standards are further reduced, effective the 2010 model year: 275 g/kW-hr for CO and 75 g/kW-hr for HC. The final standards (Phase 3) are to be implemented by 2012: 200 g/kW-hr (149 g/hp-hr) for CO and 75 g/kW-hr (56 g/hp-hr) for HC. Phase 3 will also establish a cap on NO_x. These standards represent 30 percent (in 2006) and 50 percent (in 2012) reductions in HC and CO

Table 2-13. Health Effects Associated with Pollutants Found in Snowmobile Emissions

	Carcinogenic Effects	Other Chronic Health Effects	Acute Health Effects
Particulate matter (PM)	None	Chronic bronchitis	High-level exposure: mortality, acute bronchitis Low-level exposure: cough
Carbon monoxide (CO)	None	Aggravation of cardiovascular disease	High-level exposure: visual and mental impairment
Nitrogen oxides (NO_x)	None	Reduced pulmonary function	High-level exposure: cough, fatigue, nausea Low-level exposure: lung irritation
Benzene	Known human carcinogen	Anemia and immunological disorders	High-level exposure: dizziness, headaches, tremors
1,3-Butadiene	Probable human carcinogen	Birth defects, kidney and liver disease	High-level exposure: neurological damage, nausea, headache Low-level exposure: eye, nose, throat irritation
Formaldehyde	Probable human carcinogen	NA	NA
Acetaldehyde	Possible human carcinogen	Anemia	High-level exposure: pulmonary edema, necrosis Low-level exposure: eye, skin, lung irritation
Ammonia	None	NA	High-level exposure: eye and lung irritation

NA = Not available.

Sources: U.S. Environmental Protection Agency (EPA). Integrated Risk Information System. <http://www.epa.gov/ngispgm3/iris/index.htm.>. As obtained on October 15, 2000.
U.S. Environmental Protection Agency (EPA). 1999a. 1997 National Air Quality: Status and Trends. Washington, DC: Office of Air and Radiation.

emissions from the current average levels. No standards for particulate matter (PM) were included in the rule "because limits on HC emissions will serve to simultaneously reduce PM" (EPA, 2002). Table 2-14 compares EPA's baseline assumptions and the emission reductions required by the rule and achievable using four-stroke technology.

Baseline Air Quality and Public Health Conditions in GYA Parks

YNP and GTNP are classified as mandatory Class I areas under the Federal Clean Air Act (42 USC 7401 et seq.). This air quality classification is aimed at protecting parks and wilderness areas from air quality degradation. The Parkway is a Class II area, but is managed as a Class I area under NPS

Table 2-14. Comparison of Emissions Requirements and Current Technology

Emission	EPA Baseline	Percent Emission Reduction—EPA Rule (2012)[a]	Percent Emission Reduction—Four-Stroke Machines[a]
CO[b]	397 g/kW-hr	50%	85%
HCs	149 g/kW-hr	50%	95–98%
PM		No standard	90–96%

[a]Reductions relative to EPA baseline assumption.

[b]In addition to the limits for these pollutants listed in the table, the EPA rule limits the sum of NO_x and HCs to less than or equal to the HC standard. Despite greatly reducing CO, HC, and PM emissions relative to two-stroke engines, four-stroke engines have NO_x emissions 7 to 12 times greater than two-stroke engines.

Source: National Park Service (NPS). 2003b. *Winter Use Plans: Final Supplemental Environmental Impact Statement: Yellowstone and Grand Teton National Parks and the John D. Rockefeller, Jr., Memorial Parkway*. <http://www.nps.gov/grte/winteruse/fseis>.

National park visitors traveling on snowmobile trails may be exposed to particularly high levels of CO and certain HCs.

policy. The Federal Clean Air Act requires EPA to establish national ambient air quality standards (NAAQS) to protect public health and welfare. Standards have been set for six pollutants: PM_{10}, CO, NO_x, sulfur dioxide (SO_2), ozone (O_3), and lead (Pb). These pollutants are called criteria pollutants because the standards satisfy criteria specified in the act.

Nonattainment areas are subject to planning and pollution control requirements that are more stringent than areas that meet standards. The areas covered by the three park units are in attainment. Table 2-15 lists the NAAQSs and ambient air standards adopted by Wyoming, Montana, and Idaho. The States of Montana and Wyoming have adopted more stringent standards for some pollutants.[8]

Because there is little industrial activity and a relatively low population in northwestern Wyoming, overall regional air quality in the parks is good. All park areas are located in areas that are in attainment with all federal and state ambient air quality standards. The major sources of air pollutants in the area are those emitted by motor vehicles (automobiles, buses, snowcoaches, and snowmobiles) concentrated along motorized routes, and smoke from wood fires, including stoves, fireplaces,

[8]The states of Montana and Wyoming have adopted some standards more stringent than the federal standards established by EPA under the Clean Air Act. The jurisdiction for enforcing the NAAQS is delegated to the states.

Table 2-15. Primary and Secondary Ambient Air Quality Standards

	Time period	Federal	Wyoming	Montana	Idaho
Particulate matter $(PM)_{10}$	24-hr average	150 µg/m^3 (arithmetic)	150 µg/m^3 (arithmetic)	150 µg/m^3 (arithmetic)	150 µg/m^3 (arithmetic)
	Annual mean	50 µg/m^3 (arithmetic)	50 µg/m^3 (arithmetic)	50 µg/m^3 (arithmetic)	50 µg/m^3 (arithmetic)
Particulate matter $(PM)_{2.5}$	24-hr average	65 µg/m^3 (arithmetic)	65 µg/m^3 (arithmetic)		
	Annual mean	15 µg/m^3 (arithmetic)	15 µg/m^3 (arithmetic)		
Carbon monoxide (CO)	1-hour	35 ppm	35 ppm	23 ppm	35 ppm
	8-hour	9 ppm	9 ppm	9 ppm	9 ppm
Nitrogen dioxide (NO_2)	1-hour			0.30 ppm	
	Annual average	0.053 ppm	0.05 ppm	0.05 ppm	0.05 ppm
Sulfur dioxide (SO_2)	3-hour	0.5 ppm (secondary)	0.5 ppm	0.5 ppm 1-hour)	0.5 ppm (secondary)
	24-hour	0.14 ppm	0.1 ppm	0.1 ppm	0.14 ppm
	Annual average	0.03 ppm	0.02 ppm	0.02 ppm	0.03 ppm
Ozone (current)	1-hour	0.10 ppm		0.10 ppm	0.12 ppm
Ozone (proposed)	8-hour	0.08 ppm	0.08 ppm		
Lead	90-day Average	1.5 µg/m^3	1.5 µg/m^3	1.5 µg/m^3	1.5 µg/m^3
	Calendar Quarter	1.5 µg/m^3	1.5 µg/m^3		1.5 µg/m^3

Source: National Park Service (NPS). 2003b. *Winter Use Plans: Final Supplemental Environmental Impact Statement: Yellowstone and Grand Teton National Parks and the John D. Rockefeller, Jr., Memorial Parkway*. <http://www.nps.gov/grte/winteruse/fseis>.

and campfires. The predominant fuels consumed by stationary sources in the parks are propane and number two heating oil.

Potential Impacts of Proposed Regulation on Air Quality and Public Health in GYA Parks

NPS (2003b) has conducted extensive short-term air quality analyses using atmospheric modeling to assess the relative

impacts of the winter use alternatives.[9] The following summarizes the results found in *Temporary Winter Use Plans Environmental Assessment* (NPS, 2004). NPS concludes that none of the alternatives are likely to exceed the CO and $PM_{2.5}$ NAAQS, or the Montana or Wyoming ambient air quality standards. Carbon monoxide and hydrocarbon concentrations are projected to improve under all alternatives relative to the historical baseline due to the BAT requirements and daily snowmobile entry limits. Hazardous air pollutant emissions are also expected to be reduced under all alternatives. Nitrogen oxides are expected to increase, to varying degrees, under all alternatives. None of the alternatives are expected to have impacts of sufficient magnitude to constitute impairment of park resources and values. Avalanche control would continue and have similar impacts under all alternatives.

Alternative 1. NPS expects Alternative 1 to have major beneficial impacts on air quality compared to historical conditions. In the area of employee and public health, a major beneficial impact in reducing pollutants would occur under Alternative 1. Eliminating visitor snowmobile accidents would result in a moderate beneficial impact. Health and safety related impacts are expected to be long-term.

Alternative 2. Alternative 2 would also have major beneficial impacts on air quality compared to historical conditions, similar to impacts under Alternative 1. Compared to Alternative 1, Alternative 2 would have negligible adverse impacts on most of the park and minor adverse impacts along travel corridors and at staging areas. In the area of employee and public health, a moderate beneficial impact in reducing pollutants would occur under Alternative 2. Reducing the number of snowmobiles and guide requirements would result in a moderate beneficial impact compared to historical conditions of vehicular travel accidents. Health and safety related impacts are expected to be long-term. Compared to Alternative 1, Alternative 2 would

[9]Air quality modeling was performed for NPS by EA Engineering, Science and Technology, Inc., and included short-term air quality analyses for each alternative via atmospheric dispersion modeling for CO and PM_{10} using EPA-approved air quality models. The report also included PM prevention of significant deterioration (PSD) increment analysis, estimates of total mobile emissions, and visibility modeling. The full report is included as Appendix C of the FSEIS (NPS, 2003b).

result in minor adverse impacts on employee and public health and safety.

Alternative 3. Alternative 3 would also have major beneficial impacts on air quality compared to historical conditions. Compared to Alternative 1, Alternative 3 would have negligible adverse impacts on most of the park, minor adverse impacts along travel corridors, and moderate adverse impacts at staging areas. In the area of employee and public health, a moderate beneficial impact in reducing pollutants would occur under Alternative 3. Reducing the number of snowmobiles and guide requirements would result in a moderate beneficial impact compared to historical conditions of vehicular travel accidents. Health and safety related impacts are expected to be long-term. Compared to Alternative 1, Alternative 3 would result in moderate adverse impacts on employee and public health and safety.

Alternative 4. NPS expects Alternative 4 to have moderate beneficial impacts on air quality compared to historical conditions. Compared to Alternative 1, Alternative 4 would have negligible adverse impacts on most of the park and moderate adverse impacts along travel corridors and at staging areas. In the area of employee and public health, a moderate beneficial impact in reducing pollutants would occur under Alternative 4. Guide requirements would result in a moderate beneficial impact compared to historical conditions of vehicular travel accidents. Health and safety related impacts are expected to be long-term. Compared to Alternative 1, Alternative 4 would result in moderate adverse impacts on employee and public health and safety.

Alternative 5. Alternative 5 would have moderate beneficial impacts on air quality compared to historical conditions. Compared to Alternative 1, Alternative 5 would have negligible adverse impacts on most of the park, moderate adverse impacts along travel corridors, and moderate to major adverse impacts at staging areas. In the area of employee and public health, a minor to moderate beneficial impact in reducing pollutants would occur under Alternative 5. Guide requirements would result in a minor to moderate beneficial impact compared to historical conditions of vehicular travel accidents. Health and

safety related impacts are expected to be long-term. Compared to Alternative 1, Alternative 5 would result in moderate adverse impacts on employee and public health and safety.

2.7.2 Visibility

The primary contributor to visibility impairments in general is associated with PM in the atmosphere that scatter and absorb light. There are several different sources and types of particles in the environment; however, sulfates (and to a lesser extent nitrates), primarily from the combustion of fuels, are the largest contributors to visibility reduction, especially in the eastern portions of the United States (Malm, 1999). Nationwide, the largest sources of sulfur dioxide emissions that contribute to sulfates in the atmosphere are power plants and other industrial sources. Mobile sources, such as cars, trucks, and buses (and snowmobiles), account for the largest portion of NO_x emissions, which contribute to nitrates.

Snowmobiles can be a source of visibility impairment in national parks, but their contribution to overall levels of regional haze in these areas is likely to be quite small. Nevertheless, in high-use areas and periods, they may negatively affect visual air quality in a noticeable way.

Table 2-16 compares typical emissions rates for conventional two-stroke snowmobiles and other vehicles for NO_x and PM. These pollutants are the most likely contributors to localized visibility impairments from snowmobile emissions. These emissions rates vary greatly across types and uses of these vehicles; however, the table shows that PM emissions for snowmobiles are particularly high relative to automobiles. As described in Section 2.8.1, the use of four-stroke engines dramatically reduces PM emissions, although NO_x emissions are higher for this particular technology.

Table 2-16. Comparative Emissions Factors for Snowmobiles and Other Vehicles: NO_x and PM

	NO_x	PM
Snowmobiles (lbs per 4-hr visit)	0.06	0.2
Automobiles (lbs per 4-hr drive[a])	0.09–0.41	0.02
Diesel buses (lbs per 4-hr drive[a])	3.22	0.26

[a]Assuming an average speed of 25 mph.

Source: National Park Service (NPS). February 2000a. *Air Quality Concerns Related to Snowmobile Usage in National Parks*. Denver, CO.

Current Visibility Conditions in GYA Parks

NPS assessed visibility impacts by whether the air emissions from an alternative are likely to cause a visibility impact that would be perceptible to an observer (NPS, 2003b). NPS anticipates that the baseline, Alternative 1, would not cause localized, perceptible, visibility impacts near the West Entrance, in the areas around Old Faithful and Flagg Ranch, or along the heavily used roadway segments. This is a substantial improvement relative to existing conditions where vehicular emissions would cause localized, perceptible, visibility impacts near the West Entrance, along the West Entrance to Madison Roadway, and in the areas around Old Faithful and Flagg Ranch.

Potential Impacts of Proposed Regulation on Visibility in GYA Parks

Visibility modeling was not conducted for the Environmental Assessment (EA), and it is unknown to what degree the alternatives will affect visibility (NPS, 2004).

2.7.3 Water Resources

The same constituents discussed under air quality are of concern when considering water quality and potential impacts to aquatic organisms. Although snowmobile-associated pollutants are directly released to air and the snowpack, they also have the potential to migrate to and contaminate water resources, primarily via deposition in the snowpack and subsequent melting into runoff that enters surface waters or shallow groundwater reservoirs in a concentrated pulse during spring snowmelt. Pollutants present in surface waters are available for uptake by aquatic resources such as vegetation, fish, amphibians, or others who are exposed to the contaminants in water. In addition, sunlight can further increase the toxic effect of PAHs to aquatic organisms (Mekenyan et al., 1994; Arfsten, Schaeffer, and Mulveny, 1996). Research evaluating the possible phototoxic effects of some PAHs to aquatic organisms (NCER, 1999) has demonstrated that toxicity may vary because of a number of factors including length of exposure; turbidity, humic acid, and organic carbon levels; the location of the organism relative to the surface of the water or the sediment; and weather/PAH fate

issues (NCER, 1999). For instance, increased turbidity or organic carbon tended to reduce toxicity, increasing the length of exposure tended to increase toxicity, and proximity to the surface (i.e., shallow waters) might increase toxicity.

Because there is no evidence that historic levels of snowmobile use adversely affect water quality or aquatic resources in the parks, the Alternative 1 baseline and the remaining alternatives considered are not likely to affect water resources in the park.

Current Water Resource Conditions in GYA Parks

The GYA encompasses a 3,500 square mile watershed. Surface water covers about 10 percent of GTNP and about 5 percent of YNP. Surface waters in both parks are designated Class 1 by the State of Wyoming, and their water quality is considered to be excellent. The parks are home to a vast array of native animals that depend on aquatic resources for all or part of their lives—more than 400 types of aquatic insects, 12 types of fishes, 10 types of reptiles and amphibians, at least 300 types of birds, 100 types of butterflies, and 60 types of mammals in YNP alone (NPS, 2000d).

Pollutants are deposited into the snowpack from two-cycle engine emissions along groomed park roads in YNP, GTNP, and the Parkway. Pollutants that persist in snowpacks or in soil can be washed into drainage systems with snowmelt or move through soil into nearby surface water sources or into groundwater storage over time. Contaminants from snowmobile discharges may migrate through snowmelt into surface waters, such as Jackson Lake whose frozen surface is currently used for snowmobiling and several other smaller lakes, ponds, and streams that are located near snowmobile routes. There is a potential risk of adverse effects on water quality, wetlands, and aquatic resources where oversnow motorized use closely parallels rivers and other bodies of water.

A snowpack pollutant study conducted in YNP and other areas in the Rocky Mountain region found that in YNP concentrations of ammonium, sulfate, benzene, and toluene were positively correlated with oversnow traffic (USDOI/USGS, 1998). Where increased snowmobile traffic occurred near West Yellowstone and Old Faithful, higher concentrations of the pollutants were detected. At the lower traffic locations near Lewis Lake Divide and Sylvan Lake, lower concentrations were found. At the higher snowmobile-use locations, in-road samples were substantially more concentrated than off-road samples.

Concentrations of ammonium and sulfate at the sites in the snowpacked roadways between West Yellowstone and Old Faithful were greater than those observed at any of the 50 to 60 other snowpack-sampling sites in the Rocky Mountain region. Despite this correlation, there is currently no evidence of measurable changes in water quality or effects on aquatic resources within the three parks. The study also indicates that there is a potential for localized acidification of aquatic ecosystems in high-snowmobile traffic areas, but that further site-specific studies would be necessary to verify this. Studies conducted to date have not documented exceedances of ambient water quality criteria.

Because adverse impacts to water resources have not been documented and NPS did not identify demonstrable adverse effects on water or aquatic resources for the full range of alternatives identified in the FEIS (NPS, 2000d), NPS did not consider impacts to water resources in the SEIS process or the EA process. The FSEIS states that "for the alternatives being further considered in this SEIS, there is no potential for changes in the relative risks based on information about new technology" (NPS, 2003b). Thus, although Alternative 1 would eliminate all potential impacts to water quality from snowmobiles, NPS does not anticipate snowmobile use identified in Alternatives 2 through 5 to measurably affect water resources.

2.7.4 Soundscape

NPS attempts to prevent or minimize unnatural sounds that adversely affect the natural soundscape.

Perhaps the most noticeable and intrusive aspect of snowmobiles is the level of noise they emit during normal operation. The natural soundscape is considered a natural resource of the park, and NPS attempts to prevent or minimize unnatural sounds that adversely affect the natural soundscape. National parks are especially valued for their pristine and undisturbed environments, which are often experienced by visitors through natural vistas and through the relative absence of visible or audible human activity (NPS, 2000b).

As shown in Table 2-17, estimates of noise levels from snowmobiles vary widely. The Snowmobile Safety and

Table 2-17. Comparative Noise Emissions

Source	Decibel Level
Firearms	140
Motorcycle	90–110
Snowmobiles	73–100
Vacuum cleaner	70
Normal conversation	60
Normal breathing	10

Certification Committee states that certified snowmobiles emit roughly 73 decibels (dB) of sound when traveling at 15 mph and no more than 78 dB traveling at full throttle at 50 feet away.[10] Other information sources list the noise emissions from snowmobiles at as much as 100 dB (League for the Hard of Hearing, 2000; OMGSIC, 2000). Moreover, the amount of noise from snowmobiles can vary considerably across models and different types of use.[11] To put these noise-level estimates into perspective, Table 2-17 also compares them with those of other familiar sounds.

In a recent audibility analysis, snowmobiles considered BAT (Arctic Cat four-stroke machines) emitted an average of 71.8 dB at 35 mph; conventional two-stoke snowmobiles averaged

[10]The *Code of Federal Regulations*, Title 36, Chapter 1, Part 2.18 states that operating a snowmobile that makes excessive noise in any national park, monument, lakeshore, or recreation area is prohibited. The rule defines excessive noise as a decibel level (dB, measured on an A-weighted scale measured at 50 feet) depending on the period that the snowmobile was manufactured: 78 dB for snowmobiles manufactured after July 1, 1975, 82 dB for snowmobiles manufactured between July 1, 1973, and July 1, 1975, and 86 dB for snowmobiles manufactured before July 1, 1973 (from 36 CFR 7-1-90 edition). Snowmobiles manufactured since February 1, 1975, and certified by the Snowmobile Safety and Certification Committee may emit no more than 78 dB from a distance of 50 feet while operating at full throttle (when tested under the SAE J192 procedures). In addition, those manufactured after June 30, 1976, and certified by the Snowmobile Safety and Certification Committee may emit no more than 73 dB at 50 feet while traveling at 15 mph. However, the after-market modification of snowmobile exhaust systems or substitution of factory-installed with after-market racing exhaust systems can increase the potential noise impacts of snowmobiles.

[11]Other factors that influence the pitch and intensity of snowmobile engine noise include alterations of engine and the exhaust systems and travel speed (ISMA, 2000). Sound waves travel faster in low atmospheric pressure and colder temperatures, and geographical features and other environmental objects absorb them. As a result, snowbanks and trees can cause a 10 to 20 dB noise level reduction if they are located between the snowmobile and receiver (ISMA, 2000).

74.0 dB at 35 mph (NPS, 2003b). Sound levels for both machines were lower at lower speeds and higher at 45 mph.

Current Soundscape Conditions in GYA Parks

Noise emissions from snowmobiles can present a significant disturbance, particularly in areas that are valued for their natural quiet. This problem can also be particularly acute in high-use areas, such as in YNP.

Clearly, noise emissions from oversnow vehicles can present a significant disturbance, particularly in areas that are valued for their natural quiet. Areas of primary concern are those in which mechanized noise from wheeled (e.g., cars in GTNP) or oversnow vehicles on plowed, groomed, or ungroomed motorized trails and routes affect the natural soundscape within the parks. In areas adjacent to park entrances, park lodging (e.g., Flagg Ranch and the Snow Lodge), and motorized trails, routes and plowed roads, human-generated activity is high, human encounters with wheeled or oversnow vehicles are the norm, and the natural soundscape is often obscured.

For areas somewhat removed from the motorized trails, routes, and plowed roads, human-generated sound is generally present at lower levels and for less time. With reduced human-generated sound compared to the areas adjacent to the motorized trails, routes, and plowed roads, the natural soundscape is not as affected, and visitors have increased opportunities to experience natural soundscapes.

In distant areas substantially removed from the influence of plowed roads or motorized oversnow trails and routes, human-generated sound is rare. Natural soundscapes remain unimpaired most or all the time in such distant backcountry areas. Sounds from wheeled or oversnow vehicles are only occasionally audible within the background sound in such areas, depending on the proximity of the motorized trails and routes, local topography, and sound emission levels of these vehicles.

Noise emissions have been identified as a particular nuisance to nonmotorized park users, such as cross-country skiers and snowshoers, who tend to place a particularly high value on the tranquility and natural soundscape offered by the parks. Even though the park has several backcountry areas where these visitors can recreate without being disturbed by snowmobiles, under current conditions, it is virtually impossible for them to do so in the vicinity of the parks' main attractions. Park officials indicate that snowcoach users are also frequently

disturbed by snowmobile noise, especially during stops to view wildlife and enjoy the landscape. In contrast to skiers or snowshoers, it is nearly impossible for snowcoach users to avoid contact with snowmobilers because they use the same routes.

Potential Impacts of Proposed Regulation on the Soundscape in GYA Parks

The following summarizes the results found in the EA (NPS, 2004). In the EA, NPS bases impact levels of audibility on those in the FEIS and FSEIS but includes new categories for management areas to better represent the patterns of impact on natural soundscape. Some impacts could be mitigated through speed reduction and the training of snowcoach and snowmobile guides. None of the alternatives are expected to have impacts of sufficient magnitude to constitute impairment of park resources and values.

Alternative 1. Alternative 1 was modeled using only BAT snowcoaches. This alternative would have major beneficial impacts to natural soundscapes compared to historical conditions of unlimited snowmobile use. Developed areas and roadway corridors would experience minor, and occasionally moderate, adverse impacts due to oversnow vehicles, and backcountry areas would experience negligible adverse effects. Impacts would be short-term and eliminated at the end of the season.

Alternative 2. Alternative 2 would have major beneficial impacts to natural soundscapes compared to historical conditions. Moderate adverse effects would occur in developed areas, roadway corridors, and backcountry areas. Impacts would be short-term and eliminated at the end of the season.

Alternative 3. Compared to historical conditions, Alternative 3 would have moderate beneficial impacts to natural soundscapes. Moderate to major adverse effects would occur in developed areas, moderate adverse effects would occur in roadway corridors, and moderate adverse effects would occur in backcountry areas under Alternative 3. Impacts would be short-term and eliminated at the end of the season.

Alternative 4. Alternative 4 would have moderate beneficial impacts to natural soundscapes compared to historical conditions. Major adverse effects would occur in developed areas and in roadway corridors. Moderate to major effects would occur in backcountry areas. Impacts would be short-term and eliminated at the end of the season.

Alternative 5. Alternative 5 has several features that would mitigate impacts to natural soundscapes through daily entrance limits, requirements that snowmobiles use BAT, and requirements that 80% of snowmobilers travel with commercial guides. Minor adverse impacts would occur under this alternative compared to historical conditions. Major adverse effects would occur under Alternative 5 in developed areas, roadway corridors, and backcountry areas. Impacts would be short-term and eliminated at the end of the season.

2.7.5 Geothermal

Adverse impacts can occur to geothermal features when visitors have unregulated access to geothermal basins. Park visitors can alter or damage geothermal resources by traveling off trail or throwing objects into these features. Harm to geothermal resources also affects plants and animals that depend on them. The SEIS process dismissed geothermal features as a topic to be examined, specifically because

> impact evaluation in the FEIS for most alternatives indicates that there are and would be minor adverse effects on the integrity of the geothermal resource itself as a result of winter use. The risks of impact may vary somewhat by alternative, left unmitigated. For the alternatives being further considered in this SEIS, there is essentially no greater potential impact than minor adverse impacts, which can be mitigated. (NPS, 2003b)

2.7.6 Wildlife

The parks protect the largest number and greatest variety of animal species in the lower 48 states. They protect two federally listed endangered species—the gray wolf and the whooping crane—and three threatened species—the lynx, the bald eagle, and the grizzly bear. The parks are home to the largest concentration of elk in the world. They are the only

place in the United States where bison have existed in the wild since primitive times.

As described above, snowmobile use leads to increased noise and air pollutant emissions. Noise may disrupt wildlife use patterns, and terrestrial habitat may be disturbed, particularly when snowmobiles trespass off of the designated trails into areas with sensitive habitat. In addition, emissions deposited in the snowpack may migrate into the park's water resources and, if in high enough concentrations, they may adversely affect aquatic ecosystems. Each of these effects is described in more detail below.

- Noise. Wildlife can be affected by the noise and physical presence of snowmobiles. Numerous studies have evaluated the extent to which noise and the physical presence of snowmobiles can cause physiological stresses and changes in wildlife activity patterns and feeding habits (Boyle and Samson, 1985; Eckstein et al., 1979; Freddy, Bronaugh, and Fowler, 1986; Richens and Lavigne, 1978; Moen, Whittemore, and Buxton, 1982). The evidence from these studies is mixed, but some negative effects on wildlife may exist. Additional impacts may include changes in distribution and movement, habitat use, and energetics. It should be noted that many of these wildlife studies document that the presence of humans on foot or on cross-country skis also disturb wildlife significantly (Eckstein et al., 1979; Freddy, Bronaugh, and Fowler, 1986).
- Snow Compaction. Compaction of the snowpack may pose several potential impacts to wildlife. Wildlife can take advantage of the snowpacked trail to increase their mobility, and ultimately this can change winter home ranges and predator prey relationships (Aune, 1981; Dorrance, Savage, and Huff, 1975; Nelson and Mech, 1984; Neumann and Merriam, 1972; Paquet, Wierczhowski, and Callaghan, 1996; Richens and Lavigne, 1978). Schmid (1971) demonstrated that compaction can alter the mild subsnow microclimate, and Pruitt (1971) found that energy expenditure of burrowing small mammals increases in denser snow. Burrowing small mammals, therefore, may be adversely affected by snowpack compaction.
- Habitat Disturbance. Because designated snowmobile trails in the national park system are restricted to roads used for automobile/RV/bus travel in the nonsnow season, there should be no increase in terrestrial habitat

disturbance on snowmobile trails because the habitat has already been altered and is used by other vehicles. However, trespass in nondesignated snowmobile trails may occur, resulting in damage to vegetation and/or habitat. If the snowpack is deep, trespassing in offroad habitats may not result in any damage to plants and habitat covered adequately by the snow. However, if saplings or other vegetation extend above the snow surface, there may be significant vegetative damage (Neumann and Merriam, 1972), and if trespassing occurs when there is little snow on the ground, surface soil and vegetation on the bare ground may be affected.[12]

- Water Quality. As described in Section 2.7.3, pollutants in snowmobile emissions can potentially affect water quality via deposition in the snowpack and subsequent melting into runoff. Although elevated emission concentrations along the snowmobile corridors have been detected, they are generally dispersed into the surrounding watersheds at concentrations below levels likely to threaten human or ecosystem health (USDOI/USGS, 1998).

Other winter uses and means of access also produce impacts. Cross-country skiing and other nonmotorized forms of recreation have been shown to affect wildlife. Winter recreation activities (motorized and nonmotorized) take place during the season when animals are stressed by climate and food shortages. Snow depth, cold temperatures, and lack of high quality forage can lead to synergistic and nutritional stress and consequently higher rates of competition and mortality. Disturbance or harassment of wildlife during this sensitive time can have a negative effect on individual animals and, in some cases, populations as a whole. The most critical times for wildlife involve cold weather, late pregnancy, and other times when animals are in a state of negative energy balance. The consequences of human-caused wildlife disturbance may include elevation of heart rate and metabolism, flight, displacement from habitats, reduced reproduction, increased susceptibility to predation, and diminished health as a result of increased energy costs. Thus, although animals may appear

[12] It should be noted that the damages associated with this type of trespassing may not be reduced (and may actually increase) as a result of snowmobiling restrictions. This must be accounted for in assessing the net benefits of proposed restrictions.

unaffected by human activities, adverse effects may be occurring nonetheless.

Current General Wildlife Conditions in GYA Parks

In YNP's Madison, Firehole, and Gibbon River valleys, Aune (1981) reported that wildlife developed crepuscular patterns in response to winter recreation activity, were displaced from trailsides and experienced inhibited movements because of traffic and snow berms created by plowing and grooming operations. A review of 232 publications on the impacts of recreation on wildlife concluded that in general living near small numbers of nonaggressive humans did not significantly affect wild animals. However, recreationists, because of their numbers and sometimes inappropriate behavior, were causing severe impacts resulting from harassment and the habituation of particular species (NPS, 2000d).

Ungulates

Ungulate species, such as elk and bison, are of primary concern, because of their numbers and frequent proximity to snowmobile routes. This proximity can lead to harassment of wildlife along the groomed roads, as a result of the numbers and occasional inappropriate behavior of snowmobilers. In some instances, the physical safety of the animals is threatened by the presence of motorized oversnow vehicles. Historically the most commonly cited problem involved snowmobilers unsafely passing bison. Although this harassment is usually unintended, the juxtaposition of heavily used groomed motorized routes and ungulate winter range renders it virtually inevitable along some road segments (NPS, 2002). Assessment of impacts to ungulates in the EA focused exclusively on elk and bison, and how oversnow motorized use in each of the alternatives would affect these animals.

The following summarizes the results found in the EA (NPS, 2004). Vehicle-caused mortality could be reduced under all alternatives through training of snowcoach drivers and/or snowmobile guides on wildlife locations and behavior. It is unknown to what extent any beneficial effects outweigh negative effects of groomed surfaces and plowed roads on ungulate movements. Packed trails may influence wildlife

movements and distributions by facilitating travel into areas that would normally be inaccessible because of deep snow. The impact of road grooming on ungulates was not addressed in the EA due to ongoing investigations and analyses on the topic.

Alternative 1. Under Alternative 1, the potential for adverse impacts to elk and bison from oversnow motorized use ranges from none to moderate. Specifically, mortality caused by collisions with motorized vehicles is expected to be negligible. Minor to moderate adverse disturbance and energetic/stress impacts are expected under this alternative due to having fewer but larger vehicles compared to historical conditions. These adverse effects are expected to be greater under Alternatives 2 through 5. Motorized vessel harassment and displacement of elk and bison are expected to be negligible to minor. Relative to existing conditions, replacement of individual snowmobiles with mass transit snowcoaches would serve to decrease potential risks associated with disturbance along particular road segments by greatly reducing traffic volume. No to negligible adverse population-level impacts would occur under this alternative. Compared to historical conditions, moderate, direct and indirect, short-term, regional beneficial impacts would occur on all facets of wildlife and oversnow vehicle interactions under Alternative 1. Impacts to wildlife associated with Alternative 1 would not be of sufficient magnitude to constitute impairment of park resources or values.

Alternative 2. Under Alternative 2, the potential for adverse impacts to elk and bison from oversnow motorized use ranges from none to moderate. Negligible adverse impacts on vehicle-related mortality are expected under Alternative 2 due to fewer vehicles than under historical conditions. Minor to moderate adverse disturbance and energetic/stress impacts, though more than Alternative 1, are expected under this alternative due to having fewer vehicles compared to historical conditions and all of them guided. Motorized vessel harassment and displacement of elk and bison are expected to be negligible to minor, though more than Alternative 1. No to negligible adverse population-level impacts would occur under this alternative but more than Alternative 1 due to more vehicles. Compared to historical conditions, moderate, direct and

indirect, short-term, regional beneficial impacts would occur on all facets of wildlife and oversnow vehicle interactions under Alternative 2. Impacts to wildlife associated with Alternative 2 would not be of sufficient magnitude to constitute impairment of park resources or values.

Alternative 3. Under Alternative 3, the potential for adverse impacts to elk and bison from oversnow motorized use ranges from none to moderate. Negligible adverse impacts on vehicle-related mortality are expected under Alternative 3 due to fewer vehicles than under historical conditions and most of them in guided groups. Minor to moderate adverse disturbance and energetic/stress impacts, though more than Alternative 2, are expected under this alternative due to having fewer vehicles compared to historical conditions. Motorized vessel harassment and displacement of elk and bison are expected to be minor to moderate, which is more than under Alternative 2. No to negligible adverse population-level impacts would occur under this alternative but more than Alternative 2 due to more vehicles. Compared to historical conditions, moderate, direct and indirect, short-term, regional beneficial impacts would occur on all facets of wildlife and oversnow vehicle interactions under Alternative 3. Impacts to wildlife associated with Alternative 3 would not be of sufficient magnitude to constitute impairment of park resources or values.

Alternative 4. Under Alternative 4, the potential for adverse impacts to elk and bison from oversnow motorized use ranges from none to moderate. Negligible adverse impacts on vehicle-related mortality are expected under Alternative 4 because snowmobile use would be close to the historical average which resulted in few wildlife deaths. Moderate adverse disturbance and energetic/stress impacts, more than under Alternative 3, are expected under this alternative because the historical average produced significant wildlife stress. Motorized vessel harassment and displacement of elk and bison are expected to be negligible to minor, more than Alternative 3, because even though the number of vehicles would be similar to that of historical levels all vehicles would be guided. No to negligible adverse population-level impacts would occur under this alternative but more than Alternative 3 due to more vehicles.

Compared to historical conditions, minor, direct and indirect, short-term, regional beneficial impacts would occur on all facets of wildlife and oversnow vehicle interactions under Alternative 4. Impacts to wildlife associated with Alternative 4 would not be of sufficient magnitude to constitute impairment of park resources or values.

Alternative 5. Under Alternative 5, the potential for adverse impacts to elk and bison from oversnow motorized use ranges from minor to moderate. Minor adverse impacts on vehicle-related mortality are expected under Alternative 5 because snowmobile use would be more than the historical average which resulted in some wildlife deaths. Moderate adverse disturbance and energetic/stress impacts, more than under Alternative 4, are expected under this alternative. Motorized vessel harassment and displacement of elk and bison are expected to be minor to moderate, more than Alternative 4. Minor adverse population-level impacts would occur under this alternative because the limit of vehicles is above the historical average. Compared to historical conditions, negligible, direct and indirect, short-term, regional beneficial impacts would occur on all facets of wildlife and oversnow vehicle interactions under Alternative 5. Impacts to wildlife associated with Alternative 5 would not be of sufficient magnitude to constitute impairment of park resources or values.

Federally Protected Species

Four species protected under the Endangered Species Act (ESA) are present in the parks in the winter. Threatened species include the Canada lynx (*Lynx canadensis*), bald eagle (*Haliaeetus leucocephalus*), and grizzly bear (*Ursus arctos horribilis*). The gray wolf (*Canis lupus*), although also listed as threatened, is considered experimental and nonessential within YNP.

Motorized routes pass through potential lynx habitat in the parks. Assessing the degree of impacts to lynx in the parks is speculative because very little is known about lynx distribution and abundance. Motorized oversnow recreation may affect lynx by fragmenting habitat, reducing the effectiveness of intact habitat, causing displacement from or avoidance of habitat, and

creating added energetic stress. Lynx may be affected by groomed routes because snow compaction may enable other predators, especially coyotes, to compete in deep snow conditions where lynx would otherwise have an advantage. Increased competition may reduce the value of habitat for lynx and exclude them altogether.

The primary effect of oversnow, motorized use on bald eagles is displacement of foraging eagles, especially along river corridors (e.g., the Madison River from the West Entrance to Madison Junction; the Firehole River to Old Faithful; the Gibbon River near Norris; and the Yellowstone River from Fishing Bridge to Canyon).

Any potential effects of recreation on denning bears are mitigated because, in the parks, preferred denning habitats are generally remote, and snowmobiles are required to stay on designated routes. The likelihood of visitors encountering grizzly bears in the initial weeks of the winter use season (mid- to late December) is extremely small because the vast majority of bears (about 96 percent) have denned by the second week of December. Winter activities in late February and March may conflict with emerged male grizzly bears, 31 percent of which are out of their dens by March 15. In particular, activities in ungulate winter range may disturb grizzly bears feeding on winter-killed carcasses. In YNP, ungulate winter range includes geothermally influenced areas in the Firehole, Gibbon, and Norris vicinities where the potential for human–bear conflict in the spring is high.

Gray wolves may be affected by disturbance from motorized oversnow vehicles. Wolves have been documented to avoid areas of snowmobile activity, thus becoming permanently displaced from some habitats. Although wolves have not been documented to travel on groomed snowmobile routes in YNP, they do use areas near groomed snowmobile roads in ungulate winter range, and in 1997, a pack was displaced from an elk carcass by snowmobiles.

In general, the primary potential impact of concern for federally protected species relates to avoidance of habitat associated with oversnow vehicles and other backcountry visitors; however, this impact is expected, for the most part, to be negligible.

In general, the primary potential impact of concern for federally protected species relates to avoidance of habitat associated with oversnow vehicles and other backcountry visitors; however, NPS found this impact, for the most part, to be negligible under conditions existing prior to regulatory actions implemented in January 2001 (NPS, 2000d). The impacts of motorized and nonmotorized use effects on federally listed species considered in the SEIS process did "not vary in scale from those disclosed in the Final EIS, and no new impacts are associated with any of the proposed alternatives" Thus, NPS dismissed the threatened and endangered species FSEIS specifying that "mitigation measures, including monitoring and adaptive management, that are necessary to ensure there are no greater than negligible or minor adverse impacts are incorporated into all the alternatives based on the Final EIS analysis. Furthermore, no new information on these species that would alter the assessment of affects is available" (NPS, 2003b, p. 94). Thus, while Alternative 1 would eliminate all potential impacts to threatened and endangered species from snowmobiles, NPS anticipates snowmobile use identified in Alternatives 2 through 5 would result in only negligible to minor impacts to threatened and endangered species.

Species of Concern

Species of special concern are those species for which data are sufficient to document that the species is in decline or those species that because of their unique or highly localized habitat requirements warrant special management. Most species of special concern in the parks are not winter residents and are therefore unaffected by winter use. Species of special concern that occur in the GYA national parks year-round include the wolverine (*Gulo gulo*), fisher (*Martes pennanti*), American Marten (*Martes americana*), river otter (*Lutra Canadensis*), trumpeter swan (*Cynus buccinator*), northern sagebush lizard (*Sceloporus graciosus graciosus*), rubber boa (*Charina bottae*), and boreal toad (*Bufo boreas boreas*) as well as several fish. The most likely impacts on species of special concern in the parks are displacement from preferred habitats and degradation of the aquatic environment from pollutants in the snowpack, although effects in the aquatic environment have not been

documented. Similarly, river otters, fish, and amphibians may be directly affected by degradation of the aquatic environment, but these effects have not been demonstrated. Under conditions existing prior to regulatory actions implemented in January 2001, trumpeter swans that winter near snowmobile routes may have experienced minor impacts when they are in the vicinity of snowmobile traffic. For example, trumpeter swans that winter along the Lewis, Firehole, Madison, and Yellowstone rivers may have been affected by the presence of motorized oversnow traffic, but this disturbance was considered negligible to minor. Impacts from groomed surfaces were also considered negligible.

As with threatened and endangered species, impacts of motorized and nonmotorized use effects on species of concern considered in the SEIS process did "not vary in scale from those disclosed in the Final EIS" (NPS, 2003b). Thus, NPS dismissed species of concern from the FSEIS specifying that "mitigation measures, including monitoring and adaptive management, are incorporated into all the alternatives based on the Final EIS analysis" (NPS, 2003b). Thus, while Alternative 1 would eliminate all potential impacts to species of concern from snowmobiles, NPS anticipates snowmobile use identified in Alternatives 2 through 5 would result in only negligible to minor impacts to species of concern.

2.8 ECONOMIC ACTIVITY IN THE SURROUNDING COMMUNITIES

Numerous communities rely heavily on income from tourists visiting YNP, GTNP, and the Parkway.

Numerous communities rely heavily on income from tourists visiting YNP, GTNP, and the Parkway. However, the area of analysis for the regional economy in the SEIS (NPS, 2002), FSEIS (NPS, 2003b), and EA (NPS, 2004) is a five-county portion of the GYA that includes the counties in Montana, Wyoming, and Idaho surrounding the parks: Fremont in Idaho, Gallatin and Park in Montana, and Park and Teton in Wyoming. This area was chosen to include the parks and contiguous lands, as well as other nearby lands and communities most frequently visited by nonlocal people traveling to the area. These counties have an economic base dominated by tourism. In addition to communities located within the five-county area

chosen for analysis, many communities outside this area are affected by visitor spending in the parks. However, the proportion of their economies dependent on visitation to the parks tends to be much lower than in the counties adjacent to the parks. Thus, the focus of the analysis is on the counties most affected by a reduction in visitation.[13]

Four main routes provide access to YNP in the winter:

- U.S. Highway 89 through Gardiner, Montana, which serves the North Entrance, 54 miles south of Livingston, Montana;
- U.S. Highway 16, which connects Cody, Wyoming, located 53 miles east of the park, to the East Entrance;
- the Parkway (U.S. Highway 89/287), which provides access to Flagg Ranch, 2 miles prior to the South Entrance; and
- U.S. Highways 20 and 287, which provide access to the West Entrance through West Yellowstone.

The major routes into GTNP are the following:

- U.S. Highways 89 from the south and 26/287 from the east, which provide local park access from Jackson and Moran, Wyoming; and
- U.S. Highway 26/28, which provides access from Dubois, Wyoming, about 50 miles east of Moran.

The interstate highway system provides regional access to the vicinity of the parks:

- Interstate 15 on the west side, connecting Idaho Falls, Idaho, and Butte, Montana, and
- Interstate 90 on the north and northeast sides, connecting Butte, Montana, with Bozeman, Livingston, and Billings, Montana, and Sheridan, Wyoming.

In addition, the Parkway provides access between YNP and GTNP. It is open year-round between the northern boundary of

[13]NPS evaluated the 17-county GYA in an earlier study but has since refined the area of analysis at the request of cooperating agencies. The primary drawback of analyzing the larger area is that it may understate the average impacts on the most directly affected communities. The percentage reduction in economic activity is much smaller for the 17-county region than for the five-county region that includes those counties most dependent on YNP, GTNP, and Parkway tourism.

GTNP and Flagg Ranch.[14] Flagg Ranch is the major winter destination on the Parkway and serves as a staging area for oversnow access to YNP.

Small communities adjacent to the parks such as West Yellowstone, Gardiner, Cooke City, or Flagg Ranch are highly dependent on park visitor spending, while larger communities such as Bozeman derive a much smaller share of their economic activity from park visitor spending. This is because the larger communities tend to have a much more diverse economic base, which relies less heavily on park-based tourism (although it is still a vital part of their economies), and they are located farther away from the parks.

Public lands provide the basis for much of the economic activity (recreation, mining, forestry, and agriculture) that occurs in the five counties. The GYA's overall economy has been changing for more than 20 years. The economy has shifted from a dependence on commodity extraction to a more diversified economy based on recreation, tourism, and service industries. For example, between 1969 and 1989, more than 96 percent of all jobs in the larger 17-county GYA area came from sectors other than timber, mining, and agriculture (Rasker, Tirrel, and Kloepfer, 1992).

Table 2-18 shows employment by economic sector in the five counties. Most jobs related to the recreation and tourism industry are found in the retail and services sectors of a county's economy. These sectors are much broader than recreation and tourism, however, and include activities such as health care. These two sectors account for about 42 percent of the earnings in the five-county area. Businesses related to recreation in the parks include lodging establishments, restaurants, grocery stores, souvenir shops, snowmobile rental firms, and recreational equipment rental firms (e.g., skiing equipment rentals).

[14]This route is closed in the winter to wheeled vehicles north of Flagg Ranch through YNP.

Table 2-18. Employment by Industry for Five-County GYA in 1996

Industry Classification	Five-County GYA Area Employment	Percentage of Total Area Employment
Farm	3,417	3.62%
Nonfarm	90,947	96.38%
Private	75,814	80.34%
Construction	8,149	8.64%
Insurance and Real Estate	6,109	6.47%
Manufacturing	4,872	5.16%
Mining	1,043	1.11%
Miscellaneous, Agriculture, and Forestry	1,728	1.83%
Retail	19,371	20.53%
Services	28,683	30.40%
Transport and Utilities	3,235	3.43%
Wholesale	2,624	2.78%
Government	15,133	16.04%

Source: U.S. Department of Commerce, Bureau of Economic Analysis. 1998. Regional Economic Information System <http://fisher.lib.virginia.edu/reis>.

Recreational use of the environment is a large component of the area's economy. However, in the context of total annual recreation and tourism expenditures in the area, winter expenditures are much less important than nonwinter expenditures. Historically, approximately 4 to 5 percent of annual recreational visitation to YNP has occurred during the winter (defined as the period from December to March) based on NPS visitation records. Assuming that average total tourism-related expenditures per person per day are relatively similar between the winter use season and the rest of the year, the small fraction of annual visitation that occurs during the winter will provide only a small percentage of annual tourism-related revenues. Nonetheless, revenue from winter recreation may account for a substantial share of winter revenue for many local businesses.

Historically, approximately 4 to 5 percent of annual recreational visitation to YNP has occurred during the winter (defined as the period from December to March).

Within YNP, snowmobile rentals and snowcoach tours are available at Old Faithful and Mammoth. As of the 2001–2002 winter season, about 45 machines were available in total at

Mammoth Hot Springs and at Old Faithful for self-guided tours; the exact distribution of these machines varies on an as-needed basis. In West Yellowstone, approximately 30 companies rented snowmobiles for self-guided tours or offer guided snowmobile tours (with approximately 1,400 snowmobiles available for rent [NPS, 2000d]) in 2001–2002. In addition, at least seven companies had snowcoaches available, and two provided cross-country ski equipment and guided tours.[15] Seven operators located in West Yellowstone were licensed by YNP to provide guided snowmobile tours in the park. The guided snowmobile tours are limited to 11 snowmobiles each, including guides. In addition, seven companies were licensed to provide snowcoach tours within the park during the winter season of 2001–2002, and one company was licensed for cross-country ski tours in the park operating out of West Yellowstone.

Outside of West Yellowstone to the north of the park in Bozeman, Big Sky, and Moran, six additional businesses were licensed to offer cross-country ski tours in the park during the 2001–2002 winter use season, and four businesses were identified as providing snowcoach tours. Additionally, a single snowmobile rental shop located in Victor, Idaho, offered guided tours through the West Entrance of YNP.

To the east of the park, two licensed snowmobile tour operators were located in Pahaska Teepee and Cody, Wyoming, as of the 2001–2002 winter use season. One snowmobile rental shop was also identified in Cooke City, Montana, to the northeast of the park, but at the time this shop was not licensed to provide guided tours in the park.

To the south of YNP, approximately 11 companies were licensed to offer guided snowmobile tours of YNP or GTNP (located in Jackson and Moran, Wyoming, and Tetonia, Idaho) during the winter of 2001–2002. An additional 12 companies were located that rented snowmobiles for self-guided tours in Jackson, Moran, and other nearby communities in Wyoming and Idaho. For GTNP and the Parkway, Flagg Ranch is the major staging

[15]The concession numbers are based on the 2001–2002 NPS Contract List. Several rental shops housed multiple businesses. In many cases only one of the businesses has a concession to operate in the park, but this allows the rental company to advertise guided tours.

area for oversnow travel from the south to YNP. The primary winter users at Flagg Ranch are commercial snowmobile tour operators, private snowmobiles, snowcoach tour operators, Flagg Ranch snowmobile renters, and cross-country skiers. In 2001–2002, 11 commercial snowmobile tour permits were issued at Flagg Ranch. Three snowcoach operators offered tours through the South Gate of YNP, two located in Jackson and another in Moran. Snowcoach operators currently load and unload tourists in front of the lodge at Flagg Ranch. As of the 2001–2002 winter season, six to ten snowcoaches, each accommodating 11 people, ran daily into YNP. There was also a concessionaire that maintained 85 snowmobiles for rental to lodgers and day users (NPS, 2000d). Finally, three cross-country ski companies located in Lander, Wyoming; Eugene, Oregon; and Sun Valley, Idaho, were licensed to provide guided cross-country ski tours in YNP during the 2001–2002 winter use season.

Winter lodging facilities within YNP provided a total of 256 rooms with 413 beds between facilities at Mammoth Hot Springs and Old Faithful during the 2001–2002 winter use season. In addition to the above lodging facilities, there are 10 yurts (a type of wilderness shelter), plus a community yurt, and a mess yurt. The yurt camp logged 418 user days during the winter of 1998–1999. For GTNP and the Parkway, Flagg Ranch and Triangle X are permitted by NPS to provide overnight accommodations during the winter. In addition to these accommodations within the parks, numerous lodging establishments are located outside of park boundaries (NPS, 2000d). Borrie et al. (1999) found that 84 percent of the respondents to their winter survey stayed the night near YNP, but 93 percent of those staying overnight spent the night in a hotel or motel outside the park. In this survey, West Yellowstone, Jackson, Bozeman, and Big Sky were the most frequently visited communities for overnight stays.

Furthermore, a large number of restaurants, grocery stores, gas stations, souvenir shops, and other retail establishments in the five-county portion of the GYA depend on visitation to the park for a large proportion of their income. Just as for the recreational equipment rental shops and lodging

establishments, a large part of winter income for these establishments depends on snowmobiling.

All of the proposed temporary winter management alternatives emphasize a shift from snowmobile to snowcoach travel to varying degrees, and four of the alternatives require all or at least 80 percent of snowmobiles to be accompanied by a guide. Recently, additional businesses have been granted concessions to operate guided snowmobile and snowcoach tours in YNP in anticipation of increased demand.

3 Benefit-Cost Analysis of the Alternative Regulations

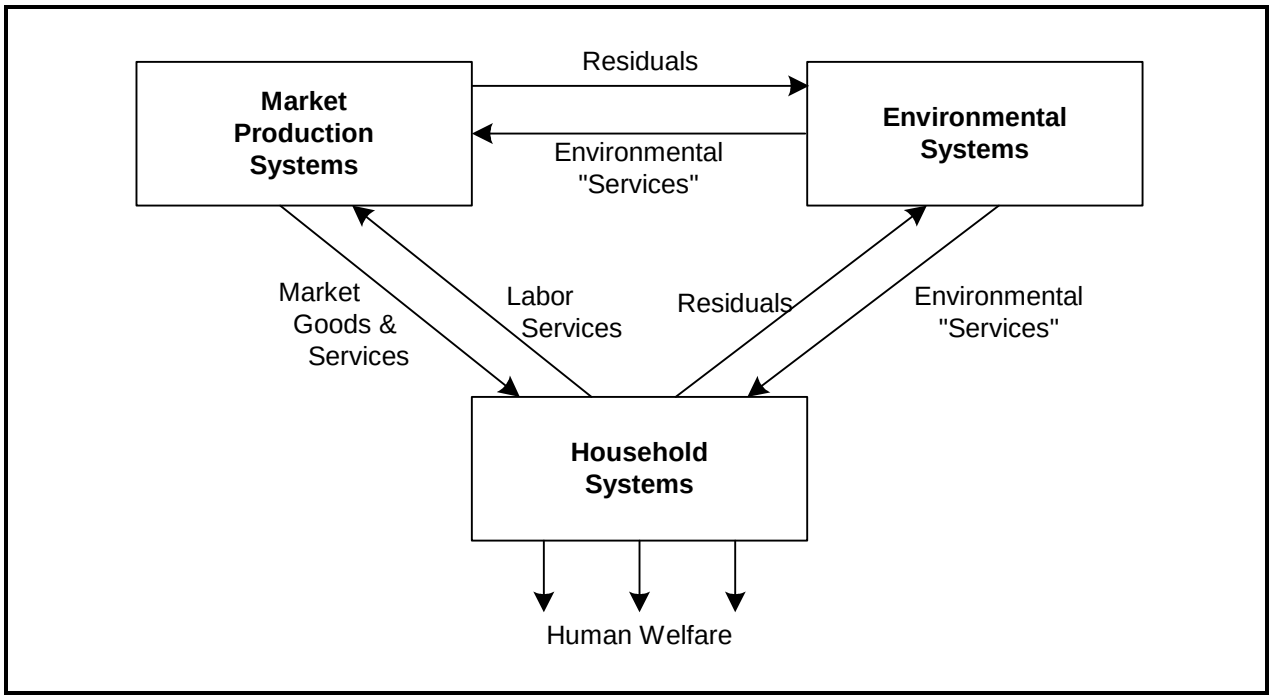
In this section, NPS presents the benefits and costs associated with alternatives considered for managing snowmobile use in the GYA under the Alternative 1 baseline.

The purpose of benefit-cost analysis is to evaluate the social welfare implications of a proposed action—in this case the regulation of snowmobile use in GYA national parks. It examines whether the reallocation of society's resources resulting from the action promotes efficiency. That is, the analysis assesses whether the action imposes costs on society (losses in social welfare) that are less than the benefits (gains in social welfare). Section 3.1 provides a conceptual framework for the benefit-cost analysis and a general discussion of the externalities associated with snowmobile use. Section 3.2 contains a specific discussion of the benefits and costs of the alternative management proposals for YNP and GTNP relative to the Alternative 1 baseline.

3.1 CONCEPTUAL BASIS FOR BENEFIT-COST ANALYSIS OF SNOWMOBILING REGULATIONS IN NATIONAL PARKS

According to the conceptual underpinnings of benefit-cost analysis, all social welfare impacts ultimately accrue to individuals. This is represented in Figure 3-1, which depicts flows of goods, services, and residuals among three major systems: market production, household, and the environment. Because these systems are closely interconnected, actions

Figure 3-1. Interrelationship Among Market, Environmental, and Household Systems and Social Welfare



taken to reduce releases of harmful residuals (e.g., chemicals or noise pollution) to the environment potentially will reverberate throughout all of these systems. Nevertheless, the impacts of these actions, both the costs and benefits, will ultimately be experienced as changes in well-being for households/individuals. As a result, identifying and measuring costs and benefits must focus on these changes in well-being.

Under regulations that restrict snowmobile use, such as the baseline alternative (1), the most direct impact will be on snowmobilers, whose recreational opportunities will be partially constrained by the restrictions on snowmobile riding in GYA.

The conceptual framework depicted in Figure 3-1, therefore, provides a basis for assessing the benefits and costs of snowmobiling regulations in national parks. Under regulations that restrict snowmobile use, such as the baseline alternative (1), the most direct impact will be on snowmobilers, whose recreational opportunities will be partially constrained by the restrictions. This will directly result in welfare losses to these individuals. In addition, the resulting changes in the behavior of these individuals are likely to affect environmental systems and market systems. Effects on these systems will indirectly affect the welfare of other park visitors and nonvisitors. For example, when regulations restrict snowmobile use, the park

environment may be improved, and this change will enhance the "services" (primarily recreation-related) that the park provides to other individuals in society. On the other hand, the resulting reduction in the market demand for snowmobile-related goods and services will have negative impacts for those who own or work for establishments supplying these services. These types of direct and indirect impacts are identified and evaluated as part of this benefit-cost analysis.

Economists generally accept willingness to pay (WTP) as the conceptually correct measure for valuing changes in individuals' welfare. WTP represents the maximum amount of money that an individual would be willing to forgo to acquire a specified change.

Estimating the value of benefits and costs also requires methods for expressing welfare changes in monetary terms. In certain instances, welfare changes are directly the result of monetary gains or losses and can therefore be thought of as being equivalent to these gains or losses. For example, under regulations restricting snowmobile use, welfare losses to snowmobile rental shops due to reductions in demand for their services can be reasonably measured as their resulting net loss in income. In other instances, welfare changes are not directly associated with pecuniary gains or losses. Such "nonmarket" changes might, for example, include the welfare gains from improved nonsnowmobiling recreational opportunities in a park. In these cases a surrogate measure of gains or losses must be used; willingness to pay (WTP) is such a surrogate. Economists generally accept WTP as the conceptually correct measure for valuing changes in individuals' welfare. WTP represents the maximum amount of money that an individual would be willing to forgo to acquire a specified change. As such it is the monetary equivalent of the welfare gain from the change.

Using this conceptual framework for identifying, measuring, and valuing changes in societal welfare, the remainder of this section, Appendix 2, and Section 2.7 provide a more detailed discussion of

- the types of benefits and costs associated with snowmobiling restrictions in national parks and
- the approaches used in measuring these benefits and costs.

3.1.1 Social Benefits of Regulations Restricting Snowmobile Use

Snowmobiling in national parks may be associated with a number of negative impacts on environmental resources and ecosystems. The extent to which adverse impacts will be realized is a function of several factors, including the level of use, the technology of the machines being used, and the extent to which users remain on designated trails. One result of any negative impacts that occur is that they impose welfare losses on individuals who value the parks' environmental systems. The benefits of regulations restricting snowmobile use, therefore, can be thought of and measured as the reduction in these losses to society. In addition, snowmobiling can negatively affect society in ways that are not directly related to the environment; therefore, the benefits of snowmobiling restrictions must also include reductions in these nonenvironmental losses.

Table 3-1 provides a broad classification of the types of environmental and nonenvironmental impacts associated with snowmobile use in national parks. In this section, this classification is used to more completely identify, categorize, and describe the full range of potential benefits associated with snowmobiling restrictions at national parks in general.

Table 3-1. Classification of Potential Negative Impacts from Snowmobile Use in National Parks

Impact Categories	Examples of Impacts
Environmental impacts	
Aesthetic	Noise, visibility, odor
Human health	Through impacts to air and water quality
Ecosystems	Loss of or damage to habitat and wildlife
Nonenvironmental impacts	
Infrastructure	Costs of trail monitoring, maintenance, and law enforcement
Human safety	Accidents
Cultural, historical, and archeological	Physical damages

Environmental Benefits of Regulations Restricting Snowmobile Use

The use of snowmobiles may have adverse impacts on air quality, natural resources (e.g., water quality, habitat), wildlife, and natural quiet. Figure 3-2 depicts the various categories of potential adverse effects to the environment through which snowmobiles in national parks can impose welfare losses on society.

As described in Section 2.7, conventional snowmobiles create noise and release pollutants into the environment. Noise from snowmobiles impairs the natural soundscape for park visitors and has the potential to negatively affect wildlife in the park. Emissions from snowmobiles can also negatively affect park ecosystems, human health, and visitor experiences. Pollutants are directly released to air and the snowpack, and they also have the potential to migrate to and contaminate water resources, primarily via deposition in the snowpack and subsequent melting into runoff.

From a benefit-cost perspective, those who ultimately benefit from actions to reduce impacts due to snowmobile use will be individuals who value the quality of the park environment.

As shown in Figure 3-2, all of these impacts can, directly or indirectly, lead to losses in human welfare. Therefore, from a benefit-cost perspective, those who ultimately benefit from actions to reduce these impacts will be individuals who value the quality of the park environment. Many of these beneficiaries will be park visitors whose nonsnowmobiling recreational experiences are enhanced. As a point of reference, Table 3-2 reports average consumer surplus values that have been estimated for common (nonsnowmobiling) winter recreation activities. These are the types of recreation values that will be restored or even increased as a result of regulations restricting snowmobile use.

Even individuals who are not park visitors (i.e., nonusers) can benefit from the knowledge that park resources are being protected and preserved. In other words, they may hold positive "nonuse values" (i.e., a positive WTP) for protecting the park environment. These nonuse values can stem from the desire to ensure others' enjoyment (both current and future generations) or from a sense that these resources have some intrinsic value. Evidence of such nonuse values for the protection of unique species and ecosystems has been

Figure 3-2. Routes of Environmental Damages and Human Welfare Losses from Snowmobiles in National Parks

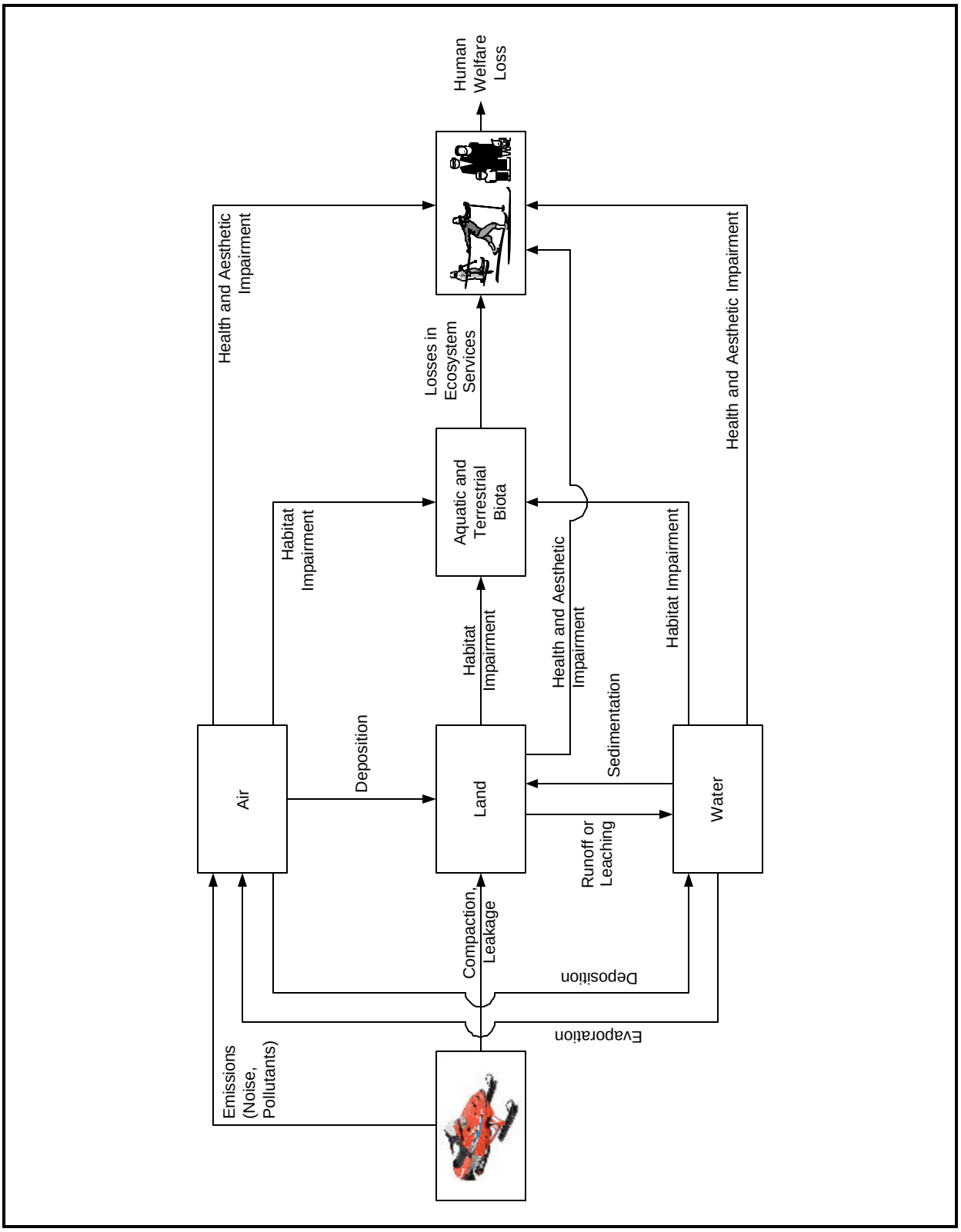


Table 3-2. Summary of Average Consumer Surplus Values (2001$ per person/day) for Selected Recreational Activities by Region[a]

Activity	Study Location				National[b]	U.S. Average
	Northeast	Southeast	Mountain	Pacific		
Hiking/backpacking	50.80 (2)	124.12 (2)	42.24 (3)	23.02 (6)	23.56 (1)	45.59 (14)
Downhill ski			26.22 (2)	23.59 (1)	22.13 (1)	24.54 (4)
Cross-country ski	32.54 (2)		13.22 (1)		14.90 (1)	23.30 (4)

[a]These values are consumer surplus values (i.e., values net of the cost of participation). All amounts were inflated using the consumer price index for recreation available from the Bureau of Labor Statistics (<http://146.4.24/cgi-bin/surveymost>). Numbers in parentheses represent the number of observations (i.e., studies).

[b]Studies estimating nationwide values.

Source: Rosenberger, Randall, and John Loomis. 2000. "Using Meta-Analysis for Benefit Transfer: In-Sample Convergent Validity Tests of an Outdoor Recreation Database." *Water Resources Research* 36(4):1097-1107.

Regulations restricting snowmobile use in national parks can provide benefits to both park users and nonusers in a number of ways by protecting the parks' ecological resources.

documented in numerous studies (see, for example, Pearce and Moran [1994] for a review of such studies). Regulations restricting snowmobile use in national parks can, therefore, provide benefits to both users and nonusers in a number of ways by protecting the parks' ecological resources. A more detailed discussion of the potential aesthetic, human health, and ecosystem benefits associated with regulations restricting snowmobile use in national parks is provided in Section 2.7 and Appendix 2.

Nonenvironmental Benefits

In addition to wide-ranging environmental benefits, regulations restricting snowmobile use in national parks can also improve societal welfare in ways that are not directly related to environmental quality in and around the parks. In particular, restrictions can improve public safety in national parks, and they can reduce the costs of operating and maintaining the infrastructure necessary to support and monitor snowmobile use. To the extent that infrastructure costs are reduced, some of the resources devoted to these activities can be diverted to other publicly beneficial uses within the parks. Appendix 2 provides a more detailed discussion of the nonenvironmental benefits associated with regulations restricting snowmobile use in national parks.

3.1.2 Social Costs of Regulations Restricting Snowmobile Use

The primary losses associated with regulations restricting snowmobiling use in national parks will accrue to

- snowmobilers, in particular individuals who cannot snowmobile in the park as a direct result of the restrictions, and
- providers of snowmobile-related services for park visitors.

The welfare losses to individual consumers (snowmobilers) are measured by their loss in consumer surplus, while losses to producers are measured by their loss of producer surplus. Appendix 2 provides more detail on measuring losses to consumers and producers.

3.1.3 Identifying Relevant Benefits and Costs

To conduct the benefit-cost analysis, the relevant benefits and costs must be identified. In this section, NPS discusses two economic concepts that are important for an analysis of the benefits and costs of the proposed snowmobile regulations: indirectly affected secondary markets and distorted primary markets. Often consumers and producers may be indirectly affected by a policy. For example, regulations restricting snowmobile use in national parks may lead to decreased demand for snowmobile sales or rentals and increased demand for cross-country ski sales or rentals or snowcoach rides. Whether these indirect, or secondary, impacts should be included in the analysis depends on whether the change in demand or supply in the secondary market results in price changes (for details, see a benefit-cost analysis textbook such as Boardman et al. [1996]). In general when the policy change in the primary market causes prices to change in the secondary markets, the net change in social welfare from the secondary market should be included in the benefit-cost analysis. If prices do not change in the secondary market, the revenue gains or losses should not be included in the benefit-cost analysis. Without more detailed information, NPS is unable to predict whether the proposed alternatives for winter use management will change prices for snowmobile sales or rentals. Thus, losses or gains to businesses that may be indirectly, but significantly,

Restricting snowmobile use in national parks may lead to decreased demand for snowmobile sales or rentals and increased demand for cross-country ski sales or rentals or snowcoach rides.

affected by the proposed alternatives are included in the benefit-cost analysis.

Distorted primary markets are also important in analyzing the impact of the proposed snowmobile regulations. As described above, snowmobile use may generate negative externalities, such as air pollution and noise that affect other park visitors and park resources. If snowmobiles do generate negative externalities, then the private cost of using a snowmobile (the cost to the individual snowmobile user) will be lower than the social cost of snowmobile use (where the social cost of snowmobile use includes both the cost to the snowmobile user plus the costs to others that result from the negative externalities associated with snowmobile use). Because snowmobile users do not have to pay the full social cost of using a snowmobile and instead only pay the lower, private cost, snowmobile use will be higher than the socially optimal use level. In addition, measures of net consumer surplus to snowmobilers that do not account for the additional costs imposed on society by the negative externalities associated with snowmobile use will overstate the true net social welfare associated with the activity.

3.2 RESULTS FOR YNP, GTNP, AND THE PARKWAY

Data from the 2002–2003 survey of winter visitors to YNP and GTNP were used to estimate the Alternative 1 baseline visitation numbers and the estimates of visitation changes for each alternative.

Based on the approach and possible impacts outlined above, this section presents the results of the benefit-cost analysis for Alternatives 2, 3, 4, and 5 for YNP, GTNP, and the Parkway. This section discusses the groups most directly affected by the proposed changes in regulation. An assessment of the benefits and costs accruing to these groups is then presented. Throughout, Alternative 1 serves as the baseline to which the other alternatives are compared.

Data from the 2002–2003 survey of winter visitors to YNP and GTNP (see Appendix 1) were used to estimate the Alternative 1 baseline visitation numbers presented in Section 2 and the estimates of visitation changes for each alternative presented in Section 3.2.2. In addition, the survey results were used to provide monetary estimates of consumer and producer surplus

gains and losses to visitors and businesses under Alternatives 2, 3, 4, and 5 relative to the Alternative 1 baseline.

3.2.1 Affected Groups

For the purpose of this study, six major affected groups have been identified:

1. Snowmobilers, whose ability to ride in YNP, GTNP, or the Parkway is affected by changes in regulations, or snowmobilers currently riding in areas other than YNP, GTNP, or the Parkway whose riding experience may be altered by GYA regulations (trails outside the parks may be less crowded if snowmobile use is not restricted in the three parks).
2. Other visitors (nonsnowmobilers) or potential visitors who may have a different experience at the park depending on snowmobile regulations in YNP, GTNP, or the Parkway.
3. The general public who may care about YNP, GTNP, or the Parkway, even when they do not visit.
4. Producers of snowmobile services in the towns of the five-county area who may experience a change in their welfare.
5. Producers of services to other types of winter visitors (for example, cross-county ski or snowshoe rentals or snowcoach tours) who may experience a change in their welfare.
6. Residents of West Yellowstone, Montana, who may experience a change in traffic congestion, air pollution, and noise if the alternatives affect the number of snowmobiles that ride on the town's streets. (Note that these same residents may also lose or gain consumer surplus and producer surplus to the extent that they fall into other categories.)

3.2.2 Scenarios

Analysis of the changes in welfare to both visitors and business owners under alternative regulations requires predicting the likely impact on visitation patterns of each alternative relative to baseline conditions. Because it is not known exactly how winter visitation to the five-county GYA will change over the period from 2004–2005 through 2006–2007 as a result of implementing Alternative 2, 3, 4, or 5, three scenarios were

Analysis of the changes in welfare to both visitors and business owners under alternative regulations requires predicting the likely impact on visitation patterns of each alternative relative to baseline conditions.

developed for each alternative to provide a range of possible outcomes. It is assumed that snowmobilers will increase their visitation to the GYA relative to the Alternative 1 baseline under each of the scenarios for the four alternatives, but the number of snowmobilers expected to visit the area differs under each scenario. The Alternative 1 baseline visitation and the likely changes in visitation resulting from Alternatives 2, 3, 4, and 5 relative to the baseline are discussed below.

Alternative 1 Baseline Visitation

Under Alternative 1 baseline conditions, snowmobile visitation to the parks would be banned beginning in 2004–2005, as shown in Tables 2-11 and 2-12. The total changes in unguided snowmobile rentals, guided snowmobile rentals, and snowcoach use were calculated separately for snowmobile owners and renters based on results from the 2002–2003 winter survey. In addition, expected changes in visitation for nonsnowmobilers were calculated for snowcoach riders, cross-country skiers and snowshoers, and other visitors using survey results. The scenarios also assume that the number of visitors per snowmobile will increase to 1.45 people per snowmobile under the regulations for people who continue to visit the GYA on snowmobiles after switching from unguided to guided machines (based on the current proportion of single- and double-passenger machines available for rent).[1] Incremental visitation under each alternative was estimated by calculating changes in visitation relative to the historical baseline level for each alternative and then subtracting projected visitation under the Alternative 1 baseline from projected visitation under each scenario for Alternatives 2, 3, 4, and 5. Incremental visitation was calculated in this way rather than defining changes in visitation relative to the ban because the survey data collected measured the stated change in visitation relative to 2002–2003 conditions (i.e., without new restrictions). This was a more logical and understandable way to frame the survey questions

[1]This increase in the estimated number of people per snowmobile is based on the expectation that, because the number of snowmobiles entering YNP was limited, visitors would be likely to increase the number of people per machine to ensure access for their entire party. However, people who take guided rentals in the baseline or who substitute snowmobiling trips in the GYA outside the parks were assumed to maintain the same number of people per snowmobile (1.15 for guided tours and 1.29 for unguided) as in the absence of the ban.

than asking respondents to make the hypothetical assumption that snowmobiles were already banned and asking how much their visitation would increase if the ban were lifted and replaced with a different alternative.

Because visitation under each alternative (including the Alternative 1 baseline) is calculated relative to the historical baseline using survey results, it was necessary to estimate the number of people expected to visit the parks in that situation. An estimated 72,437 people entered the national parks in the GYA on a snowmobile in the winter of 2002–2003.[2] Based on results from the 2002–2003 survey of winter visitors, it was assumed that approximately 70.4 percent of snowmobilers in the parks use rented machines.[3] This implies that 21,427 of these visitors rode privately owned snowmobiles and 51,010 entered the parks on rented snowmobiles. Data from YNP on the total number of snowmobile riders and snowmobiles that entered YNP indicate that the overall average number of visitors per snowmobile (renters and owners) is approximately 1.25. Based on this ratio of visitors to snowmobiles, NPS assumed that the estimated 21,427 owners rode a total of 17,095 machines into the parks in 2002–2003. In addition, the 51,010 snowmobile renters entering the parks in 2002–2003 were assumed to be riding 40,698 machines. Reports filed with the three parks by their licensed concessionaires in 1999–2000 indicated that approximately 27.5 percent of all rented snowmobiles entering the parks were on guided tours, and that there were an average of approximately 1.15 visitors per snowmobile. Assuming that both the percentage of rented snowmobiles on guided tours and the average number of people per guided snowmobile are representative of any year, NPS estimated that 11,192 guided, rented machines were used in the parks in 2002–2003, and that they carried 12,826 guided

[2]This number is based on visitation numbers in Section 2.4.2 adjusting total reported snowmobile visitation for YNP, GTNP, CDST, and the Parkway by subtracting the number of snowmobile visitors using the South Entrance of YNP. This adjustment was made based on input from park officials who indicated that these machines would otherwise be double-counted.

[3]This percentage (and other percentages and ratios presented in the text) is the rounded value; in subsequent calculations, the calculated value, as opposed to the rounded value, was used. This was done to avoid the introduction of multiple (successive) rounding errors and is not meant to imply additional significant digits. As a result, the reader (using the rounded values) may not be able to calculate exactly the same numbers presented in the text.

rental visitors. Of the total rental visitors in winter 2002–2003, this leaves 38,184 visitors who entered the parks on 29,506 rented but unguided machines.[4]

Based on the projections presented in Section 2.4.3, the number of snowmobilers would have increased over the period of 2004–2005 through 2006–2007 in the historical baseline. NPS assumed that the number of people per machine, the percentage of snowmobilers that are renters, and the percentage of rented snowmobiles that are used on guided tours all would have remained constant at the values presented above for 2002–2003. As mentioned above, these projections do not represent Alternative 1 baseline conditions but were used in estimating the response of winter visitors to Alternatives 1, 2, 3, 4, and 5.

Scenarios for 2004–2005. The scenarios that were analyzed for each management alternative during 2004–2005 are summarized in Table 3-3. Each scenario is presented as the change in winter use patterns estimated to occur relative to the historical baseline case. The percentage changes used in each alternative were calculated based on the results of the stated behavior portion of the *Winter 2002–2003 Visitor Survey*. For each of the visitor categories included in Table 3-3, the net change in the total number of trips that would be taken by survey respondents in that winter use category[5] under a particular management alternative relative to the total number of trips that respondents state they would have taken in the absence of snowmobile restrictions (the historical baseline) was the basis for the percentage changes used in the scenarios.

The results for snowmobilers generally follow the expected pattern between alternatives. People who would use unguided snowmobiles in the parks in the absence of restrictions are assumed to continue that activity in the parks if they are willing to continue visiting the parks under a given management alternative and unguided snowmobile use is permitted under

[4]This results in approximately 1.29 visitors per rented, unguided snowmobile.
[5]As mentioned elsewhere in this report, many visitors participate in multiple activities during their trip to the GYA. Respondents were categorized based on the activity they indicated was their primary activity in the parks.

Table 3-3. Summary of Scenarios Used in Analyzing Economic Impacts of Snowmobile Management Alternatives Relative to the Alternative 1 baseline on GYA in 2004-2005[a]

	Alternative 1 Baseline[b]	Alternative 2			Alternative 3			Alternative 4			Alternative 5					
		1	2	3	1	2	3	1	2	3	S1 (YNP)	S2 (YNP)	S3 (YNP)	S1 (GTNP)	S2 (GTNP)	S3 (GTNP)
Percentage of snowmobile owners' visitation that continues as unguided use in the parks	0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	8.1%	6.8%	5.5%	41%	34%	27%
Percentage of snow-mobile owners' visitation switched to guided snowmobile rentals	0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%
Percentage of snow-mobile owners' visitation switched to snowcoaches	29%	35.8%	28.7%	21.5%	35.8%	28.7%	21.5%	35.8%	28.7%	21.5%	28.6%	22.9%	17.2%	0%	0%	0%
Percentage reduction in visitation to GYA by snowmobile owners	42%	37.9%	42.2%	46.4%	37.9%	42.2%	46.4%	37.9%	42.2%	46.4%	36.2%	40.3%	44.3%	29%	33%	36%
Percentage of park visitation by snow-mobile owners that is substituted with visits to GYA outside parks	29%	26.3%	29.2%	32.1%	26.3%	29.2%	32.1%	26.3%	29.2%	32.1%	27.0%	30.0%	33.0%	30%	33%	37%
Percentage of snow-mobile renters' visitation that continues unchanged	0%	9.4%	10.5%	11.5%	13.8%	15.3%	16.8%	13.3%	14.8%	16.3%	17.9%	17.7%	17.5%	90%	88%	87%
Percentage of unguided snow-mobile renters' visitation switched to guided snowmobile rentals	0%	41.9%	35.4%	29.0%	41.9%	35.4%	29.0%	41.9%	35.4%	29.0%	33.5%	28.3%	23.2%	0%	0%	0%

(continued)

Table 3-3. Summary of Scenarios Used in Analyzing Economic Impacts of Snowmobile Management Alternatives Relative to the Alternative 1 baseline on GYA in 2004-2005[a] (continued)

	Alternative 1 Baseline[b]	Alternative 2			Alternative 3			Alternative 4			Alternative 5					
		1	2	3	1	2	3	1	2	3	S1 (YNP)	S2 (YNP)	S3 (YNP)	S1 (GTNP)	S2 (GTNP)	S3 (GTNP)
Percentage of snowmobile renters' visitation switched to snowcoaches	25%	22.6%	25.1%	27.6%	22.6%	25.1%	27.6%	22.6%	25.1%	27.6%	18.1%	20.1%	22.1%	0%	0%	0%
Percentage reduction in visitation to GYA by snowmobile renters	34%	17.3%	19.2%	21.1%	17.3%	19.2%	21.1%	17.3%	19.2%	21.1%	14.8%	16.4%	18.0%	4.6%	5.1%	5.6%
Percentage of park visitation by snowmobile renters that is substituted with visits to GYA outside parks	41%	18.2%	20.3%	22.3%	18.2%	20.3%	22.3%	18.2%	20.3%	22.3%	15.8%	17.5%	19.3%	5.8%	6.5%	7.1%
Percentage change in snowcoach use by nonsnowmobilers	4%	1.2%	1.4%	1.5%	1.2%	1.4%	1.5%	1.2%	1.4%	1.5%	-0.2%	-0.2%	-0.2%	N/A	N/A	N/A
Percentage change in cross-country skiing and snowshoeing in YNP by nonsnowmobilers	26%	3.3%	3.7%	4.1%	3.3%	3.7%	4.1%	3.3%	3.7%	4.1%	6.0%	6.7%	7.4%	N/A	N/A	N/A
Percentage change in cross-country skiing and snowshoeing in GTNP by nonsnowmobilers	8%	3.1%	3.5%	3.8%	3.1%	3.5%	3.8%	3.1%	3.5%	3.8%	3.3%	3.7%	4.0%	4.0%	4.5%	4.9%
Percentage change in other nonsnowmobiling activities by nonsnowmobilers[c]	13%	0.9%	1.1%	1.2%	3.9%	4.4%	4.8%	0.9%	1.1%	1.2%	3.9%	4.4%	4.8%	15.8%	17.6%	19.3%

[a]The values presented for the Alternative 1 baseline and for scenario 2 of Alternatives 2, 3, 4, and 5 are based on survey results. Scenario 1 reflects a 10 percent decrease in the percentage of snowmobiles switching to each of the other categories, while Scenario 3 reflects a 10 percent increase.

[b]The percentage changes for renters apply only to those that would have been unguided rentals in the historical baseline. Those that would have been guided rentals are assumed to remain unchanged.

[c]These percentages apply only to YNP visitors. The "other" nonsnowmobiling visitors in GTNP are generally much less affected by snowmobiles than visitors to YNP and are assumed not to change visitation in response to the management alternatives analyzed.

Based on survey results, snowmobile owners react to a requirement that snowmobile use be limited to guided tours in an almost identical way to a ban on snowmobile use in the parks.

that alternative. In addition, there is assumed to be no switching between unguided snowmobiling and guided snowmobile rentals for snowmobile owners. Based on survey results, snowmobile owners react to a requirement that snowmobile use be limited to guided tours in an almost identical way to a ban on snowmobile use in the parks. There appears to be essentially no interest in guided tours among snowmobile owners.

Scenarios for 2005–2006 through 2006–2007. The scenarios for 2005–2006 and 2006–2007 are the same as for 2004–2005 for the Alternative 1 baseline and for Alternatives 2, 4, and 5. Starting in 2005-2006, 20 percent of snowmobiles can be unguided under Alternative 3. Incremental visitation is expected to increase under this alternative at the same rate as under Alternative 5.

3.2.3 Benefits

Benefits to Snowmobilers

The Alternative 1 baseline requires a complete ban on snowmobiles starting in the 2004–2005 winter season. As discussed above in Section 3.2.2, Alternatives 2, 3, 4, and 5 will benefit snowmobilers and providers of services to snowmobilers by allowing continued snowmobile access to the parks. If implemented, the benefits of these management alternatives will begin accruing to snowmobilers in the 2004–2005 winter season. This section describes the consumer surplus benefits to snowmobilers that will result from implementing the less-restrictive management options compared to baseline conditions.

Discussions with park staff and rental shop owners suggest that they believe the majority of snowmobilers who currently use the park would not consider the national forests a good substitute.

If snowmobile use in the three parks is allowed to continue, riders who currently ride in the national parks for at least some portion of their trip to the area would experience a gain in consumer surplus. To the extent that individuals consider areas in nearby national forests close substitutes, the gain in consumer surplus associated with keeping parks open to this form of winter recreation would be lessened. Discussions with park staff and rental shop owners suggest that they believe the majority of snowmobilers who currently use the park would not consider the national forests a good substitute for visiting YNP.

Most riders in the park are interested in the chance to view unique natural features, such as the geysers, and plentiful wildlife that are not duplicated in the surrounding forests. However, discussions with park staff and rental shop owners also emphasized that avid snowmobilers prefer the longer, more challenging trails and varied terrain of the national forest. The 45-mph speed limit in the national parks may also be unattractive to some riders. Statistics from the *Winter 2002–2003 Visitor Survey* suggest that, on average, snowmobilers spend more time recreating outside the parks than inside the parks, whether snowmobiling in the national forests or downhill skiing at local resorts. These riders may continue to visit the GYA and suffer little loss in consumer surplus even if snowmobiles are banned in the three parks.

Results from the Winter 2002–2003 Visitor Survey *confirm that the majority of snowmobilers would not visit the park if snowmobiles were banned.*

Similarly, the gain in consumer surplus would be lessened to the extent that snowcoach tours of YNP offer an acceptable substitute for viewing the park. Business owners indicated that for some customers the coach tours are a very poor substitute for riding a snowmobile in the park and that some customers would not visit the park if snowmobiles were banned. Other customers are less interested in riding snowmobiles and more interested in seeing the sights of YNP and would find snowcoaches an acceptable substitute. Results from the *Winter 2002–2003 Visitor Survey* confirm that the majority of snowmobilers would not visit the park if snowmobiles were banned.

For each individual, consumer surplus for the chosen activity accounts for the value for substitute activities. Thus, the total change in consumer surplus would be the sum of the changes for each individual whose recreation choices were affected by the proposed alternatives. Following the implementation of a cap on the number of snowmobiles permitted in the parks, snowmobilers who are denied access to the parks, are forced to switch to a second option for travel, or forced to snowmobile on dates that are less than optimal would lose consumer surplus. However, those riders and other visitors who do get into the park may experience an increase in consumer surplus because it would be less crowded and the potential problems of noise, air emissions, and safety considerations associated with

snowmobiles will be lessened. In addition, a requirement to be part of a guided tour to snowmobile in YNP would also diminish the consumer surplus of those riders who prefer to see the park at their own pace. On the other hand, consumer surplus may be increased for people who get enhanced enjoyment from the interpretive services offered by the guides in what may be for novices the more secure environment that is provided by snowmobiling with an experienced guide. Requirements for emission controls and the use of an NPS-trained guide will tend to increase the cost of snowmobiling in the parks. The various winter management alternatives discussed in this report present a variety of degrees of regulation of snowmobile numbers and technology and guide requirements.

For each alternative, WTP to shift from the ban to the alternative on low and moderate crowding days was calculated. Using the predicted percentage of low and moderate crowding days under each alternative, a weighted WTP was created.

To calculate the consumer surplus benefits to snowmobilers of moving from the baseline (the ban on snowmobiles) to the different alternatives, WTP estimates derived from the *Winter 2002–2003 Visitor Survey* were used. The survey and regression models used to calculate WTP in this report are described in Appendix 1. Table 3-4 contains the WTP estimates for each alternative. It must be emphasized that the WTP values reported in Table 3-4 represent mean estimates (within a range of uncertainty) based on the modeling approaches discussed in Appendix 1. For each alternative, WTP to shift from the Alternative 1 baseline to the alternative on low and moderate crowding days was calculated. Using the predicted percentage of low and moderate crowding days under each alternative, a weighted WTP was created. Table 3-5 presents the percentage of low and moderate crowding days expected under each alternative, based on the definitions of moderate and low crowding used in the *Winter 2002–2003 Visitor Survey* and the expected visitation levels under each alternative. For GTNP, WTP is based on the assumption that all snowmobile trips are unguided and all days are low crowding.

Two estimates of baseline utility were used to create a range of WTP values for the snowmobilers. The first estimate uses the utility associated with not visiting the park estimated in Model 2

Table 3-4. Per-Day WTP for Snowmobile Riders to Change from the Alternative 1 Baseline to Alternatives 2, 3, 4, and 5[a]

	Model 2[b]	RUM[c]
Alternative 2 moderate crowding	$30	$230
Alternative 2 low crowding	$100	$300
Alternative 2 weighted average[d]	$100	$300
Alternative 3 moderate crowding, 2005–2006, 2006–2007	$60	$260
Alternative 3 low crowding, 2005–2006, 2006–2007	$130	$320
Alternative 3 weighted average, 2005–2006, 2006–2007[d]	$110	$310
Alternative 3 moderate crowding, 2004–2005	$30	$230
Alternative 3 low crowding, 2004–2005	$100	$300
Alternative 3 weighted average, 2004–2005[d]	$90	$290
Alternative 4 moderate crowding	$30	$230
Alternative 4 low crowding	$100	$300
Alternative 4 weighted average[d]	$90	$290
Alternative 5 moderate crowding	$60	$260
Alternative 5 low crowding	$130	$320
Alternative 5 weighted average[d]	$110	$310
GTNP low crowding	$230	$430

[a]All dollar values in 2003 dollars, rounded to the nearest $10.

[b]Change in utility based on regression results for Model 2 for visiting under conditions when snowmobiles banned, see Table 6-7 of Appendix 1.

[c]Change in utility based on multiple-site RUM estimate of $32, see Appendix 1, Section 6.2 for details.

[d]Weighted average based on percentage of moderate and low crowding days during the season.

Table 3-5. Percentage of Moderate and Low Crowding Days Expected During the Season in YNP[a]

	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Days moderate	3%	19%	19%	19%
Days low	97%	81%	81%	81%

[a]Moderate and low crowding are defined as in the survey described in Appendix 1 with the following adjustment: moderate is defined as 250 to 700 machines in YNP per day and low is defined as fewer than 250 machines in YNP per day. Based on the 2002–2003 winter season, visitation was adjusted for changes in visitation forecast under each alternative. The 2002–2003 winter season was assumed to start December 28 when the West Entrance opened.

(mixed logit), and presented in Table 6-7 of Appendix 1.[6] The second estimate uses the WTP estimate from the multiple-site Random Utility Model (RUM), discussed in Section 6.2 of Appendix 1. The estimate from the multiple-site RUM is based on trips that snowmobilers living west of the Mississippi River made during the 2001–2002 season to Montana, Wyoming, and Idaho. It measures the WTP of this sample to maintain the option of riding a snowmobile in YNP or GTNP under current, unrestricted conditions (which is the loss associated with banning snowmobiles from YNP and GTNP compared with current, unrestricted conditions). The utility associated with snowmobiling outside YNP and GTNP is much smaller in the multiple-site RUM than estimated in the Model 2 regressions, leading to larger WTP values for the alternatives. There is not a theoretical reason to expect that the RUM model would yield larger WTP values for the alternatives than the mixed logit model used in Model 2 estimation. These values are calculated using different samples, and the models approach WTP estimation in different ways. Both approaches were used in this analysis to provide a range of possible WTP values.

Finally, the WTP numbers for Alternatives 3 (in 2005–2006 and 2006–2007) and 5 are calculated as a weighted average of the WTP for guided and unguided tours. Under Alternatives 3 and 5, at least 20 percent of visitors can be unguided or on tours led by noncommercial guides. It was assumed that tours led by noncommercial guides would be similar to unguided tours because they could be led by a member of the group rather than an outside commercial guide; thus, the WTP values for unguided tours were used for this group of visitors. The other 80 percent of the value is the WTP commercially guided tours.

Using the WTP values from Table 3-5, the total consumer surplus benefits for snowmobilers under Alternatives 2, 3, 4, and 5 compared to the Alternative 1 baseline were calculated. Table 3-6 presents the estimates of total consumer surplus gains for 2004–2005 through 2006–2007 under Scenario 2 of

[6]Appendix 1 also presents results for Model 1, which relies on conditional logit estimation rather than mixed logit. The mixed logit form used in Model 2 is less restrictive and was determined to be a superior model. Thus, Model 2 results were used in the benefit-cost analysis rather than results from Model 1.

Table 3-6. Total Consumer Surplus Gains for Snowmobile Riders under Alternatives 2, 3, 4, and 5: 2004–2005 through 2006–2007

	Alternative 2 Weighted Average WTP[a]		Alternative 3 Weighted Average WTP[a]		Alternative 4 Weighted Average WTP[a]		Alternative 5 Weighted Average WTP[a]	
	Model 2 Baseline[b]	RUM Baseline[c]	Model 2 Baseline[b]	RUM Baseline[c]	Model 2 Baseline[b]	RUM Baseline[c]	Model 2 Baseline[b]	RUM Baseline[c]
2004–2005	$3,517,730	$9,402,720	$3,694,450	$9,872,700	$3,649,450	$9,872,700	$5,701,930	$14,330,830
2005–2006	$3,575,650	$9,579,260	$4,858,680	$13,663,160	$3,872,610	$10,252,370	$5,916,810	$14,792,310
2006–2007	$3,632,670	$9,753,040	$4,933,370	$13,910,420	$4,054,580	$10,637,000	$6,134,320	$15,256,140

[a]Weighted average based on percentage of moderate and low crowding days during the season.

[b]Utility relative to the Alternative 1 baseline based on regression results for Model 2, see Table 6-7 of Appendix 1.

[c]Utility relative to the Alternative 1 baseline based on multiple-site RUM estimate of $32, see Appendix 1, Section 6.2 for details.

Note: All dollar values in 2003 dollars, rounded to the nearest $10.

each alternative. Again, it must be emphasized that these estimates are based on mean WTP estimates (within a range of uncertainty). Under the Alternative 1 baseline, a majority of current snowmobilers said they would not visit the parks. A small percentage said they would still visit, and presumably these riders would participate in other activities in the park. For the purposes of these calculations, all snowmobilers were assigned the same baseline utility for the ban based on the utility estimated for riders who decide not to visit the parks. Riders who decide to visit the park and participate in other activities may experience a somewhat different level of utility under the ban, which could be larger or smaller than riders who decide not to visit the park. A discussion of the results for each alternative follows.

Alternative 2 will result in the smallest consumer surplus gains to most snowmobilers.

Consumer Surplus Gains of Alternatives 2, 3 (for 2004-2005), and 4. Alternative 2 generates the smallest consumer surplus gains to snowmobilers (see Table 3-6). Instead of phasing out snowmobiles as in the Alternative 1 baseline, Alternatives 2, 3, and 4 allow the activity to continue under daily entrance limits. The caps on snowmobiles allowed per day at each entrance are the lowest under Alternative 2 and will trigger reductions from historical average peak-day use on holidays and busy weekends and possibly on some off-peak days. The caps on snowmobiles allowed per day at each entrance under Alternatives 3 (in 2004–2005) and 4 are higher and will trigger reductions from historical average peak-day use on holidays and busy weekends but will likely have no effect on individuals snowmobiling on off-peak days.[7]

All three alternatives require 100 percent of snowmobiles in YNP to be commercially guided. This requirement results in lower estimated consumer surplus gains compared to a situation where the trips were unguided. The majority of current snowmobilers are unguided, suggesting a preference for unguided trips over guided trips. For some visitors the cost of a guided tour may be prohibitive, while for others the added cost of a guided tour will limit the choice set of recreational

[7] Visitation projections suggest that the daily entrance caps will not be binding if riders switch to less crowded days, because of the guided tour requirement.

options for the rest of the trip. The Model 2 results in Appendix 1 support the contention that, on average, snowmobilers prefer unguided to guided snowmobile trips, although this is not true for all snowmobilers.

The snowmobile technology requirements imposed by Alternatives 2, 3, and 4 are a potential limiting factor in the consumer surplus gains that are not reflected in the WTP estimates. Under this winter use management option, BAT snowmobile technology is required for all snowmobiles. Local snowmobilers who own traditional two-stroke models may experience lower consumer surplus gains under this alternative because they would eventually be unable to use their machines in the GYA parks (GTNP for unguided trips). However, renters and individuals who already own the permitted models will experience significant welfare gains relative to baseline conditions. In addition, those who continue to snowmobile in the parks will be able to do so in a way that causes less environmental damage and will be less likely to suffer health effects than GYA snowmobilers in past seasons.

The snowmobile technology requirements imposed by Alternatives 2, 3, 4, and 5 are a potential limiting factor in the consumer surplus gains that are not reflected in the WTP estimates. Under these winter use management options, BAT snowmobile technology is required for all snowmobiles.

Consumer Surplus Gains of Alternatives 3 (after 2004–2005) and 5. Starting in 2005–2006, Alternative 3 allows for 20 percent of snowmobiles to be unguided. Alternative 5 stipulates that 20 percent of snowmobilers in YNP may be unguided in 2004–2005 and led by noncommercial guides in the following years, which should benefit snowmobilers who do not like guided tours because a member of their party could act as the guide and the trip would resemble an unguided trip. It also lowers the cost of the tour compared to traveling with a commercial guide. Alternative 5 generates the largest gains in consumer surplus relative to the Alternative 1 baseline.

Again the technology requirements are not reflected in the WTP values. The emission requirements will not be put into place for private (i.e., nonrental) snowmobiles until 2005–2006 under Alternative 5, meaning that owners of older models will have one more year to enjoy the parks as they have in the past compared to other alternatives.

Benefits to Businesses

Compared to the Alternative 1 baseline, Alternatives 2, 3, 4, and 5 will result in increased numbers of snowmobiles in YNP, GTNP, and the Parkway. The increase will positively affect the suppliers of snowmobile and other tourism-related services in the GYA.

Compared to the Alternative 1 baseline, Alternatives 2, 3, 4, and 5 will result in increased numbers of snowmobiles in YNP, GTNP, and the Parkway. The increase will positively affect the suppliers of snowmobile and other tourism-related services in the GYA. Under the baseline, current snowmobilers could respond to the ban on snowmobiles in 2004–2005 in a variety of ways that imply different impacts on the local economy. For instance, it is possible, although unlikely, that all the people currently riding in the national parks may decide to ride in the surrounding national forests, and demand for snowmobile services would remain unchanged under the baseline rule. However, based on survey results, NPS expects an increase in the number of park visitors under Alternatives 2, 3, 4, and 5 relative to the Alternative 1 baseline. Thus, most businesses are expected to benefit from implementation of Alternatives 2, 3, 4, and 5, although there are substantial reductions in nonsnowmobilers. Businesses that specialize in nonsnowmobile-related activities may experience reductions in revenue relative to baseline conditions.

To calculate gains in producer surplus to businesses, changes in business revenue relative to the Alternative 1 baseline were calculated. For each alternative and each visitation change scenario, revenue changes are reported for eight spending/business categories. To estimate these values, scenario-specific estimates of the change in the number of visitors were multiplied by the average (per visitor) spending in each category, based on responses to the visitor survey.

To translate changes in revenue into changes in producer surplus for the purposes of benefit-cost analysis, NPS used estimates of the increase in revenue associated with each scenario and the return-on-sales measure for the Standard Industrial Classification (SIC) code provided by Dun & Bradstreet (D&B).[8]

[8]The D&B lower and upper quartile profit margins are: snowmobile and snowcoach rentals (SIC 7999) 3.90 percent – 8.7 percent; lodging (SIC 7011) 1.30 percent – 14.70%; restaurants and bars (SIC 5812) 0.60 percent – 7.50 percent; grocery stores (SIC 5411) 0.40 percent – 3.00 percent; gas and oil (SIC 5541) 1.10 percent – 3.10 percent; souvenir shops and other retail establishments (SIC 5947) 1.10 percent – 9.90 percent.

The use of this profit margin only approximates gains in producer surplus. Producer surplus captures the difference between marginal costs and marginal revenue, while return on sales contains other measures reflecting fixed costs, taxes, and/or accounting conventions rather than measures of variable profits. For this reason, the use of D&B accounting profit margin data may understate producer surplus gains.

Tables 3-7a through 3-7d summarize the total estimated change in producer surplus for each winter season between 2004–2005 and 2006–2007 for businesses in the GYA relative to the Alternative 1 baseline.

Table 3-7a. Alternative 2 Estimated Change in Producer Surplus, 2004–2005 through 2006–2007

	Alternative 2					
	Scenario 1		Scenario 2		Scenario 3	
	Low	High	Low	High	Low	High
2004–2005	$17,930	$380,840	$13,910	$303,900	$9,480	$215,920
2005–2006	$18,460	$399,150	$14,140	$313,980	$9,810	$228,810
2006–2007	$18,830	$407,540	$14,420	$320,460	$10,000	$233,390

Note: Rounded to the nearest $10.

Table 3-7b. Alternative 3 Estimated Change in Producer Surplus, 2004–2005 through 2006–2007

	Alternative 3					
	Scenario 1		Scenario 2		Scenario 3	
	Low	High	Low	High	Low	High
2004–2005	$19,350	$406,850	$15,760	$333,060	$12,160	$259,320
2005–2006	$24,900	$488,410	$22,580	$440,420	$20,250	$392,430
2006–2007	$25,490	$498,720	$22,980	$448,220	$20,470	$397,720

Note: Rounded to the nearest $10.

Table 3-7c. Alternative 4 Estimated Change in Producer Surplus, 2004–2005 through 2006–2007

	Alternative 4					
	Scenario 1		Scenario 2		Scenario 3	
	Low	High	Low	High	Low	High
2004–2005	$18,050	$382,520	$14,020	$304,460	$9,710	$217,940
2005–2006	$18,980	$404,650	$14,780	$322,080	$10,590	$239,510
2006–2007	$19,470	$414,290	$15,210	$330,410	$10,950	$246,530

Note: Rounded to the nearest $10.

Table 3-7d. Alternative 5 Estimated Change in Producer Surplus, 2004–2005 through 2006–2007

	Alternative 5					
	Scenario 1		Scenario 2		Scenario 3	
	Low	High	Low	High	Low	High
2004–2005	$24,460	$479,300	$22,180	$432,400	$19,920	$385,490
2005–2006	$25,030	$489,560	$22,740	$442,220	$20,410	$394,840
2006–2007	$25,700	$501,060	$23,260	$451,860	$20,820	$402,660

Note: Rounded to the nearest $10.

Impacts through National Park Expenditures in YNP, GTNP, or the Parkway of Alternative 2, 3, 4, or 5

Snowmobilers pay $15 for a 7-day pass to enter the parks. Revenue from entrance fees will decline under the Alternative 1 baseline beginning in the winter of 2004–2005 if visitation to the parks declines (if snowmobile visitation is not offset by increases in visitation by snowcoach riders or skiers).[9] Under Alternative 2, 3, 4, or 5, if visitation is higher than it would have been under the Alternative 1 baseline rule, revenue from entrance fees will be higher. An increase in entrance fee revenue may have welfare impacts on local businesses, local residents, and visitors. To the extent that local workers or businesses are hired by YNP, GTNP, or the Parkway to work in the park, there may be gains in producer surplus if the parks

[9]National parks are permitted to keep a significant portion of their entrance fee revenue to fund projects and services within the park. Thus, a reduction in entrance fee revenue may lead to a decline in resources available to the park.

spend more money in the surrounding communities. Park visitors' welfare may be affected to the extent that there is more revenue for maintenance and improvements in the park.

Impacts through the Town of West Yellowstone of Alternative 2, 3, 4, or 5

West Yellowstone, Montana, applies a 3 percent resort tax to lodging, dining, bars, snowmobile rentals, and souvenir sales (Neher, Robison, and Duffield, 1997). An increase in visitors to West Yellowstone as a result of Alternative 2, 3, 4, or 5 relative to the Alternative 1 baseline would also affect the tax revenue and public services provided by the town to citizens and visitors. The welfare of businesses and individuals may be affected to the extent that more services are provided as a result of an increase in tax revenue, most of which is paid by visitors from outside the community. For example, several local officials and businessmen mentioned the importance of the resort tax for funding the local schools. In addition, if there are increases in employment following the imposition of new regulations, then the gain in residents in West Yellowstone may also positively affect the viability of the school and other public services.

3.2.4 Costs

As described in Sections 2.7 and 3.1, as well as Appendix 2, snowmobile use in national parks can be linked to a variety of negative externalities for nonsnowmobilers. Under Alternatives 2, 3, 4, and 5, snowmobile use would be allowed, while it is banned under the Alternative 1 baseline. Section 2.7 specifically describes the impacts on natural resources that could result from snowmobile use within the boundaries of YNP, GTNP, and the Parkway. This section assesses the costs of the aforementioned management alternatives resulting from the negative impacts of snowmobile use.

Through the 2002–2003 winter season, snowmobiling in YNP was permitted during the winter months on a large majority of the paved roadways within the park. Roughly 185 miles (out of a total of almost 300 roadway miles) were specifically groomed for snowmobile and snowcoach use, and they provided access to virtually all of the most popular sites and destinations within

the park, such as the Geyser Basin, Old Faithful, and Hayden Valley. Most snowmobile activity took place in the western portion of the park, which is most directly accessible from the West Entrance at the town of West Yellowstone. In GTNP and the Parkway, snowmobiles were permitted on the CDST and Grassy Lake Road. The most commonly used route was between Flagg Ranch and YNP's southern entrance.

Nonsnowmobiling winter recreators in YNP and GTNP whose park experience is negatively affected by the presence of snowmobiles bear the bulk of the costs from regulations allowing snowmobiles continued access to the parks. Among the more popular activities and means of experiencing the parks during the winter season other than snowmobiling are cross-country skiing, snowshoeing, winter hiking, automobile touring, and snowcoach touring. As shown in Table 2-3, in 2002–2003 the number of winter recreation visits to the park was 112,736 to YNP, and nonsnowmobile visitors accounted for just over 46 percent of these visits.

Nonsnowmobiling winter recreators in YNP and GTNP whose park experience is negatively affected by the presence of snowmobiles bear the bulk of the costs from regulations allowing snowmobilers continued access to the parks.

Negative externalities associated with snowmobiles may reduce the value of trips to YNP, GTNP, and the Parkway, causing a loss of consumer surplus for nonsnowmobilers. Snowcoach passengers and cross-country skiers are particularly susceptible to the externalities of snowmobile use. Snowcoach passengers share snowmobilers' routes through the park and are exposed to high concentrations of exhaust and noise at popular stopping points. An added stress is put on cross-country skiers recreating in the vicinity of snowmobile routes when they are forced to breathe snowmobile emissions. Alternatives 2, 3, 4, and 5 result in consumer surplus losses for nonsnowmobiling visitors relative to the baseline.

Consumer Surplus Losses

Primarily due to impacts from snowmobile sound and air emissions, there are expected to be consumer surplus losses to nonsnowmobilers of moving from the Alternative 1 baseline to Alternatives 2 through 5. To quantify these welfare losses, NPS used WTP estimates derived from the *Winter 2002–2003 Visitor Survey*. The survey and regression models used to calculate WTP in this report are described in Appendix 1. Table 3-8

presents the WTP estimates for each alternative. The WTP values are based on the Model 2 regression results presented in Table 6-7 of Appendix 1. For each alternative, WTP to move from the ban to the alternative on low and moderate crowding days was calculated. WTP is negative because nonsnowmobilers are worse off under Alternative 2, 3, 4, or 5 than under baseline conditions. A negative value implies that nonsnowmobilers would need to be compensated to reach the same level of welfare as under the baseline.

Table 3-8. Per-Day WTP for Nonsnowmobile Riders to Change from the Alternative 1 Baseline to Alternatives 2, 3, 4, and 5[a]

	Model 2[b]
Alternative 2 moderate crowding	–$240
Alternative 2 low crowding	–$90
Alternative 2 weighted average WTP[c]	–$90
Alternative 3 moderate crowding	–$240
Alternative 3 low crowding	–$90
Alternative 3 weighted average WTP[c]	–$120
Alternative 4 moderate crowding	–$240
Alternative 4 low crowding	–$90
Alternative 4 weighted average WTP[c]	–$120
Alternative 5 moderate crowding	–$240
Alternative 5 low crowding	–$90
Alternative 5 weighted average WTP[c]	–$120

[a]All dollar values in 2003 dollars, rounded to the nearest $10.

[b]Change in utility based on regression results for Model 2 for visiting under conditions when snowmobiles banned, see Table 6-7 of Appendix 1.

[c]Weighted average based on percentage of moderate and low crowding days during the season.

Note: There may be unquantified differences in WTP between these alternatives. For instance, the Winter Visitor Survey did not include an attribute describing whether all the snowmobiles were on guided tours or not. Thus, measured WTP is not affected by this management provision.

Using the predicted percentage of low and moderate crowding days under each alternative, a weighted WTP was created (see Table 3-5 for the percentage of low and moderate crowding days selected under each alternative). For nonsnowmobile riding visitors, the Alternative 1 baseline utility is based on conditions in the park under a ban on snowmobiles. WTP is

calculated for moving from this baseline to Alternatives 2, 3, 4, and 5. Table 3-8 presents the WTP estimates. While the WTP under low and moderate crowding are the same across all the alternatives for nonsnowmobilers, the weighted WTP varies because of differences in the forecast number of low and moderate crowding days. In the *Winter 2002–2003 Visitor Survey*, the valuation questions used to calculate WTP described conditions in the park in terms of crowding, noise, emissions, and road surface conditions. The survey did not include an attribute describing whether all the snowmobiles were on guided tours or not; thus, the measured WTP of nonsnowmobilers is not affected by this management provision. To the extent that nonsnowmobilers prefer that snowmobile riders are part of a guided tour, the welfare losses for Alternatives 3 and 5 will be smaller (smaller negative numbers).

The WTP values generated for nonsnowmobilers are very similar in magnitude to those estimated for snowmobilers (see Table 3-4) but opposite in sign, indicating that snowmobilers gain consumer surplus from each of these alternatives and nonsnowmobilers lose consumer surplus. The weighted average WTP values estimated using Model 2 (the most comparable values available) indicate that the per capita reductions in welfare for nonsnowmobilers are about 10 to 35 percent larger in magnitude than the gains to snowmobilers across Alternatives 2, 3, 4, and 5.

Using the WTP values from Table 3-8, NPS calculated the total consumer surplus losses for nonsnowmobilers under Alternatives 2, 3, and 4 compared to the Alternative 1 baseline. Table 3-9 summarizes the estimated consumer surplus losses in each year from 2004–2005 through 2006-2007.

In addition to these quantified impacts on nonsnowmobilers that currently visit the parks, these alternatives may discourage additional visits to the parks by the nonsnowmobiling public who do not currently visit the parks in the winter but might if snowmobiles are banned from the parks. The values from the *Winter 2002–2003 Visitor Survey* and the consumer surplus losses estimated are based on current visitors to the park and do not reflect that values of people who might visit the park if

Table 3-9. Total Consumer Surplus for Nonsnowmobilers for Alternatives 2, 3, and 4, 2004–2005 through 2006–2007[a,b]

	Alternative 2 Weighted Average WTP[c]	Alternative 3 Weighted Average WTP[c]	Alternative 4 Weighted Average WTP[c]	Alternative 5 Weighted Average WTP[c]
2004–2005	–$14,817,530	–$19,066,800	–$19,066,800	–$19,066,800
2005–2006	–$15,237,900	–$19,607,720	–$19,607,720	–$19,607,720
2006–2007	–$15,657,650	–$20,147,840	–$20,147,840	–$20,147,840

[a]All dollar values in 2003 dollars, rounded to the nearest $10.

[b]Utility under the baseline (Alternative 1) based on regression results for Model 2 for visiting under conditions when snowmobiles banned, see Table 6-7 of Appendix 1.

[c]Weighted average based on percentage of moderate and low crowding days during the season.

snowmobiles are banned, but will not visit under Alternatives 2, 3, 4, and 5, and as such underestimate consumer surplus losses associated with these alternatives.

Costs to "nonusers" of the park are also likely to result from continued snowmobile use in the parks (see Section 3.1 and Appendix 2 for additional details). For example, individuals who do not visit the parks can benefit simply from the knowledge that the natural resources of the park are being protected. Part of this benefit may stem from an increased assurance that the quality of the parks' resources is being protected for the enjoyment of future generations. Under Alternatives 2, 3, 4, and 5, nonusers will be less confident that the park is being protected and will therefore incur costs arising from the disutility of knowing that resources in the park may be compromised by the presence of snowmobiles.[10]

Other Costs

Other potential costs from allowing continued snowmobile activity in the park include those associated with the risks of snowmobile-related safety hazards and continued impairments

[10]The importance of recognizing these values is affirmed in the Organic Act. It established the fundamental purpose of the national park system, which includes providing for the enjoyment of park resources and values by the people of the United States. The mandate applies not just to the people who visit parks—but to all people—including those who derive inspiration and knowledge from afar. Furthermore, through the Redwood Act of March 27, 1978 Congress has provided that when there is a conflict between conserving national park resources and values and providing for enjoyment of them, conservation is to be the primary concern.

in the quality of the groomed surface for oversnow vehicles. By reducing the number of vehicles in the park, snowmobile restrictions would improve the quality of the groomed surface of the oversnow routes in the parks. Under heavy traffic conditions (particularly from the West Entrance to Old Faithful), the groomed surface can become very rough and unpleasant for both snowcoach riders and snowmobilers.

To the extent that snowmobilers are unaware of the risks that they face on the park roads, restrictions on snowmobile use would benefit these individuals by protecting their safety.[11] Restrictions would also benefit nonsnowmobiling recreators by reducing their risks of being involved in accidents with snowmobiles. Reducing snowmobile-related accidents would also reduce the costs to NPS associated with medical/rescue operations, which would allow these resources to be redirected to other park management activities. Alternatives 2, 3, 4, and 5 impose costs on the above-mentioned parties by reducing the accrual of these benefits.

In general, reducing snowmobile activity in the park would allow NPS to redirect resources that are currently devoted to snowmobile-related activities to other park management activities.

In general, reducing snowmobile activity in the park would allow NPS to redirect resources that are currently devoted to snowmobile-related activities to other park management activities. Until the ban is in effect, park rangers would continue to provide a range of services to snowmobilers, including grooming of roads and providing of fuel, equipment repairs, minor first aid, directions, and emergency medical services as part of their regular activities. Incidents in the park that involve either general ranger support or law enforcement incidents involve a disproportionate number of snowmobiles relative to total winter visitors. Ultimately the baseline rule would eliminate these demands on park resources as they relate to snowmobile use (although grooming would be required for snowcoach travelers). Consequently, Alternatives 2, 3, 4, and 5 impose costs on the park by requiring it to continue to devote resources towards managing snowmobiles in the park that could be diverted to other uses under the Alternative 1 baseline.

[11] If snowmobilers are fully aware of the risks, NPS assumes that these effects are already discounted from the per-trip consumer surplus estimates for snowmobilers.

3.2.5 Uncertainty

A number of factors will affect the estimated costs and benefits associated with the snowmobile management alternatives being analyzed. Multiple scenarios were developed for Alternatives 2, 3, 4, and 5 to show the impacts of varying assumptions concerning the number of visitors that will continue to visit the GYA to participate in various activities. Nonetheless, many additional uncertainties remain. Some of the main sources of uncertainty include the following:

Although NPS has provided their best estimates of the costs and benefits associated with the alternatives being analyzed, numerous sources of uncertainty may influence the results.

- The sample of visitors included in the *Winter 2002–2003 Visitor Survey* was primarily intercepted in YNP. Using the WTP estimates from the YNP sample for nonsnowmobilers in GTNP may overstate the consumer surplus losses associated with Alternatives 2, 3, 4, and 5. It was assumed that there are no welfare impacts on the other nonsnowmobiler category in GTNP of reinstating snowmobile use because these users are unlikely to be substantially impacted by snowmobiles. However, large losses to cross-country skiers and snowshoers in GTNP resulting from Alternatives 2, 3, 4, and 5 are calculated based on using the per-day WTP estimate from the YNP sample. To the extent that nonsnowmobilers in GTNP are less affected by snowmobiles, this may tend to overstate welfare losses of reinstating snowmobiles.
- As discussed in the *Winter 2002–2003 Visitor Survey* report (included in Appendix 1), the benefits to snowmobilers of Alternatives 2, 3, 4, and 5 may be understated because the survey focused on day trips. It appears that snowmobilers prefer to be outside the park for a single day spent snowmobiling but may still prefer to visit YNP or GTNP as one part of a multiday trip to the GYA. In other words, while they may have higher WTP for trips outside the parks than inside on a given day of their trip, the WTP for their entire trip to the GYA would be higher if they could spend part of their trip in the parks and they may choose not to make the trip to the GYA if the parks are not available for snowmobiling. Thus, focusing on day trips may understate the value of being able to snowmobile in the parks to snowmobilers' consumer surplus.
- Although NPS attempted to limit strategic behavior through the survey design (see Appendix 1), it is possible that snowmobilers are overstating the amount they would reduce their trips under Alternatives 2, 3, 4, and 5. Based on stated behavior, visitation to the parks

would fall by enough that the caps on the number of snowmobiles would generally not be a limiting factor under any of the alternatives. These stated behaviors represent relatively large changes compared with historical visitation.

- Just as there may potentially be strategic bias exhibited by snowmobilers, nonsnowmobilers may be overstating the increase in the number of trips they would make to the GYA if snowmobiles were banned. In addition, they may be overstating the reduction in the number of trips (relative to current conditions) they would make if snowmobile use were reinstated under Alternative 2, 3, 4, or 5. Both of these potential biases will tend to overstate the losses to nonsnowmobilers associated with Alternatives 2, 3, 4, and 5.
- The stated behavior questions in the *Winter 2002–2003 Visitor Survey* indicate that everyone would have to use snowmobiles with four-stroke engines, so people may have said they would not visit if they do not currently own a compliant snowmobile. The baseline for this analysis does not reflect this technology shift over time. However, this will become less of an issue over time as people replace their old snowmobiles. Thus, the number of snowmobilers that would visit in future years under Alternatives 2 and 4 (alternatives where unguided and/or noncommercial guided access is maintained) may be understated.
- To the extent that there are current nonvisitors who would start visiting the GYA if snowmobiles were restricted in YNP and GTNP, losses to nonsnowmobilers under Alternatives 2, 3, 4, and 5 will be understated.
- There is insufficient information available to include welfare impacts on people that do not visit the park, but derive welfare from the knowledge that park natural resources are protected. Including nonuse value would increase the consumer surplus losses associated with Alternatives 2, 3, 4, and 5.
- The rule proposal process itself may have affected the number of snowmobile users who visited YNP and GTNP in recent years. Any change in visitation due to uncertainty over future restrictions in the parks that has occurred over the last few years will influence all of the projections used in the analysis. However, it is not clear whether the prospect of future restrictions would cause an increase or decrease in visitation. It may lead to an increase as people attempt to access YNP and GTNP prior to additional restrictions being implemented.

- The estimates of producer surplus gains do not account for adaptations that businesses may have made if snowmobiles had not been permitted in the parks. Businesses may have been able to partially offset their losses through adaptations to address the demands of a different mix of visitors. Thus, by not including this adaptive behavior, the estimates in this report may similarly overstate gains to local businesses from permitting snowmobile use.
- EPA regulations phasing in emissions reductions from new snowmobile over the period from 1996 to 2006 are expected to increase the cost of producing snowmobile over time. The corresponding increase in market price of snowmobile may lead to a reduction in sales that would reduce baseline snowmobile ownership and use relative to the projected levels. This would tend to reduce the incremental costs attributable to NPS regulations in future years. However, cost increases due to these regulations are probably captured in the current baseline to some degree because the rule has already required some reduction in emissions.

3.3 SUMMARY

Four temporary winter use management alternatives are analyzed relative to the Alternative 1 baseline to examine the effect of allowing the use of snowmobiles in YNP, GTNP, and the Parkway. Under the Alternative 1 baseline, most snowmobile use would be prohibited in the parks with a few minor exceptions in GTNP. Alternatives 2, 3, 4, and 5 allow for continued recreational snowmobile use subject to daily limits on the number of snowmobiles that can enter the parks, BAT requirements, and requirements that most or all of the snowmobiles be on guided tours.

The primary beneficiaries of Alternatives 2, 3, 4, and 5 relative to the Alternative 1 baseline are the park visitors who ride snowmobiles in the park and the businesses that serve them. Welfare changes, whether benefits or losses, accruing to individual visitors are called consumer surplus changes and those accruing to businesses are called producer surplus changes. Consumer surplus measures the net economic benefit obtained by individuals from participating in their chosen activities, while producer surplus measures the net economic benefit obtained by businesses from providing services to

individuals. Overall, Alternative 5 should provide greater consumer surplus benefits to snowmobilers than Alternatives 2 through 4. The daily caps on snowmobile use vary across the four alternatives, with Alternative 5 allowing the most snowmobiles per day into the parks. Alternatives 2, 3 (in 2004–2005), and 4 require snowmobilers to be part of a guided tour, which is expected to reduce the consumer surplus gains to snowmobilers who prefer unguided tours or who face additional expenses from being forced to take a guided tour. Alternatives 3 (in 2005–2006 and beyond) and 5 allow for at least 20 percent of the tours to be unguided or led by noncommercial guides, which may somewhat mitigate the potential loss in consumer surplus associated with the guided tour requirement. In 2004–2005, Alternative 5 does not require BAT snowmobiles for the 20 percent unguided, while the other alternatives require BAT the first year. Again, the technology provisions may reduce consumer surplus for snowmobilers by increasing costs to snowmobilers who want to use machines that do not conform to the technology standards.

Table 3-10 summarizes the change in per-day consumer surplus that results from moving to more stringent alternatives (other than moving from the Alternative 1 baseline to Alternative 2, which is less restrictive).

Table 3-10. Incremental Per-Day Consumer Surplus Between Alternatives as Net Benefits Increase

	Baseline to Alternative 4	Alternative 4 to Alternative 3 (2005–2006 and 2006–2007)	Alternative 3 (2005–2006 and 2006–2007) to Alternative 5	Alternative 5 (2005–2006 through 2006–2007) to Alternative 2
Snowmobile, Model 2 baseline	$90	$30	$0	–$20
Snowmobile, RUM baseline	$290	$30	$0	–$20
Nonsnowmobile[a]	–$120	$0	$0	$30

Notes: All dollar values in 2003 dollars, rounded to the **nearest $10**. WTP calculated using weighted average WTP (weighted by proportion of low and moderate crowding days).

[a]There is no difference between Alternatives 3, 4, and 5 based on mixed logit, because no change in WTP values for non-snowmobile riders when snowmobile riders all on guided tours. The differences in WTP for Alternative 2 come from the projection that there will be more days of low crowding under this alternative.

As with the benefits described above, the costs of any alternative are measured relative to the Alternative 1 baseline. The primary consumer group that would incur costs under Alternatives 2, 3, 4, and 5 would be the park visitors who do not ride snowmobiles. Out of the set of alternatives that allow for continued snowmobile access to the parks, Alternative 2 is expected to impose the lowest costs on nonsnowmobile users because of the lower daily limits and the guided tour requirements relative to Alternatives 3, 4, and 5. The other alternatives result in equal losses to nonsnowmobilers because there is no difference in WTP for nonsnowmobilers if snowmobiles are on guided tours and the percentage of moderate and low crowding days are projected to be the same under all three alternatives.

For businesses, the producer surplus gains relative to the Alternative 1 baseline are expected to be ordered similar to the way consumer surplus gains are for snowmobilers because they are driven largely by the number of visitors. Alternative 5 is expected to have the greatest positive impact on local businesses because it places the least restrictions on snowmobilers and is expected to result in the largest increase in visitation. Alternatives 2 and 4 are the most restrictive options for snowmobilers (primarily due to the requirement that all snowmobilers in YNP must be on guided tours) and are expected to result in the smallest increase in visitation relative to the Alternative 1 baseline among Alternatives 2, 3, 4, and 5.

Table 3-11 summarizes the present value of the total quantified benefits and costs of each alternative relative to the Alternative 1 baseline for 2004–2005 through 2006–2007. Table 3-12 shows the incremental costs and benefits associated with moving from the baseline to Alternative 4, then from Alternative 4 to Alternative 3, then from Alternative 3 to Alternative 5, and finally from Alternative 5 to Alternative 2 (in order of increasing net benefits between Alternatives 2, 3, 4, and 5).

Table 3-11. Present Value of Projected Incremental Costs and Benefits Relative to the Alternative 1 Baseline Under Alternatives 2, 3, 4, and 5, 2004–2005 through 2006-2007[a]

	Change in Consumer Surplus for Snowmobilers (Benefit)	Change in Consumer Surplus for Nonsnowmobilers (Cost)	Change in Producer Surplus for Businesses (Benefit)
Alternative 2			
Discounted at 3%[b]	$10,110,070 to $27,083,640	–$43,078,110	$52,040 to $638,890
Discounted at 7%[c]	$9,376,050 to $25,115,870	–$39,938,850	$48,250 to $592,160
Alternative 3			
Discounted at 3%[b]	$12,681,350 to $35,193,990	–$55,431,730	$65,580 to $985,640
Discounted at 7%[c]	$11,723,620 to $32,515,800	–$51,392,210	$60,640 to $909,780
Alternative 4			
Discounted at 3%[b]	$10,947,670 to $28,983,350	–$55,431,730	$53,230 to $662,960
Discounted at 7%[c]	$10,144,990 to $26,864,600	–$51,392,210	$49,340 to $614,120
Alternative 5			
Discounted at 3%[b]	$16,726,790 to $41,818,130	–$55,431,730	$70,860 to $1,114,920
Discounted at 7%[c]	$15,504,310 to $38,767,030	–$51,392,210	$65,700 to $1,033,830

[a]The range for snowmobiles' change in consumer surplus reflects the different values obtained using estimates from the RUM and Model 2 results to estimate baseline utility. For nonsnowmobilers, only the Model 2 baseline was estimated and results are provided relative to that baseline. The range for producer surplus reflects the lowest and highest estimates across all three scenarios for each alternative.

[b]The economics literature supports a 3 percent discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3 percent discount rate in the valuation of lost natural resources use (61 FR 453; 61 FR 20584). While the welfare impacts in this case are for private goods, the 3 percent discount rate was used to be consistent with discounting of other impacts in this report.

[c]Office of Management and Budget (OMB). 2003. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 2003.

Note: All dollar values in 2003 dollars, rounded to the nearest $10.

Based on the results of this analysis, the losses to nonsnowmobilers generally outweigh the gains to snowmobilers and local businesses. However, as noted earlier in this section, there are a number of uncertainties that may be influencing this result. The most important factor is the fact that the total costs and benefits provided in Table 3-11 transfer WTP values based primarily on a YNP sample to GTNP. This transfer of WTP values may overstate the losses to nonsnowmobilers associated with the presence of snowmobiles in the parks because there are far fewer snowmobiles in GTNP than in YNP, which implies that nonsnowmobilers may be less affected by their presence.

Table 3-12. Incremental Costs and Benefits Between Alternatives, 2004–2005 through 2006–2007

	Snowmobile Riders	Nonsnowmobilers	Businesses
Baseline to Alternative 4			
NPV 3%	$10,947,670 to $28,983,350	–$55,431,730	$53,230 to $662,960
NPV 7%	$10,144,990 to $26,864,600	–$51,392,210	$49,340 to $614,120
Alternative 4 Compared to Alternative 3			
NPV 3%	$1,733,680 to $6,210,640	$0	$12,350 to $322,680
NPV 7%	$1,578,630 to $5,651,200	$0	$11,300 to $295,660
Alternative 3 Compared to Alternative 5			
NPV 3%	$4,045,440 to –$6,624,140	$0	–$5,280 to –$129,280
NPV 7%	$3,780,690 to –$6,251,230	$0	–$5,060 to –$124,050
Alternative 5 Compared to Alternative 2			
NPV 3%	$6,616,720 to $14,734,490	–$12,353,620	$18,820 to $476,030
NPV 7%	$6,128,260 to $13,651,160	–$11,453,360	$17,450 to $441,670

[a]The economics literature supports a 3 percent discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3 percent discount rate in the valuation of lost natural resources use (61 FR 453; 61 FR 20584). While the welfare impacts in this case are for private goods, the 3 percent discount rate was used to be consistent with discounting of other impacts in this report.

[b]Office of Management and Budget (OMB). 2003. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 2003.

Note: All dollar values in 2003 dollars, rounded to the nearest $10.

In addition, snowmobile use in GTNP tends to be in separate areas of the park from nonsnowmobile activities to a much greater extent than for YNP where there is much more overlap in the areas used by these visitors. Using WTP values from YNP in GTNP is more likely to overstate losses to nonsnowmobilers than gains to snowmobilers under these alternatives, although snowmobiles are unguided in GTNP, which will increase WTP in GTNP relative to YNP for snowmobile riders. However, nonsnowmobilers may be affected quite differently.

No welfare impacts were calculated for the other nonsnowmobiler category in GTNP because these visitors are primarily driving through the park and are assumed to be relatively unaffected by snowmobiles. However, there are a very large number of cross-country skiers and snowshoers in GTNP for whom large welfare losses are modeled under

Alternatives 2, 3, 4, and 5 based on the estimated losses to cross-country skiers and snowshoers in YNP. To the extent that cross-country skiers and snowshoers in GTNP are less affected by snowmobiles than those in YNP, welfare losses of reinstating snowmobiles will be overstated.

In addition, it is possible that both snowmobilers and nonsnowmobilers are providing responses displaying strategic bias that influences the results in the same direction. Nonsnowmobilers may be overstating the gains they would receive from restricting snowmobiles in the parks, while snowmobilers may be overstating their reduction in visitation under restrictions. However, steps were taken in designing the survey to minimize the potential for strategic bias, and there is no evidence that strategic bias is present in the survey results.

The total present value of net benefits expected from Alternatives 2, 3, 4, and 5 are calculated over a 3-year horizon from the 2004–2005 winter season through the 2006–2007 winter season. A range of net benefits is calculated to acknowledge uncertainty in the benefit and cost estimates.

Table 3-13 presents the total present value of net benefits for both YNP and GTNP. In this valuation case, the nonsnowmobile visitors to GTNP are assigned the same unit costs as nonsnowmobile visitors to Yellowstone National Park. This valuation case may overstate the cost impacts to nonsnowmobile visitors to GTNP because they are believed to be less than the costs imposed on nonsnowmobile visitors to YNP. The amortized net benefits per year over the 10-year time frame of the analysis for this valuation case are presented in Table 3-14.

The range of net benefits for the valuation case represented by Tables 3-13 and 3-14 is entirely negative for Alternatives 2, 3, 4, and 5.

Table 3-13. Total Present Value of Net Benefits for Yellowstone and Grand Teton National Parks Relative to the Alternative 1 Baseline, 2004–2005 through 2006–2007

	Total Present Value of Net Benefits[a]
Alternative 2	
Discounted at 3%[b]	–$32,916,000 to –$15,355,580
Discounted at 7%[c]	–$30,514,550 to –$14,230,820
Alternative 3	
Discounted at 3%[b]	–$42,684,800 to –$19,252,100
Discounted at 7%[c]	–$39,607,950 to –$17,966,630
Alternative 4	
Discounted at 3%[b]	–$44,430,830 to –$25,785,420
Discounted at 7%[c]	–$41,197,880 to –$23,913,490
Alternative 5	
Discounted at 3%[b]	–$38,634,080 to –$12,498,680
Discounted at 7%[c]	–$35,822,200 to –$11,591,350

[a]The range in net benefits reflects the different values obtained for snowmobile visitors using the estimates from two economic valuation models, and the different scenarios analyzed for impacts to businesses.

[b]The economics literature supports a 3 percent annual discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rulemakings also support a 3 percent annual discount rate in the valuation of lost natural resource use (61 FR 453; 61 FR 20584).

[c]Office of Management and Budget (OMB). 2003. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 2003.

Note: All dollar values in 2003 dollars, rounded to the nearest $10.

Table 3-14. Annualized Net Benefits per Year for Yellowstone and Grand Teton National Parks Relative to the Alternative 1 Baseline, 2004–2005 through 2006–2007

	Annualized Net Benefits per Year[a]
Alternative 2	
Discounted at 3%[b]	–$11,636,805 to –$5,428,664
Discounted at 7%[c]	–$11,627,620 –$5,422,678
Alternative 3	
Discounted at 3%[b]	–$15,089,949 –$6,803,579
Discounted at 7%[c]	–$15,092,233 –$6,843,494
Alternative 4	
Discounted at 3%[b]	–$15,707,647 to –$9,115,929
Discounted at 7%[c]	–$15,698,521 to –$9,112,275
Alternative 5	
Discounted at 3%[b]	–$13,658,320 to –$4,418,663
Discounted at 7%[c]	–$13,650,109 to –$4,416,903

[a]This is the total present value of net benefits reported in Table 3-3 amortized over the 3-year analysis timeframe at the indicated discount rate.

[b]The economics literature supports a 3 percent annual discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rulemakings also support a 3 percent annual discount rate in the valuation of lost natural resource use (61 FR 453; 61 FR 20584).

[c]Office of Management and Budget (OMB). 2003. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 2003.

Note: All dollar values in 2003 dollars, rounded to the nearest $10.

4 Benefit-Cost Analysis of the Alternative Regulations Under the Historical Baseline

In this section, NPS presents the benefits and costs associated with alternatives considered for managing snowmobile use in the GYA relative to the historical baseline.

4.1 RESULTS FOR YNP, GTNP, AND THE PARKWAY

Based on the approach and possible impacts outlined in Sections 2 and 3, this section presents the results of the benefit-cost analysis for Alternatives 1, 2, 3, 4, and 5 for YNP, GTNP, and the Parkway relative to the historical baseline. Impacts were calculated using the same methodology as in Section 3.

4.1.1 Affected Groups

Data from the Winter 2002–2003 Visitor Survey *to YNP and GTNP were used to estimate the baseline visitation numbers and the estimates of visitation changes for each alternative.*

For the purpose of this study, six major affected groups have been identified:

1. Snowmobilers, whose ability to ride in YNP, GTNP, or the Parkway is affected by changes in regulations, or snowmobilers currently riding in areas other than YNP, GTNP, or the Parkway whose riding experience may be altered by GYA regulations (trails outside the parks may be less crowded if snowmobile use is not restricted in the three parks).

2. Other visitors (nonsnowmobilers) or potential visitors who may have a different experience at the park depending on snowmobile regulations in YNP, GTNP, or the Parkway.
3. The general public who may care about YNP, GTNP, or the Parkway, even when they do not visit.
4. Producers of snowmobile services in the towns of the five-county area who may experience a change in their welfare.
5. Producers of services to other types of winter visitors (for example, cross-county ski or snowshoe rentals or snowcoach tours) who may experience a change in their welfare.
6. Residents of West Yellowstone, Montana, who may experience a change in traffic congestion, air pollution, and noise if the alternatives affect the number of snowmobiles that ride on the town's streets. (Note that these same residents may also lose or gain consumer surplus and producer surplus to the extent that they fall into other categories.)

The impact on each group is discussed in more detail below.

4.1.2 Scenarios

Analysis of the changes in welfare to both visitors and business owners under alternative regulations requires predicting the likely impact on visitation patterns of each alternative relative to historical baseline conditions.

Analysis of the changes in welfare to both visitors and business owners under alternative regulations requires predicting the likely impact on visitation patterns of each alternative relative to historical baseline conditions. Because it is not known exactly how winter visitation to the five-county GYA will change over the period from 2004–2005 through 2006–2007 as a result of implementing Alternative 1, 2, 3, 4, or 5, three scenarios were developed for each alternative except Alternative 1, the ban on snowmobiles, to provide a range of possible outcomes. It is assumed that snowmobilers will decrease their visitation to the GYA relative to the historical baseline under each of the scenarios for the three alternatives, but the number of snowmobilers expected to visit the area differs under each scenario. The historical baseline visitation and the likely changes in visitation resulting from Alternatives 1, 2, 3, 4, and 5 are discussed below.

Historical Baseline Visitation

Under historical baseline conditions snowmobile use would continue as it was managed in 2002–2003 and previous years.

Under historical conditions, there are no daily caps, no technology requirements, and no requirements for guided tours. Incremental visitation under each alternative was estimated by calculating changes in visitation relative to the historical baseline level.

Because visitation under each alternative is calculated relative to the historical baseline using survey results, it was necessary to estimate the number of people expected to visit the parks in that situation. An estimated 72,437 people entered the national parks in the GYA on a snowmobile in the winter of 2002–2003.[1] Based on results from the *Winter 2002–2003 Visitor Survey*, it was assumed that approximately 70.4 percent of snowmobilers in the parks use rented machines.[2] This implies that 21,427 of these visitors rode privately owned snowmobiles and 51,010 entered the parks on rented snowmobiles. Data from YNP on the total number of snowmobile riders and snowmobiles that entered YNP indicate that the overall average number of visitors per snowmobile (renters and owners) is approximately 1.25. Based on this ratio of visitors to snowmobiles, NPS assumed that the estimated 21,427 owners rode a total of 17,095 machines into the parks in 2002–2003. In addition, the 51,010 snowmobile renters entering the parks in 2002–2003 were assumed to be riding 40,698 machines. Reports filed with the three parks by their licensed concessionaires in 1999–2000 indicated that approximately 27.5 percent of all rented snowmobiles entering the parks were on guided tours, and that there were an average of approximately 1.15 visitors per snowmobile. Assuming that both the percentage of rented snowmobiles on guided tours and the average number of people per guided snowmobile are representative of any year, NPS estimated that 11,192 guided, rented machines were used in the parks in

[1] This number is based on visitation numbers in Section 2.4.2 adjusting total reported snowmobile visitation for YNP, GTNP, CDST, and the Parkway by subtracting the number of snowmobile visitors using the south entrance of YNP. This adjustment was made based on input from park officials who indicated that these machines would otherwise be double-counted.

[2] This percentage (and other percentages and ratios presented in the text) is the rounded value; in subsequent calculations, the calculated value, as opposed to the rounded value, was used. This was done to avoid the introduction of multiple (successive) rounding errors, and is not meant to imply additional significant digits. As a result, the reader (using the rounded values) may not be able to calculate exactly the same numbers presented in the text.

2002–2003, and that they carried 12,826 guided rental visitors. Of the total rental visitors in winter 2002–2003, this leaves 38,184 visitors who entered the parks on 29,506 rented but unguided machines.[3]

Based on the projections presented in Section 2.4.3, the number of snowmobilers would have increased over the period of 2004–2005 through 2006–2007 in the historical baseline. NPS assumed that the number of people per machine, the percentage of snowmobilers that are renters, and the percentage of rented snowmobiles that are used on guided tours all would have remained constant at the values presented above for 2002–2003.

Scenarios for 2004–2005. The scenarios that were analyzed for each management alternative during 2004–2005 are summarized in Table 4-1. Each scenario is presented as the change in winter use patterns estimated to occur relative to the historical baseline. The percentage changes used in each alternative were calculated based on the results of the stated behavior portion of the *Winter 2002–2003 Visitor Survey* (NPS 2003a). For each of the visitor categories included in Table 4-1, the net change in the total number of trips that would be taken by survey respondents in that winter use category[4] under a particular management alternative relative to the total number of trips that respondents state they would have taken in the absence of snowmobile restrictions was the basis for the percentage changes used in the scenarios.

Based on survey results, snowmobile owners react to a requirement that snowmobile use be limited to guided tours in an almost identical way to a ban on snowmobile use in the parks.

The results for snowmobilers generally follow the expected pattern between alternatives. People who would use unguided snowmobiles in the parks under the historical baseline are assumed to continue that activity in the parks if they are willing to continue visiting the parks under a given management alternative and unguided snowmobile use is permitted under that alternative. In addition, there is assumed to be no switching between unguided snowmobiling and guided snowmobile rentals for snowmobile owners. Based on survey

[3]This results in approximately 1.29 visitors per rented, unguided snowmobile.
[4]As mentioned elsewhere in this report, many visitors participate in multiple activities during their trip to the GYA. Respondents were categorized based on the activity they indicated was their primary activity in the parks.

Table 4-1. Summary of Scenarios Used in Analyzing Economic Impacts of Snowmobile Management Alternatives on GYA in 2004–2005[a]

	Historical Baseline[b,c]	Alternative 1	Alternative 2			Alternative 3			Alternative 4			Alternative 5					
			1	2	3	1	2	3	1	2	3	S1 (YNP)	S2 (YNP)	S3 (YNP)	S1 (GTNP)	S2 (GTNP)	S3 (GTNP)
Percentage of snowmobilers owners' visitation that continues as unguided use in the parks	100%	0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	8.1%	6.8%	5.5%	41%	34%	27%
Percentage of snowmobilers owners' visitation switched to guided snowmobile rentals	0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0%	0%	0%
Percentage of snowmobilers owners' visitation switched to snowcoaches	0%	29%	35.8%	28.7%	21.5%	35.8%	28.7%	21.5%	35.8%	28.7%	21.5%	28.6%	22.9%	17.2%	0%	0%	0%
Percentage reduction in visitation to GYA by snowmobilers owners	0%	42%	37.9%	42.2%	46.4%	37.9%	42.2%	46.4%	37.9%	42.2%	46.4%	36.2%	40.3%	44.3%	29%	33%	36%
Percentage of park visitation by snowmobilers owners that is substituted with visits to GYA outside parks	0%	29%	26.3%	29.2%	32.1%	26.3%	29.2%	32.1%	26.3%	29.2%	32.1%	27.0%	30.0%	33.0%	30%	33%	37%
Percentage of snowmobilers renters' visitation that continues unchanged	100%	0%	9.4%	10.5%	11.5%	13.8%	15.3%	16.8%	13.3%	14.8%	16.3%	17.9%	17.7%	17.5%	90%	88%	87%
Percentage of unguided snowmobilers renters' visitation switched to guided snowmobile rentals	0%	0%	41.9%	35.4%	29.0%	41.9%	35.4%	29.0%	41.9%	35.4%	29.0%	33.5%	28.3%	23.2%	0%	0%	0%
Percentage of snowmobilers renters' visitation switched to snowcoaches	0%	25%	22.6%	25.1%	27.6%	22.6%	25.1%	27.6%	22.6%	25.1%	27.6%	18.1%	20.1%	22.1%	0%	0%	0%

(continued)

Table 4-1. Summary of Scenarios Used in Analyzing Economic Impacts of Snowmobile Management Alternatives on GYA in 2004–2005 (continued)

	Historical Baseline[b,c]	Alternative 1	Alternative 2			Alternative 3			Alternative 4			Alternative 5					
			1	2	3	1	2	3	1	2	3	S1 (YNP)	S2 (YNP)	S3 (YNP)	S1 (GTNP)	S2 (GTNP)	S3 (GTNP)
Percentage reduction in visitation to GYA by snowmobilers renters	0%	34%	17.3%	19.2%	21.1%	17.3%	19.2%	21.1%	17.3%	19.2%	21.1%	14.8%	16.4%	18.0%	5%	5%	6%
Percentage of park visitation by snowmobilers renters that is substituted with visits to GYA outside parks	0%	41%	18.2%	20.3%	22.3%	18.2%	20.3%	22.3%	18.2%	20.3%	22.3%	15.8%	17.5%	19.3%	6%	6%	7%
Percentage change in snowcoach use by nonsnowmobilers	0%	4%	1.2%	1.4%	1.5%	–0.2%	–0.2%	–0.2%	1.2%	1.4%	1.5%	–0.2%	–0.2%	–0.2%	N/A	N/A	N/A
Percentage change in cross-country skiing and snowshoeing in YNP by nonsnowmobilers	0%	26%	3.3%	3.7%	4.1%	6.0%	6.7%	7.4%	3.3%	3.7%	4.1%	6.0%	6.7%	7.4%	N/A	N/A	N/A
Percentage change in cross-country skiing and snowshoeing in GTNP by nonsnowmobilers	0%	8%	3.1%	3.5%	3.8%	3.3%	3.7%	4.0%	3.1%	3.5%	3.8%	N/A	N/A	N/A	4%	4%	5%
Percentage change in other nonsnowmobiling activities by nonsnowmobilers[d]	0%	13%	0.9%	1.1%	1.2%	3.9%	4.4%	4.8%	0.9%	1.1%	1.2%	3.9%	4.4%	4.8%	16%	18%	19%

[a]The values presented for the Scenario 2 of Alternatives 1, 2, 3, 4, and 5 are based on survey results. Scenario 1 reflects a 10 percent decrease in the percentage of snowmobiles switching to each of the other categories, while Scenario 3 reflects a 10 percent increase.

[d]These percentages apply only to YNP visitors. The "other" nonsnowmobiling visitors in GTNP are generally much less affected by snowmobiles than visitors to YNP and are assumed not to change visitation in response to the management alternatives analyzed.

In all scenarios for each of the three alternatives, the number of snowmobilers will increase relative to baseline conditions, but the number of nonsnowmobilers may increase or decrease.

results, snowmobile owners react to a requirement that snowmobile use be limited to guided tours in an almost identical way to a ban on snowmobile use in the parks. There appears to be essentially no interest in guided tours among snowmobile owners.

In all scenarios for each of the four alternatives, the number of snowmobilers will decrease relative to historical baseline conditions, but the number of nonsnowmobilers in a particular category (e.g., cross-country skier or snowshoer, snowcoach rider, or other nonsnowmobilers) may increase or decrease.

Scenarios for 2005–2006 through 2006–2007. The scenarios that were analyzed for each management alternative for 2005–2006 and 2006–2007 are the same as for 2004–2005 for Alternatives 1, 2, 4, and 5. Under Alternative 3, 20 percent of the snowmobiles can be unguided starting in 2005-2006. The assumptions for Alternative 3 are the same as for Alternative 5, which also allows 20 percent unguided or noncommercially guided.

4.1.3 Costs

Costs to Snowmobilers

As discussed above in Section 4.1.2, Alternatives 1, 2, 3, 4, and 5 will hurt snowmobilers and providers of services to snowmobilers by restricting or eliminating snowmobile access to the parks. This section describes the consumer surplus losses to snowmobilers that will result from implementing the more restrictive management options compared to the historical baseline conditions.

If snowmobile use in the three parks is restricted, some riders who currently ride in the national parks for at least some portion of their trip to the area would experience a loss in consumer surplus. Snowmobile riders excluded from the parks because of daily entrance limits or a ban will lose consumer surplus. Similarly, riders who prefer unguided trips will lose consumer surplus if they have to take guided tours. However, if the parks are less crowded, snowmobile riders who continue to use the parks will benefit from reductions in crowding and other externalities associated with snowmobile use. To the

Discussions with park staff and rental shop owners suggest that they believe the majority of snowmobilers who currently use the park would not consider the national forests a good substitute.

extent that individuals consider areas in nearby national forests close substitutes, the loss in consumer surplus associated with restricting access by snowmobiles to the parks would be lessened. Discussions with park staff and rental shop owners suggest that they believe the majority of snowmobilers who currently use the park would not consider the national forests a good substitute for visiting YNP. Most riders in the park are interested in the chance to view unique natural features, such as the geysers, and plentiful wildlife that are not duplicated in the surrounding forests. However, discussions with park staff and rental shop owners also emphasized that avid snowmobilers prefer the longer, more challenging trails and varied terrain of the national forest. The 45-mph speed limit in the national parks may also be unattractive to some riders. Statistics from the *Winter 2002–2003 Visitor Survey* suggest that on average snowmobilers spend more time recreating outside the parks than inside the parks, whether snowmobiling in the national forests or downhill skiing at local resorts. These riders may continue to visit the GYA and suffer smaller losses in consumer surplus even if snowmobiles are banned in the three parks.

Results from the Winter 2002–2003 Visitor Survey *confirm that the majority of snowmobilers would not visit the park if snowmobiles were banned.*

Similarly, the loss in consumer surplus would be lessened to the extent that snowcoach tours of YNP offer an acceptable substitute for viewing the park. Business owners indicated that for some customers the coach tours are a very poor substitute for riding a snowmobile in the park and that some customers would not visit the park if snowmobiles were banned. Other customers are less interested in riding snowmobiles and more interested in seeing the sights of YNP and would find snowcoaches an acceptable substitute. Results from the *Winter 2002–2003 Visitor Survey* confirm that the majority of snowmobilers would not visit the park if snowmobiles were banned.

For each individual, consumer surplus for the chosen activity accounts for the value for substitute activities. Thus, the total change in consumer surplus would be the sum of the changes for each individual whose recreation choices were affected by the proposed alternative. Following the implementation of a cap on the number of snowmobiles permitted in the parks,

snowmobilers who are denied access to the parks, or are forced to switch to a second option for travel or forced to snowmobile on dates that are less than optimal would lose consumer surplus. However, those riders and other visitors who do get into the park may experience an increase in consumer surplus because it would be less crowded and the potential problems of noise, air emissions, and safety considerations associated with snowmobiles will be lessened. In addition, a requirement to be part of a guided tour to snowmobile in YNP would also diminish the consumer surplus of those riders who prefer to see the park at their own pace. On the other hand, consumer surplus may be increased for people who get enhanced enjoyment from the interpretive services offered by the guides in what may be for novices the more secure environment that is provided by snowmobiling with an experienced guide. Requirements for emission controls and the use of an NPS-trained guide will tend to increase the cost of snowmobiling in the parks. The various winter management alternatives discussed in this report present a variety of degrees of regulation of snowmobile numbers and technology and guide requirements.

For each alternative, WTP to shift from the historical baseline to the alternative on low and moderate crowding days was calculated. Using the predicted percentage of low and moderate crowding days under each alternative, a weighted WTP was created.

To calculate the consumer surplus losses to snowmobilers of moving from the historical baseline to the different alternatives, WTP estimates derived from the *Winter 2002–2003 Visitor Survey* were used. The survey and regression models used to calculate WTP in this report are described in Appendix 1. Table 4-2 contains the WTP estimates for each alternative. It must be emphasized that the WTP values reported in Table 4-2 represent mean estimates (within a range of uncertainty) based on the modeling approaches discussed in Appendix 1. For each alternative, WTP to shift from the historical baseline to the alternative on low, moderate, and high crowding days was calculated. Using the predicted percentage of low, moderate, and high crowding days under the historical baseline and each alternative, a weighted WTP was created. Table 4-3 presents the percentage of low, moderate, and high crowding days expected under each alternative, based on the definitions of high, moderate and low crowding used in the *Winter 2002–2003 Visitor Survey*. For GTNP, WTP is based on the assumption that all snowmobile trips are unguided and all days are low crowding.

Table 4-2. Per-Day WTP for Snowmobile Riders to Change from Historical Baseline to Alternatives 1, 2, 3, 4, and 5[a]

	Model 2[b]
Alternative 1 WTP[c]	–$30
Baseline high to Alternative 2 moderate crowding	–$30
Baseline high to Alternative 2 low crowding	$70
Baseline moderate to Alternative 2 low crowding	–$30
Alternative 2 weighted average WTP[c]	$0
Baseline high to Alternative 3 moderate crowding, 2005–2006, 2006–2007	–$30
Baseline high to Alternative 3 low crowding, 2005–2006, 2006–2007	$120
Baseline moderate to Alternative 3 low crowding, 2005–2006, 2006–2007	–$30
Alternative 3 weighted average WTP, 2005–2006, 2006–2007[c]	–$10
Baseline high to Alternative 3 moderate crowding, 2004–2005	–$30
Baseline high to Alternative 3 low crowding, 2004–2005	$70
Baseline moderate to Alternative 3 low crowding, 2004–2005	–$30
Alternative 3 weighted average WTP, 2004–2005[c]	–$20
Baseline high to Alternative 4 moderate crowding	–$30
Baseline high to Alternative 4 low crowding	$70
Baseline moderate to Alternative 4 low crowding	–$30
Alternative 4 weighted average WTP[c]	–$20
Baseline high to Alternative 5 moderate crowding	–$30
Baseline high to Alternative 5 low crowding	$120
Baseline moderate to Alternative 5 low crowding	–$30
Alternative 5 weighted average WTP[c]	–$10

[a]All dollar values in 2003 dollars, rounded to the nearest $10.

[b]Change in utility based on regression results for Model 2 for visiting under conditions when snowmobiles banned, see Table 6-7 of Appendix 1..

[c]Weighted average based on percentage of high, moderate, and low crowding days during the season.

WTP values reflecting changes in utility for snowmobile riders are estimated from Model 2 (mixed logit) and presented in Table 6-7 of Appendix 1.5 Most of the WTP numbers come

[5]Appendix 1 also presents results for Model 1, which relies on conditional logit estimation rather than mixed logit. The mixed logit form used in Model 2 is less restrictive and was determined to be a superior model. Thus, Model 2 results were used in the benefit-cost analysis rather than results from Model 1.

Table 4-3. Percentage of High, Moderate, and Low Crowding Days Expected During the Season in YNP[a]

	Historical Baseline	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Days high	33%				
Days moderate	63%	3%	19%	19%	19%
Days low	4%	97%	81%	81%	81%

[a]Moderate and low crowding are defined as in the survey described in Appendix 1 with the following adjustment: moderate is defined as 250 to 700 machines in YNP per day and low is defined as fewer than 250 machines in YNP per day. Based on the 2002–2003 winter season, visitation was adjusted for changes in visitation forecast under each alternative. The 2002–2003 winter season was assumed to start December 28 when the West Entrance opened.

from Table 6-9 in Appendix 1, while the rest were calculated based on the results in Table 6-7. Under Alternative 1, snowmobiles are banned from the park. The model results indicate that snowmobile riders lose on average $32 in consumer surplus when they cannot ride in YNP.[6] A negative WTP indicates that snowmobile riders would need to be compensated to reach the same level of welfare they experienced under historical baseline conditions. For the other alternatives, which allow snowmobiles but require guided tours for most or all of the riders, WTP values were calculated comparing utility from unguided snowmobile trips under historical conditions for high and moderate crowding[7] to utility under Alternatives 2, 3 (in 2004–2005), and 4 with guided tours and lower levels of crowding, noise and exhaust fumes (see Appendix 1 for details). A weighted average WTP was created assuming that riders who visited under high crowding conditions in the historical baseline will visit in moderate crowding under Alternatives 2 through 5 up to the percentage of moderate crowding days predicted for the alternative. The rest of the visitors will either switch from high to low crowding or from moderate to low crowding (and from unguided to guided tours).

[6]In this case, $32 is the WTP associated with not choosing one of the trips presented in the survey, but instead recreating outside YNP or staying home. See Appendix 1 for details.

[7] Although 4 percent of days are predicted to have low crowding under the historical baseline, these days were combined with moderate crowding days for the analysis.

Because most snowmobile riders prefer unguided tours, WTP to take a guided trip to YNP under some of the crowding assumptions generated WTP values that were less than -$32. In these cases, we used a WTP of -$32 assuming that these individuals would recreate outside YNP or stay home if their welfare loss from taking a guided tour in YNP was greater than their welfare loss for not visiting the park. Alternatives 3 (in 2005-2006 and 2006-2007) and 5 allow for 20 percent of the riders to be unguided or non-commercially guided. WTP for these alternatives was calculated as a weighted average of guided and unguided WTP. For GTNP, we assumed no change in consumer surplus under Alternatives 2 though 5. GTNP already has low snowmobile visitation using the definitions from the 2002-2003 Winter Use Survey, so the daily entrance limits specified in the alternatives would not result in a radically different experience for these riders.

In all 5 alternatives, the only riders with consumer surplus benefits compared to the historical baseline are those who visited under high crowding conditions (on an unguided tour) in the historical baseline, but would visit under low crowding conditions (on a guided tour) under the alternative.

Using the WTP values from Table 4-2, the total consumer surplus benefits for snowmobilers under Alternatives 1, 2, 3, 4, and 5 compared to the historical baseline were calculated. Table 4-4 presents the estimates of total consumer surplus gains for 2004–2005 through 2006–2007 under Scenario 2 of each alternative. For Alternative 1 we assumed that all riders projected to visit the parks under the historical baseline would lose consumer surplus. For Alternatives 2 through 5 we assumed that snowmobile riders who did not continue to ride a snowmobile in the park lost $32 in consumer surplus. Riders who participated in guided tours or unguided and noncommercially guided trips were assumed to lose the weighted WTP value associated with the alternative. Looking at Table 4-4, over the 3-years, Alternative 1 generates the largest losses to snowmobile riders. Among the alternatives that allow snowmobiles in the park, Alternative 4 generates the largest losses while Alternative 5 generates the smallest losses. Alternative 5 has the highest daily limits and the provision for

Table 4-4. Total Consumer Surplus Losses for Snowmobile Riders under Alternatives 1, 2, 3, 4, and 5 Relative to the Historical Baseline: 2004–2005 to 2006–2007

	Alternative 1 Weighted Average WTP[a, b]	Alternative 2 Weighted Average WTP[a, b]	Alternative 3 Weighted Average WTP[a, b]	Alternative 4 Weighted Average WTP[a, b]	Alternative 5 Weighted Average WTP[a, b]
2004–2005	–$3,453,760	–$1,943,310	–$2,019,610	–$2,019,610	–$1,607,310
2005–2006	–$3,527,040	–$1,989,640	–$1,647,330	–$2,052,230	–$1,633,860
2006–2007	–$3,598,400	–$2,035,240	–$1,686,750	–$2,083,440	–$1,659,310

[a]Weighted average based on percentage of high, moderate and low crowding days during the season.

[b]Utility under the historical baseline based on regression results for Model 2, see Table 6-7 of Appendix 1.

Note: All dollar values in 2003 dollars, rounded to the nearest $10.

20 percent of the trips to be noncommercially guided. Note that these estimates represent welfare losses to snowmobile riders who took unguided trips under historical baseline conditions. Snowmobile riders who took guided trips under the historical baseline and will continue to take guided trips under all the alternatives except Alternative 1 should experience an increase in consumer surplus due to the decrease in crowding and other externalities associated with snowmobiles. The increase in consumer surplus for current guided snowmobile visitors is not quantified in this report.

Costs to Businesses

Compared to the baseline delay rule, Alternatives 2, 3, 4, and 5 will result in increased numbers of snowmobiles in YNP, GTNP, and the Parkway. The increase will positively affect the suppliers of snowmobile and other tourism-related services in the GYA.

Compared to the historical baseline, Alternatives 1, 2, 3, 4, and 5 will result in decreased numbers of snowmobiles in YNP, GTNP, and the Parkway. The decrease will negatively affect the suppliers of snowmobile and other tourism-related services in the GYA. Based on survey results, NPS expects a decrease in the number of park visitors under Alternatives 1, 2, 3, 4, and 5 relative to the baseline. Thus, most businesses are expected to lose business from implementation of Alternatives 1, 2, 3, 4, and 5, although there are projected to be increases in nonsnowmobilers. Businesses that specialize in nonsnowmobile-related activities may experience increases in revenue relative to baseline conditions.

Following the methodology outlined in Section 3, for each alternative and each visitation change scenario, revenue changes were calculated for eight spending/business categories. To estimate these values, scenario-specific estimates of the change in the number of visitors were multiplied by the average (per visitor) spending in each category, based on responses to the visitor survey. To translate changes in revenue into changes in producer surplus for the purposes of benefit-cost analysis, NPS used estimates of the increase in revenue associated with each scenario and the return-on-sales measure for the SIC code provided by Dun & Bradstreet (see Section 3 for SIC and profit margins).

The use of this profit margin only approximates gains in producer surplus. Producer surplus captures the difference between marginal costs and marginal revenue, while return on

sales contains other measures reflecting fixed costs, taxes, and/or accounting conventions rather than measures of variable profits. For this reason, the use of D&B accounting profit margin data may understate producer surplus gains.

Tables 4-5a through 4-5e present the estimated change in producer surplus for the five alternatives for the three years covered by this analysis.

Impacts through National Park Expenditures in YNP, GTNP, or the Parkway of Alternative 1, 2, 3, 4, or 5

Snowmobilers pay $15 for a 7-day pass to enter the parks. Revenue from entrance fees will decline relative to the historical if visitation to the parks declines (if snowmobile visitation is not offset by increases in visitation by snowcoach riders or skiers).[8] A decrease in entrance fee revenue may have welfare impacts on local businesses, local residents, and visitors. To the extent that local workers or businesses are hired by YNP, GTNP, or the Parkway to work in the park, there may be losses in producer surplus if the parks spend more money in the surrounding communities. Park visitors' welfare may be affected to the extent that there is less revenue for maintenance and improvements in the park.

Impacts through the Town of West Yellowstone of Alternative 1, 2, 3, 4, or 5

West Yellowstone, Montana, applies a 3 percent resort tax to lodging, dining, bars, snowmobile rentals, and souvenir sales (Neher, Robison, and Duffield, 1997). A decrease in visitors to West Yellowstone as a result of Alternative 1, 2, 3, 4, or 5 relative to the historical baseline would also affect the tax revenue and public services provided by the town to citizens and visitors. The welfare of businesses and individuals may be affected to the extent that fewer services are provided as a result of a decrease in tax revenue, most of which is paid by visitors from outside the community. For example, several local officials and businessmen mentioned the importance of the resort tax for funding the local schools. In addition, if there are decreases in employment following the imposition of new

[8]National parks are permitted to keep a significant portion of their entrance fee revenue to fund projects and services within the park. Thus, a reduction in entrance fee revenue may lead to a decline in resources available to the park.

Table 4-5a. Alternative 1 Estimated Change in Producer Surplus, 2004–2005 to 2012–2013

	Alternative 1	
	Low	High
2004–2005	–$35,080	–$542,250
2005–2006	–$35,850	–$554,040
2006–2007	–$36,570	–$565,570

Note: Rounded to the nearest $10.

Table 4-5b. Alternative 2 Estimated Change in Producer Surplus, 2004–2005 to 2012–2013

	Alternative 2					
	Scenario 1		Scenario 2		Scenario 3	
	Low	High	Low	High	Low	High
2004–2005	–$16,990	–$151,630	–$21,390	–$239,850	–$25,800	–$328,080
2005–2006	–$17,370	–$154,870	–$21,690	–$240,040	–$26,020	–$325,210
2006–2007	–$17,740	–$158,030	–$22,160	–$245,100	–$26,580	–$332,180

Note: Rounded to the nearest $10.

Table 4-5c. Alternative 3 Estimated Change in Producer Surplus, 2004–2005 to 2012–2013

	Alternative 3					
	Scenario 1		Scenario 2		Scenario 3	
	Low	High	Low	High	Low	High
2004–2005	–$15,710	–$135,430	–$19,310	–$209,180	–$22,890	–$282,950
2005–2006	–$11,610	–$85,220	–$13,670	–$125,610	–$15,740	–$166,010
2006–2007	–$10,910	–$65,610	–$13,250	–$113,600	–$15,580	–$161,600

Note: Rounded to the nearest $10.

Table 4-5d. Alternative 4 Estimated Change in Producer Surplus, 2004–2005 to 2012–2013

	Alternative 4					
	Scenario 1		Scenario 2		Scenario 3	
	Low	High	Low	High	Low	High
2004–2005	–$16,580	–$147,340	–$20,900	–$233,870	–$25,210	–$320,410
2005–2006	–$16,850	–$149,370	–$21,050	–$231,940	–$25,240	–$314,520
2006–2007	–$17,100	–$151,280	–$21,360	–$235,160	–$25,630	–$319,040

Note: Rounded to the nearest $10.

Table 4-5e. Alternative 5 Estimated Change in Producer Surplus, 2004–2005 to 2012–2013

	Alternative 5					
	Scenario 1		Scenario 2		Scenario 3	
	Low	High	Low	High	Low	High
2004–2005	–$10,620	–$62,950	–$12,900	–$109,850	–$15,170	–$156,770
2005–2006	–$10,820	–$64,470	–$13,110	–$111,820	–$15,420	–$159,160
2006–2007	–$10,880	–$64,510	–$13,320	–$113,710	–$15,760	–$162,910

Note: Rounded to the nearest $10.

regulations, then the loss in residents in West Yellowstone may also negatively affect the viability of the school and other public services.

4.1.4 Benefits

As described in Sections 2.7 and 3.1, as well as Appendix 2, snowmobile use in national parks can be linked to a variety of negative externalities for nonsnowmobilers. Section 2.7 specifically describes the impacts on natural resources that could result from snowmobile use within the boundaries of YNP, GTNP, and the Parkway. This section assesses the benefits of the five proposed management alternatives resulting from a decrease in the negative impacts of snowmobile use.

Nonsnowmobiling winter recreators in YNP and GTNP whose park experience is negatively affected by the presence of snowmobiles receive the majority of the benefits from regulations restricting snowmobile access to the parks.

Nonsnowmobiling winter recreators in YNP and GTNP whose park experience is negatively affected by the presence of snowmobiles receive the majority of the benefits from regulations restricting snowmobile access to the parks. Among the more popular activities and means of experiencing the parks during the winter season other than snowmobiling are cross-country skiing, snowshoeing, winter hiking, automobile touring, and snowcoach touring. As shown in Table 2-3, in 2002–2003 the number of winter recreation visits to the park was 112,736 to YNP, and nonsnowmobile visitors accounted for just over 46 percent of these visits.

Negative externalities associated with snowmobiles may reduce the value of trips to YNP, GTNP, and the Parkway. Reductions in the number of snowmobiles will cause an increase in consumer surplus for nonsnowmobilers. Snowcoach passengers and cross-country skiers are particularly susceptible

to the externalities of snowmobile use. Snowcoach passengers share snowmobilers' routes through the park and are exposed to high concentrations of exhaust and noise at popular stopping points. An added stress is put on cross-country skiers recreating in the vicinity of snowmobile routes when they are forced to breathe snowmobile emissions. For reasons discussed in more detail in Section 3.2.4, Alternatives 1, 2, 3, 4, and 5 result in consumer surplus losses for nonsnowmobiling visitors relative to the historical baseline.

Consumer Surplus Gains

Primarily because of impacts from snowmobile sound and air emissions, there are expected to be consumer surplus gains to nonsnowmobilers of moving from the historical baseline to the different alternatives. To quantify these welfare gains, NPS used WTP estimates derived from the 2002-2003 Winter Visitor Survey. The survey and regression models used to calculate WTP in this report are described in Appendix 1. Table 4-6 presents the WTP estimates for each alternative. The WTP values are based on the Model 2 regression results presented in Table 6-7 and Table 6-9 of Appendix 1. For each alternative, WTP to move from the historical baseline to the alternative on low, moderate, and high crowding days were calculated.

Using the predicted percentage of low, moderate, and high crowding days under each alternative, a weighted WTP was created (see Table 4-3 for the percentage of low, moderate, and high crowding days expected under each alternative). WTP is calculated for moving from the historical baseline to Alternatives 1, 2, 3, 4, and 5. While the WTP estimates under low, moderate, and high crowding are the same across all the alternatives except Alternative 1, the weighted WTP varies because of differences in the forecasted number of low and moderate crowding days. In the *Winter 2002–2003 Visitor Survey*, the valuation questions used to calculate WTP described conditions in the park in terms of crowding, noise, emissions, and road surface conditions. The survey did not include an attribute describing whether all the snowmobiles were on guided tours; thus, the measured WTP of nonsnowmobilers is not affected by this management provision. To the extent that nonsnowmobilers prefer that snowmobile

Table 4-6. Per-Day WTP for Nonsnowmobile Riders to Change from Historical Baseline to Alternatives 1, 2, 3, 4, and 5[a]

	Model 2[b]
Baseline high to Alternative 1	$440
Baseline moderate to Alternative 1	$280
Alternative 1 weighted average WTP[c]	$320
Baseline high to Alternative 2 moderate crowding	$160
Baseline high to Alternative 2 low crowding	$350
Baseline moderate to Alternative 2 low crowding	$200
Alternative 2 weighted average WTP[c]	$240
Baseline high to Alternative 3 moderate crowding	$160
Baseline high to Alternative 3 low crowding	$350
Baseline moderate to Alternative 3 low crowding	$200
Alternative 3 weighted average WTP[c]	$210
Baseline high to Alternative 4 moderate crowding	$160
Baseline high to Alternative 4 low crowding	$350
Baseline moderate to Alternative 4 low crowding	$200
Alternative 4 weighted average WTP[c]	$210
Baseline high to Alternative 5 moderate crowding	$160
Baseline high to Alternative 5 low crowding	$350
Baseline moderate to Alternative 5 low crowding	$200
Alternative 5 weighted average WTP[c]	$210

[a]All dollar values in 2003 dollars, rounded to the nearest $10.

[b]Change in utility based on regression results for Model 2 for visiting under conditions when snowmobiles banned, see Table 6-7 of Appendix 1.

[c]Weighted average based on percentage of high, moderate, and low crowding crowding days during the season.

Note: There may be unquantified differences in WTP between these alternatives. For instance, the Winter Visitor Survey did not include an attribute describing whether all the snowmobiles were on guided tours or not. Thus, measured WTP is not affected by this management provision.

riders are part of a guided tour, the welfare gains for Alternatives 3 and 5 will be smaller. Note that the WTP values are based on responses from nonsnowmobile visitors who visited in 2002-2003 under historical conditions. They do not reflect the WTP of people who do not currently visit YNP in the winter but who might visit if snowmobiles are restricted or banned. Their WTP may be larger or smaller.

Using the WTP values from Table 4-6, NPS calculated the total consumer surplus gains for nonsnowmobilers under Alternatives 1, 2, 3, 4, and 5 to the historical baseline. Total consumer surplus gains were calculated by multiplying the weighted average WTP for each alternative by the number of nonsnowmobile visitors in the park under historical baseline conditions, who are assumed to continue visiting, plus new nonsnowmobile visitors who will come as a result of restrictions on snowmobile use. Note that we assume the same WTP value calculated for current nonsnowmobile visitors for new visitors. Table 4-7 summarizes the estimated consumer surplus gains in each year from 2004–2005 through 2006-2007.

Table 4-7. Total Consumer Surplus Gains for Nonsnowmobile Riders for Alternatives 1, 2, 3, 4, and 5, 2004–2005 through 2006–2007[a,b]

	Alternative 1 Weighted Average WTP[c]	Alternative 2 Weighted Average WTP[c]	Alternative 3 Weighted Average WTP[c]	Alternative 4 Weighted Average WTP[c]	Alternative 5 Weighted Average WTP[c]
2004–2005	$45,497,290	$31,938,970	$28,062,930	$27,783,100	$28,062,930
2005–2006	$46,825,970	$32,885,390	$28,890,980	$28,606,380	$28,890,980
2006–2007	$48,163,980	$33,839,310	$29,725,377	$29,411,326	$29,725,380

[a]All dollar values in 2003 dollars, rounded to the nearest $10.

[b]Utility under the baseline (Alternative 1) based on regression results for Model 2 for visiting under conditions when snowmobiles banned, see Table 6-7 of Appendix 1.

[c]Weighted average based on percentage of moderate and low crowding days during the season.

Benefits to "nonusers" of the park are also likely to result from Alternatives 1 through 5 (see Section 3.1 and Appendix 2 for additional details). For example, individuals who do not visit the parks can benefit simply from the knowledge that the natural resources of the park are being protected. Part of this benefit may stem from an increased assurance that the quality

of the parks' resources is being protected for the enjoyment of future generations.[9]

Other Benefits

Other potential benefits from Alternatives 1 through 5 include those associated with the risks of snowmobile-related safety hazards and continued impairments in the quality of the groomed surface for oversnow vehicles. By reducing the number of vehicles in the park, snowmobile restrictions would improve the quality of the groomed surface of the oversnow routes in the parks. Under heavy traffic conditions (particularly from the West Entrance to Old Faithful), the groomed surface can become very rough and unpleasant for both snowcoach riders and snowmobilers.

To the extent that snowmobilers are unaware of the risks that they face on the park roads, restrictions on snowmobile use would benefit these individuals by protecting their safety.[10] Restrictions would also benefit nonsnowmobiling recreators by reducing their risks of being involved in accidents with snowmobiles. Reducing snowmobile-related accidents would also reduce the costs to NPS associated with medical/rescue operations, which would allow these resources to be redirected to other park management activities.

In general, reducing snowmobile activity in the park would allow NPS to redirect resources that are currently devoted to snowmobile-related activities to other park management activities.

In general, reducing snowmobile activity in the park would allow NPS to redirect resources that are currently devoted to snowmobile-related activities to other park management activities. Incidents in the park that involve either general ranger support or law enforcement incidents involve a disproportionate number of snowmobiles relative to total winter visitors. Ultimately the alternatives would eliminate or reduce these demands on park resources as they relate to snowmobile

[9]The importance of recognizing these values is affirmed in the Organic Act. It established the fundamental purpose of the national park system, which includes providing for the enjoyment of park resources and values by the people of the United States. The mandate applies not just to the people who visit parks—but to all people—including those who derive inspiration and knowledge from afar. Furthermore, through the Redwood Act of March 27, 1978, Congress has provided that when there is a conflict between conserving national park resources and values and providing for enjoyment of them, conservation is to be the primary concern.

[10]If snowmobilers are fully aware of the risks, NPS assumes that these effects are already discounted from the per-trip consumer surplus estimates for snowmobilers.

use (although grooming would be required for snowcoach travelers).

4.1.5 Uncertainty

A number of factors will affect the estimated costs and benefits associated with the snowmobile management alternatives being analyzed. Multiple scenarios were developed for Alternatives 2, 3, 4, and 5 to show the impacts of varying assumptions concerning the number of visitors that will continue to visit the GYA to participate in various activities. Nonetheless, many additional uncertainties remain. Some of the main sources of uncertainty include the following:

Although NPS has provided their best estimates of the costs and benefits associated with the alternatives being analyzed, numerous sources of uncertainty may influence the results.

- The sample of visitors included in the *Winter 2002–2003 Visitor Survey* was primarily intercepted in YNP. Using the WTP estimates from the YNP sample for nonsnowmobilers in GTNP may overstate the consumer surplus gains associated with Alternatives 1, 2, 3, 4, and 5. It was assumed that there are no welfare impacts on the other nonsnowmobiler category in GTNP of reinstating snowmobile use because these users are unlikely to be substantially affected by snowmobiles. However, large gains to cross-country skiers and snowshoers in GTNP resulting from Alternatives 1, 2, 3, 4, and 5 are calculated based on using the per-day WTP estimate from the YNP sample. To the extent that nonsnowmobilers in GTNP are less affected by snowmobiles, this may tend to overstate welfare gains of reinstating snowmobiles.
- As discussed in the *Winter 2002–2003 Visitor Survey* report (included in Appendix 1), the losses to snowmobilers of Alternatives 1, 2, 3, 4, and 5 may be understated because the survey focused on day trips. It appears that snowmobilers prefer to be outside the park for a single day spent snowmobiling but may still prefer to visit YNP or GTNP as one part of a multiday trip to the GYA. In other words, while they may have higher WTP for trips outside the parks than inside on a given day of their trip, the WTP for their entire trip to the GYA would be higher if they could spend part of their trip in the parks and they may choose not to make the trip to the GYA if the parks are not available for snowmobiling. Thus, focusing on day trips may understate the value of being able to snowmobile in the parks to snowmobilers' consumer surplus.

- Although NPS attempted to limit strategic behavior through the survey design (see Appendix 1), it is possible that snowmobilers are overstating the amount they would reduce their trips under Alternatives 1, 2, 3, 4, and 5.
- Just as there may be strategic bias exhibited by snowmobilers, nonsnowmobilers may be overstating the increase in the number of trips they would make to the GYA if snowmobiles were banned. In addition, they may be overstating the reduction in the number of trips relative to current conditions they would make if under Alternative 2, 3, 4, or 5. Both of these potential biases will tend to overstate the gains to nonsnowmobilers associated with Alternatives 2, 3, 4, and 5.
- The stated behavior questions in the *Winter 2002–2003 Visitor Survey* indicate that everyone would have to use snowmobiles with four-stroke engines, so people may have said they would not visit if they do not currently own a compliant snowmobile. The baseline for this analysis does not reflect this technology shift over time. However, this will become less of an issue over time as people replace their old snowmobiles. Thus, the number of snowmobilers that would visit in future years under Alternatives 3 and 5 (alternatives where unguided and/or noncommercial guided access is maintained) may be understated.
- To the extent that there are current nonvisitors who would start visiting the GYA if snowmobiles were restricted in YNP and GTNP, gains to nonsnowmobilers under Alternatives 1, 2, 3, 4, and 5 will be understated.
- There is insufficient information available to include welfare impacts on people who do not visit the park but derive welfare from the knowledge that the park's natural resources are protected. Including nonuse values would increase the consumer surplus losses associated with Alternatives 1, 2, 3, 4, and 5.
- The rule proposal process itself may have affected the number of snowmobile users who visited YNP and GTNP in recent years. Any change in visitation resulting from uncertainty over future restrictions in the parks that has occurred over the last few years will influence all of the projections used in the analysis. However, it is not clear whether the prospect of future restrictions would cause an increase or decrease in visitation. It may lead to an increase as people attempt to access YNP and GTNP prior to additional restrictions being implemented.

- The estimates of producer surplus gains do not account for adaptations that businesses may have made if snowmobiles had not been permitted in the parks. Businesses may have been able to partially offset their losses from reductions in snowmobile visitors through adaptations to address the demands of a different mix of visitors. Thus, by not including this adaptive behavior, the estimates in this report may similarly overstate losses to local businesses from restricting snowmobile use.
- EPA regulations phasing in emissions reductions from new snowmobiles over the period from 1996 to 2006 are expected to increase the cost of producing snowmobiles over time. The corresponding increase in the market price of snowmobiles may lead to a reduction in sales that would reduce baseline snowmobile ownership and use relative to the projected levels. This would tend to reduce the incremental costs attributable to NPS regulations in future years. However, cost increases due to these regulations are probably captured in the current baseline to some degree because the rule has already required some reduction in emissions.

4.2 SUMMARY

Five alternatives are analyzed to examine the effect of restricting the use of snowmobiles in the YNP, GTNP, and the Parkway relative to the historical baseline. Alternative 1 prohibits snowmobile use in the parks. Alternatives 2, 3, 4, and 5 allow for continued recreational snowmobile use subject to daily limits on the number of snowmobiles that can enter the parks and requirements for guided tours.

The primary losses under Alternatives 1, 2, 3, 4, and 5 are to park visitors who ride snowmobiles in the park and the businesses that serve them. Changes in welfare, whether benefits or losses, accruing to individual visitors are called consumer surplus changes and those accruing to businesses are called producer surplus changes. Consumer surplus measures the net economic benefit obtained by individuals from participating in their chosen activities, while producer surplus measures the net economic benefit obtained by businesses from providing services to individuals. Overall, Alternative 1 should impose greater consumer surplus loses on snowmobilers than other alternatives. Alternative 1 bans snowmobile use in

the parks, while the daily caps on snowmobile use vary across the four other alternatives, with Alternative 2 allowing the fewest number of snowmobiles in the park each day. Alternatives 2, 3 (in 2004-2005) and 4 require all snowmobilers to be part of a guided tour. Alternatives 3 (after 2004-2005) and 5 (in 2004-2005), however, allow a small portion (20 percent) of snowmobile access to be unguided. After 2004-2005, Alternative 5 allows for the 20 percent of the tours to be led by noncommercial guides, which we treat as unguided. The guided tour component of the alternatives is expected to reduce the consumer surplus gains to snowmobilers who prefer unguided tours or who face additional expenses from being forced to take a guided tour. In 2004–2005, Alternative 5 does not require BAT snowmobiles for the 20 percent unguided, while the other alternatives require BAT the first year. Again, the technology provisions may reduce consumer surplus for snowmobilers by increasing costs to snowmobilers who want to use machines that do not conform to the technology standards.

Table 4-8 summarizes the change in per-day consumer surplus that results from moving to alternatives with higher net benefits. Moving from the historical baseline to Alternative 4 results in an incremental reduction in WTP of $20 for snowmobilers, but an increase of $210 for nonsnowmobilers. Going from Alternative 4 to Alternative 3 does not affect WTP for snowmobilers, but increases WTP for nonsnowmobilers by $30. From Alternative 3 to Alternative 5, both snowmobilers and nonsnowmobilers have no change in estimated WTP. Alternative 2 increases snowmobiler WTP by $10 and nonsnowmobiler WTP by $30 relative to Alternative 5. Finally, Alternative 1 decreases snowmobiler WTP by $30, but increases nonsnowmobiler WTP by $80.

As with the consumer surplus losses described above, the gains of any alternative are measured relative to the baseline conditions, which are represented by the historical baseline. The primary consumer group that would gain under Alternatives 1, 2, 3, 4, and 5 would be the park visitors who do not ride snowmobiles. Alternative 1 results in the greatest consumer surplus gains for nonsnowmobilers and the greatest losses for snowmobilers. Out of the set of alternatives allowing continued

Table 4-8. Incremental Per-Day Consumer Surplus Between Alternatives as Stringency Increases

	Baseline to Alternative 4	Alternative 4 to Alternative 3 (2005–2006 and 2006–2007)	Alternative 3 (2005–2006 and 2006–2007) to Alternative 5	Alternative 5 to Alternative 2	Alternative 2 to Alternative 1
Snowmobile, Model 2 baseline	–$20	$0	$0	$10	-$30
Nonsnow-mobile[c]	$210	$30	$0	$30	$80

Notes: All dollar values in 2003 dollars, rounded to the nearest $10. WTP calculated using weighted average WTP (weighted by proportion of low, moderate, and high crowding days)

snowmobile access to the parks, Alternative 2 is expected to generate the largest gains for nonsnowmobile visitors because of the lower daily limits, stricter technology requirements, and the guided tour requirement relative to Alternatives 3, 4, and 5. Alternative 4 is expected to generate only slightly lower gains for nonsnowmobile users than Alternative 2, with the biggest difference between Alternatives 2 and 4 coming from the higher daily use limits under Alternative 4.

For businesses, the producer surplus losses relative to the historical baseline are expected to be ordered in the same way as consumer surplus losses to snowmobilers because they are driven largely by the number of visitors. Alternative 1 is expected to have the greatest negative impact on local businesses because it places the highest restrictions on snowmobilers and is expected to result in the largest decrease in visitation. Alternative 5 is the least restrictive option for snowmobilers and is expected to result in the smallest decrease in visitation relative to the historical baseline among Alternatives 1, 2, 3, 4, and 5.

Table 4-9 summarizes the present value of the total quantified benefits and costs of each alternative relative to the historical baseline for 2004–2005 through 2006–2007. Table 4-10 shows the incremental costs and benefits associated with moving from the historical baseline to Alternative 4, then from Alternative 4

Table 4-9. Present Value of Projected Incremental Costs and Benefits Under Alternatives 1, 2, 3, 4, and 5 Relative to the Historical Baseline, 2004–2005 to 2006–2007[a]

	Change in Consumer Surplus for Snowmobilers (Benefit)	Change in Consumer Surplus for Nonsnowmobilers (Cost)	Change in Producer Surplus for Businesses (Benefit)
Alternative 1			
Discounted at 3%[b]	–$9,970,780	$132,386,960	–$101,320 to –$1,566,270
Discounted at 7%[c]	–$9,245,830	$122,736,600	–$93,950 to –$1,452,370
Alternative 2			
Discounted at 3%[b]	–$5,624,670	$92,974,100	-$49,100 to -$929,050
Discounted at 7%[c]	–$5,215,370	$86,195,830	-$45,530 to -$861,820
Alternative 3			
Discounted at 3%[b]	–$5,057,170	$81,681,020	-$36,180 to -$579,070
Discounted at 7%[c]	–$4,703,220	$75,726,300	-$33,730 to -$541,350
Alternative 4			
Discounted at 3%[b]	–$5,801,850	$80,853,670	-$47,630 to -$899,500
Discounted at 7%[c]	–$5,380,690	$74,959,840	-$44,170 to -$834,590
Alternative 5			
Discounted at 3%[b]	–$4,619,070	$81,681,020	-$30,460 to -$451,310
Discounted at 7%[c]	–$4,283,730	$75,726,300	-$28,250 to -$418,510

[a]The range for snowmobiles' change in consumer surplus reflects the different values obtained using estimates from the RUM and Model 2 results to estimate baseline utility. For nonsnowmobilers, only the Model 2 baseline was estimated and results are provided relative to that baseline. The range for producer surplus reflects the lowest and highest estimates across all three scenarios for each alternative.

[b]The economics literature supports a 3 percent discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3 percent discount rate in the valuation of lost natural resources use (61 FR 453; 61 FR 20584). While the welfare impacts in this case are for private goods, the 3 percent discount rate was used to be consistent with discounting of other impacts in this report.

[c]Office of Management and Budget (OMB). 2003. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 2003.

Note: All dollar values in 2003 dollars, rounded to the nearest $10.

Table 4-10. Incremental Costs and Benefits Between Alternatives Relative to the Historical Baseline, 2004–2005 to 2006–2007

	Snowmobilers	Nonsnowmobilers	Businesses
Baseline Relative to Alternative 4			
Discounted at 3%[a]	–$5,801,850	$80,853,670	–$47,630 to –$899,590
Discounted at 7%[b]	–$5,380,690	$74,959,840	–$44,170 to –$834,590
Alternative 4 Relative to Alternative 3			
Discounted at 3%[a]	$744,680	$827,350	$11,450 to $320,430
Discounted at 7%[b]	$677,470	$766,460	$10,440 to $293,240
Alternative 3 Relative to Alternative 5			
Discounted at 3%[a]	$438,100	$0	$5,720 to $127,760
Discounted at 7%[b]	$419,490	$0	$5,480 to $122,840
Alternative 5 Relative to Alternative 2			
Discounted at 3%[a]	-$1,005,600	$11,293,080	-$18,640 to -$477,740
Discounted at 7%[b]	-$931,640	$10,469,530	-$17,280 to -$443,310
Alternative 2 Relative to Alternative 1			
Discounted at 3%[a]	-$4,346,110	$39,412,860	–$52,220 to –$637,220
Discounted at 7%[b]	-$4,030,460	$36,540,770	–$48,420 to –$590,550

[a]The economics literature supports a 3 percent discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3 percent discount rate in the valuation of lost natural resources use (61 FR 453; 61 FR 20584). While the welfare impacts in this case are for private goods, the 3 percent discount rate was used to be consistent with discounting of other impacts in this report.

[b]Office of Management and Budget (OMB). 2003. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 22, 2002.

Note: All dollar values in 2003 dollars, rounded to the nearest $10.

to Alternative 3, next from Alternative 3 to Alternative 5, then from Alternative 5 to Alternative 2, and finally from Alternative 2 to Alternative 1 (in order of increasing net benefits).

Based on the results of this analysis, the gains to nonsnowmobilers generally outweigh the losses to snowmobilers and local businesses. However, as noted earlier in this section, there are a number of uncertainties that may be influencing this result. The most important factor is the fact

that the total costs and benefits provided in Table 4-9 transfer WTP values based primarily on a YNP sample to GTNP. This transfer of WTP values may overstate the gains to nonsnowmobilers associated with the reduction of snowmobiles in the parks because there are far fewer snowmobiles in GTNP than in YNP, which implies that nonsnowmobilers may be less impacted by their presence. In addition, snowmobile use in GTNP tends to be in separate areas of the park from nonsnowmobile activities to a much greater extent than for YNP where there is much more overlap in the areas used by these visitors. Using WTP values from YNP in GTNP is more likely to overstate gains to nonsnowmobilers than losses to snowmobilers under these alternatives because snowmobiles are restricted in similar ways between the two parks but nonsnowmobilers may be affected quite differently.

No welfare impacts were calculated for the other nonsnowmobiler category in GTNP because these visitors are primarily driving through the park and are assumed to be relatively unaffected by snowmobiles. However, there are a very large number of cross-country skiers and snowshoers in GTNP that are being assumed to receive large welfare gains under Alternatives 1, 2, 3, 4, and 5 based on the estimated losses to cross-country skiers and snowshoers in YNP. To the extent that cross-country skiers and snowshoers in GTNP are less affected by snowmobiles than those in YNP, welfare gains of restricting snowmobiles will be overstated.

In addition, it is possible that both snowmobilers and nonsnowmobilers are providing responses displaying strategic bias that influences the results in the same direction. Nonsnowmobilers may be overstating the gains they would receive from restricting snowmobiles in the parks, while snowmobilers may be overstating their reduction in visitation under restrictions. However, steps were taken in the design of the survey to minimize the potential for strategic bias and there is no evidence that strategic bias is present in the survey results.

Table 4-11 presents the total present value of net benefits for both YNP and GTNP. In this valuation case, the nonsnowmobile visitors to GTNP are assigned the same unit benefits as

nonsnowmobile visitors to YNP. This valuation case may overstate the benefits to nonsnowmobile visitors to GTNP because they are believed to be less than the benefits accruing to nonsnowmobile visitors in YNP. The annualized net benefits per year over the 10-year time frame of the analysis for this valuation case are presented in Table 4-12.

The range of net benefits for the valuation case represented by Tables 4-11 and 4-12 is entirely positive for all alternatives considered.

Table 4-11. Total Present Value of Net Benefits for Yellowstone and Grand Teton National Parks Relative to the Historical Baseline, 2004–2005 to 2006–2007

	Total Present Value of Net Benefits[a]
Alternative 1	
Discounted at 3%[b]	$122,314,860 to $130,820,690
Discounted at 7%[c]	$113,396,820 to $121,284,230
Alternative 2	
Discounted at 3%[b]	$87,300,330 to $92,045,050
Discounted at 7%[c]	$80,934,930 to $85,334,010
Alternative 3	
Discounted at 3%[b]	$76,587,670 to $81,101,950
Discounted at 7%[c]	$70,989,350 to $75,184,950
Alternative 4	
Discounted at 3%[b]	$75,004,190 to $79,954,170
Discounted at 7%[c]	$69,534,980 to $74,125,250
Alternative 5	
Discounted at 3%[b]	$77,031,490 to $81,229,710
Discounted at 7%[c]	$71,414,320 to $75,307,790

[a]The range in net benefits reflects the different values obtained for snowmobile visitors using the estimates from two economic valuation models, and the different scenarios analyzed for impacts to businesses.

[b]The economics literature supports a 3 percent annual discount rate in the valuation of public goods (e.g., Freeman 1993). Federal rulemakings also support a 3 percent annual discount rate in the valuation of lost natural resource use (61 FR 453; 61 FR 20584).

[c]Office of Management and Budget (OMB). 2003. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 2003.

Note: All dollar values in 2003 dollars, rounded to the nearest $10.

Table 4-12. Amortized Net Benefits per Year for Yellowstone and Grand Teton National Parks Relative to the Historical Baseline, 2004–2005 to 2006–2007

	Amortized Net Benefits per Year[a]
Alternative 1	
Discounted at 3%[b]	$43,242,020 to $46,249,090
Discounted at 7%[c]	$43,210,050 to $46,215,560
Alternative 2	
Discounted at 3%[b]	$30,863,320 to $32,540,720
Discounted at 7%[c]	$30,840,390 to $32,516,670
Alternative 3	
Discounted at 3%[b]	$27,076,067 to $28,672,000
Discounted at 7%[c]	$27,050,610 to $28,649,350
Alternative 4	
Discounted at 3%[b]	$26,516,260 to $28,266,230
Discounted at 7%[c]	$26,496,420 to $28,245,550
Alternative 5	
Discounted at 3%[b]	$27,232,970 to $28,717,170
Discounted at 7%[c]	$27,212,550 to $28,696,160

[a]This is the total present value of net benefits reported in Table 4-11 amortized over the 3-year analysis time frame at the indicated discount rate.

[b]The economics literature supports a 3 percent annual discount rate in the valuation of public goods (e.g., Freeman 1993). Federal rulemakings also support a 3 percent annual discount rate in the valuation of lost natural resource use (61 FR 453; 61 FR 20584).

[c]Office of Management and Budget (OMB). 2003. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs: Memorandum for Heads of Executive Departments and Establishments." OMB Circular A-94, revised January 2003.

Note: All dollar values in 2003 dollars, rounded to the nearest $10.

5 Small Entity Impact Analysis

This section assesses the potential for changes to the management of snowmobile use in the GYA to affect small businesses.

Changes to the management of snowmobile use in the GYA potentially affect the economic welfare of all area businesses, organizations, and governmental jurisdictions, large and small. However, small entities may have special problems in complying with such regulations. The Regulatory Flexibility Act (RFA) of 1980, as amended in 1996, requires special consideration be given to these entities during the regulatory process.

To fulfill these requirements, agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities (SISNOSE). This section identifies the small businesses potentially affected by the rule, provides a screening-level analysis that assists in determining whether this rule is likely to impose such an impact, provides an Initial Regulatory Flexibility Analysis (IRFA), and analyzes reasonable alternatives.

Throughout this report, the alternatives have been judged relative to two baselines, the Alternative 1 baseline and the historical baseline. As discussed below, using the Alterative 1 baseline, which prohibits snowmobiles in the parks, Alternatives 2 though 5 result in increased revenue for all businesses. However, compared to the historical baseline Alternatives 1 through 5 lead to declines in revenue.

Judging the difference in impacts between the alternatives is difficult because of a lack of detailed financial data for the small businesses. NPS is soliciting from the public data on the

potential impacts of Alternatives 1 through 5 that would be useful for this analysis.

Section 1 presents Alternative 4 as the preferred alternative and contains a discussion of NPS's reasons for this decision. From the point of view of small businesses, Alternative 5 and potentially Alternative 3 might be marginally better for small businesses depending on how popular commercially guided tours turn out to be, because they may result in higher visitation. However, for reasons described in Section 1, and in the August 2004 Temporary Winter Use Plans Environmental Assessment, NPS has decided that all snowmobiles should be commercially guided. Compared to Alternative 2, Alternative 4 would be better for small businesses because of the higher daily entrance limits, thus potentially increasing revenue generated by higher snowmobile visitation to the parks.

5.1 IDENTIFYING SMALL ENTITIES

Small entities potentially affected by the management alternatives considered include companies providing snowmobile rental services, those providing guided tours (which are available for snowmobiling, riding snowcoaches, or cross-country skiing), lodging establishments, restaurants, grocery stores, and other retail businesses. For analysis of the small business impacts of these alternatives, NPS identified numerous companies providing these services in the area surrounding the parks. There were 70 snowmobile rental businesses (including 26 concessionaires that offer guided tours), 11 companies offering snowcoach tours, and 11 companies offering guided cross-country skiing tours identified in the area, although there may be others. A large number of the snowmobile and snowcoach companies are located in West Yellowstone. There were 30 snowmobile rental companies and 10 snowcoach operators identified in West Yellowstone. Jackson, Wyoming, was second to West Yellowstone in number of snowmobile rental companies, with 14 companies identified. The city with the most companies providing cross-country skiing tours is Bozeman, Montana, with four businesses. The rest of the companies are spread among numerous communities in the GYA.

There were 70 snowmobile rental businesses (including 26 concessionaires that offer guided tours), 11 companies offering snowcoach tours, and 11 companies offering guided cross-country skiing tours identified in the area, although there may be others.

The Small Business Administration's (SBA) general size standard definitions for these industries (NAICS 532292—Recreational Goods Rental, and NAICS 561520—Tour Operators) classify companies with annual sales less than or equal to $5 million as small.[1] Only one firm interviewed provided an estimate of their annual revenue. That firm estimated their gross revenue to be $6.5 million, with $955,000 of that from renting snowmobiles.[2] Where available, revenue estimates (provided in ranges) were obtained for the rest of the firms from *info*USA (2001).

Among the establishments offering snowmobile, snowcoach, and/or cross-country skiing rentals and tours with available data, 31 have sales less than $500,000, 17 have sales between $500,000 and $1 million, 14 have sales between $1 and $2.5 million, 7 have sales between $2.5 and $5 million, 4 have sales between $5 and $10 million, and 1 firm has estimated sales between $10 and $20 million. Snowcoach and cross-country skiing companies are not directly affected by this regulation, but they may experience impacts on their business following changes in snowmobile management.

Using the SBA criterion above and available sales estimates, 69 out of 74 snowmobile rental shops and guided tour operators (either snowmobile, snowcoach, or skiing) with available revenue estimates were classified as small businesses.

Using the SBA criterion above and available sales estimates, 69 out of 74 snowmobile rental shops and guided tour operators (either snowmobile, snowcoach, or skiing) with available revenue estimates were classified as small businesses.[3] In addition, firms in these categories for which no sales estimate was available were assumed to be small businesses. Although these rental shops and tour operators will be affected most directly, numerous hotels, restaurants, gas stations, and retail establishments may also experience an impact from the regulation. Because the primary direct impacts are expected in the equipment rental and guided tour sectors, we did not attempt to gather revenue estimates for businesses in other

[1]Five million dollars is also the threshold for hotels and motels (NAICS 721110), restaurants (NAICS 722110), and souvenir shops (NAICS 453220) to be classified as small businesses. For gas stations without convenience stores (NAICS 447190), the small business threshold is $6.5 million, and for supermarkets and grocery stores (NAICS 445110) and gas stations with convenience stores (NAICS 447110), the cutoff is $20.0 million.

[2]Figure provided by business to Michelle Bullock, RTI, January 2001 (Personal communication).

[3]Some of these businesses may be owned by the same parent company, but there is insufficient information to determine the extent to which this occurs.

tourism-related sectors. Instead, we assumed that they are all small businesses.

5.2 SCREENING-LEVEL ANALYSIS

For the purposes of assessing the potential economic impact of this rule on small entities, NPS estimated the change in business revenue under each of the five alternatives considered in this report relative to both the Alternative 1 and historical baselines.

For the purposes of assessing the potential economic impact of this rule on small entities, NPS estimated the change in business revenue under each of the five alternatives considered in this report relative to both the Alternative 1 and historical baselines. Expected changes in revenue and producer surplus across all firms are presented earlier in this report in Sections 3 and 4. Section 3 estimates these impacts relative to the Alternative 1 baseline, while Section 4 presents these impacts relative to the historical baseline. The estimated change in company revenue under each alternative relative to total annual revenue provides a basis for evaluating the magnitude of the impact on typical affected companies. In addition to this "affordability" analysis, this section includes assessments of the potential for the alternatives considered to have disproportional impacts on small entities or to cause business closures.

5.2.1 Alternative 1 Baseline (Ban on Snowmobile Use)

Compared with the Alternative 1 baseline, each of the management alternatives considered is expected to result in increases in winter visitation to the GYA. Thus, the impact on small businesses is generally expected to be positive under Alternatives 2, 3, 4, and 5, although small businesses that provide goods and services primarily to nonsnowmobilers may experience reductions in revenue. Alternative 1 has no incremental impact on small businesses because it maintains baseline conditions.

Affordability Analysis

An affordability analysis is an assessment of the ability of affected entities to meet costs imposed by regulatory policies.

An affordability analysis is an assessment of the ability of affected entities to meet costs imposed by regulatory policies. In this case, the majority of small businesses identified are expected to have increases in revenue. Thus, there is no concern with these businesses being able to afford compliance with the regulatory alternatives. A relatively small number of firms that cater primarily to nonsnowmobilers could potentially

suffer negative impacts, but these impacts are typically not expected to be significant.

The projected reduction in visitation by nonsnowmobilers is a little over 3 percent in the scenarios with the largest estimated changes in visitation. However, projected increases in visitation by snowmobilers typically more than offset these reductions. Thus, for businesses that depend on both types of visitors (e.g., hotels, restaurants, grocery stores), average revenue will increase. Also, even businesses that provide some goods and services related to activities other than snowmobiling often provide goods and services used by snowmobilers as well and could potentially benefit from the increase in overall visitation.

Disproportionality Analysis

NPS does not expect small entities to be substantially disadvantaged relative to large entities. First of all, while the entities identified vary substantially in size, almost all operators identified are small businesses. Second, most small entities are expected to be positively affected under Alternatives 2, 3, 4, and 5. To the extent that small firms rely on revenue from nonsnowmobilers for a greater share of their total revenue, it is possible that they would be relatively disadvantaged if visitation by nonsnowmobilers decreases. However, NPS does not have any evidence to suggest that small firms are more dependent on revenue from nonsnowmobilers than large firms.

Business Closure Analysis

As noted above, small businesses are generally expected to have increased revenue under Alternatives 2, 3, 4, and 5, while Alternative 1 has no incremental impact. There may be some negative impacts on revenue for businesses that primarily provide goods and services to nonsnowmobilers. However, these impacts are expected to be relatively small, and no business closures are expected due to any of the regulatory alternatives considered.

5.2.2 Historical Baseline

Relative to the historical baseline, each of the management alternatives under consideration is expected to result in net decreases in winter visitation to the GYA. Therefore, the

impact on small businesses will generally be negative. The exception is small businesses that focus on providing goods and services to nonsnowmobilers. Those businesses may have increased revenue compared with expected conditions under the historical baseline.

Affordability Analysis

Unlike the case for the Alternative 1 baseline considered above, many firms are expected to have substantial negative costs relative to the historical baseline.

As mentioned above, an affordability analysis provides an assessment of the extent to which affected entities are able to meet the expense of regulatory costs. Unlike the case for the Alternative 1 baseline considered above, many firms are expected to have substantial negative costs relative to the historical baseline. The cost imposed by changes in snowmobile management in YNP, GTNP, and the Parkway that reduce snowmobile use is the loss of revenue associated with this use, which may be significant. This burden may affect the financial viability of companies dependent on growth in operating revenue to meet obligations such as equipment purchase loans.

A company's short-run financial strength is substantially influenced, among other things, by its liquidity (working capital position and its ability to pay short-term liabilities). Unfortunately, data are not available on the amount of working capital that these operators have to finance changes in short-term costs associated with lost revenue.

There is an alternative perspective to the assessment of affordability based on the amount of working capital available to affected firms. This alternative perspective is commonly used in regulatory analyses and pertains to the size of the costs of the rule relative to annual revenues. The lower the relative importance of those costs or lost revenue, the greater the likelihood of the company remaining viable. Cost-to-sales ratios (CSRs) are typically used to assess the relative magnitude of impacts. For instance, a CSR of 5 percent indicates that the incremental revenue loss the company will experience due to changes in regulation is equivalent to 5 percent of company revenue. The smaller the CSR, the more likely affected firms can afford the regulatory costs and remain in business.

There is insufficient information to estimate CSRs for individual firms. However, average CSRs can be estimated for selected key business categories to provide an indication of typical impacts. Among the snowmobile businesses with revenue estimates from *info*USA (2001), 60 companies have total estimated revenue of approximately $78 million.[4] Scaling the revenue figure up to reflect the identified universe of snowmobile businesses in the area (including 10 companies identified for which no revenue estimate was available) yields an estimate of about $90 million across 70 companies.

Alternative 1 was estimated to lead to a reduction in snowmobile rental revenue (combining unguided and guided rentals) of $3.8 million relative to the historical baseline (see Section 4). This is about 4.3 percent of total annual sales estimated for area snowmobile businesses, although the actual cost to individual businesses relative to their sales will likely vary substantially. The actual cost depends on the share of revenue that each business derives from snowmobile rentals and the decrease in rentals that their individual shop faces, which may depend on location and other factors.

Using a threshold of a 3 percent CSR to determine significance, this screening analysis indicates that Alternative 1 is likely to have a significant negative impact on a substantial number of small entities involved in the snowmobile rental business.

In addition to the losses from reductions in snowmobile rentals, Alternative 1 also leads to reduced revenue for hotels, restaurants, grocery stores, gas stations, and souvenir/retail establishments, as shown in Section 4. The direct losses to these sectors are estimated to range from $208,000 for grocery stores to $1.3 million for lodging establishments.

Using a threshold of a 3 percent CSR to determine significance,[5] this screening analysis indicates that Alternative 1 is likely to have a significant negative impact on a substantial number of small entities involved in the snowmobile rental business. Thus, NPS prepared and included an IRFA below. Other businesses could have significant negative impacts, but based on the smaller total impacts and the large number of businesses potentially affected in sectors such as lodging, restaurants, and retail, most of these businesses would

[4]This revenue figure was calculated assuming each company's revenue is the midpoint of the range provided for that company by *info*USA.

[5]NPS used the 3 percent threshold based on criteria developed by other agencies (NMFS, 2000; EPA, 1999b; SBA, 2003).

probably not exceed the 3 percent CSR threshold. Small snowcoach and cross-country skiing businesses are expected to experience gains in revenue under Alternative 1.

In addition, at least one small government, the town of West Yellowstone, will be affected by snowmobile restrictions under Alternative 1. West Yellowstone has a 3 percent resort tax that applies to most tourist expenditures, including lodging, restaurants, souvenirs, and snowmobile rentals. Based on reductions in snowmobile rental revenue in West Yellowstone proportional to the share of park entrances through the West Entrance of YNP and an assumption that 50 percent of spending on other items by snowmobilers entering the parks through this entrance takes place in West Yellowstone, it is estimated that West Yellowstone will experience a reduction in resort tax revenue of between 5 to 7 percent of annual resort tax collections.

Alternatives 2, 3, 4, and 5 are also estimated to have negative impacts on snowmobile rental businesses ranging from $547,200 to $1,898,200. Alternatives 2 and 4 are expected to have larger negative impacts than Alternatives 3 and 5 based on the analysis conducted. However, even under the highest end of this range, the average CSR is only 2.1 percent. This is netting out gains for guided snowmobile rentals from losses for unguided rentals, however. To the extent that some businesses are better suited to increasing the number of guided rentals they offer, those businesses may actually gain while businesses that are more dependent on unguided rentals and less able to switch to offering more guided rentals may have larger than average CSRs under these alternatives.

It is expected that most rental firms will be sufficiently able to switch between unguided and guided snowmobile rentals that the majority of firms will have CSRs below 3 percent for each of these alternatives. However, it is certainly possible that some firms would be affected above 3 percent of sales, especially under Alternatives 2 and 4.

All four of these alternatives are also expected to result in reduced revenue for hotels, restaurants, grocery stores, gas stations, and souvenir/retail establishments, as shown in

Section 4. However, these losses are smaller than under Alternative 1.

Based on a 3 percent CSR threshold and an assumption that proportionate losses to snowmobile rental firms are evenly distributed across firms, this screening analysis indicates that Alternatives 2, 3, 4, and 5 are not likely to have significant negative impacts on a substantial number of small entities. As with Alternative 1, small snowcoach and cross-country skiing businesses are expected to experience gains in revenue under these alternatives.

Disproportionality Analysis

NPS does not expect small entities to be substantially disadvantaged relative to large entities. One primary reason for this is that, within the context of the RFA, almost all operators identified are small businesses. In addition, the costs of this regulation as a share of revenue are expected to remain relatively constant across different size firms. Firms that are more dependent (or exclusively dependent) on snowmobile rentals as a proportion of their total revenue will be at a relative disadvantage, but NPS does not have any evidence to suggest that small firms are more dependent on revenue from snowmobilers than large firms.

However, to the extent that larger firms can more easily finance the purchase of snowcoaches, snowmobiles with clean and quiet engines required under the regulatory alternatives, and other capital equipment necessary for providing alternative recreational services, these companies could potentially be at an advantage relative to small firms.

Business Closure Analysis

Because of data limitations, NPS is unable to determine the extent to which the regulatory alternatives under consideration may cause small entities to close their operations. As noted above, many small businesses dependent on revenue from snowmobile rentals are likely to be significantly affected relative to the historical baseline. In determining whether the identified small entities or the other restaurants, hotels, gas stations, grocery stores, and other retail establishments will close their businesses as the result of complying with these alternatives,

the question that must be answered is "Will the cost of compliance be so great as to impair an entity's ability to remain in business?"

Alternative 1 is likely to significantly affect many businesses dependent on revenue from snowmobile rentals. For instance, the number of snowmobile rentals in the GYA is projected to decline by slightly more than 60 percent and the average CSR for snowmobile rental firms is 4.3 percent.

Alternative 1 is likely to significantly affect many businesses dependent on revenue from snowmobile rentals. For instance, the number of snowmobile rentals in the GYA is projected to decline by slightly more than 60 percent and the average CSR for snowmobile rental firms is 4.3 percent. Thus, it is likely that some businesses that are highly dependent on snowmobile rentals are likely to close. It is expected that this alternative will result in a large reduction in the total number of winter visitors to the parks and it is possible that additional businesses (other than snowmobile rental shops) may close as well.

While Alternatives 2, 3, 4, and 5 will not affect snowmobile rental businesses as significantly as Alternative 1, the number of snowmobile rentals within the GYA is still estimated to decline by about 24 to 36 percent across these four alternatives, and the average CSR ranges from 0.6 percent to 2.1 percent. This is a large reduction in snowmobile rental activity that could potentially lead to the closure of some firms that are highly dependent on snowmobile rental revenue. The closure decision for individual businesses will hinge on the businesses' ability to provide snowmobiles with clean and quiet engines for use in the park and their ability to hire a sufficient number of guides. It is also possible that there may be closures for other winter tourism-related businesses based on the large net reductions in winter visitation expected under these alternatives.

Initial Regulatory Flexibility Analysis

Under Section 603(b) of the RFA (as amended), each regulatory flexibility analysis is required to address the following points:

- reasons why the rule is being considered;
- the objectives and legal basis for the rule;
- the kind and number of small entities to which the rule will apply;
- the projected reporting, recordkeeping, and other compliance requirements of the rule; and

- all federal rules that may duplicate, overlap, or conflict with the rule.

In addition, Section 603(c) requires a description of any significant alternatives that may reduce the regulatory burden on affected small entities.

Reasons Why the Park Service is Considering the Proposed Rule. In May 1997, NPS was sued for allegedly failing to comply with the NPS Organic Act, NEPA, Endangered Species Act, and other federal laws and regulations. NPS subsequently settled the suit, in part, by an agreement to prepare a winter use plan based on an EIS. A ROD on the winter use plan for the parks was signed on November 22, 2000. The new rule was published in the *Code of Federal Regulations* (CFR) on January 22, 2001 (36 CFR Part 7). On December 6, 2000, a lawsuit filed by the International Snowmobile Manufacturers Association asked for the pending decision, reflected in the ROD and final rule, to be set aside on the basis of NEPA process infractions. The Office of the Secretary of the Interior negotiated a procedural settlement that became final on June 29, 2001. Through the terms of the settlement, NPS agreed to prepare an SEIS. The draft SEIS examined two alternatives to allow some form of snowmobile access to continue: a no-action alternative that would implement the November 2000 ROD and another alternative that would implement the no-action alternative 1 year later to allow additional time for phasing in snowcoach-only travel and was published on March 29, 2002.

On November 18, 2002, NPS published a final rule (67 FR 69473) based on the FEIS, which generally postponed for 1 year implementation of the phase-out of snowmobiles in the parks pursuant to the January 2001 final rule (66 FR 7260).

The Notice of Availability for final SEIS (FSEIS) was published on February 24, 2003. The FSEIS included a new alternative, Alternative 4, which was identified as the preferred alternative. A ROD for the FSEIS was signed on March 25, 2003. The ROD selected FSEIS Alternative 4 for implementation, and it enumerated additional modifications to that alternative.

On December 11, 2003, NPS published a final rule based on the FSEIS Alternative 4. However, on December 16, 2003, a DC District Court judge ordered NPS to implement the 2001 rule. In February 2004, a Wyoming federal judge temporarily halted implementation of the 2001 rule. These early and mid-winter rule changes resulted in much uncertainty about the status of snowmobile use during the 2003–2004 winter season and beyond. Thus, the regulations analyzed in the current report are necessary to implement a temporary rule that will apply while additional analyses are conducted.

The Objectives and Legal Basis for the Proposed Rule. The rule implements plans to manage snowmobile use in YNP, GTNP, and the Parkway with restrictions on the number of snowmobiles that can enter the parks daily, requirements for many snowmobilers to be on guided tours, and a requirement that snowmobiles used in the parks must meet BAT standards for emissions and noise. These regulations shift oversnow motorized use of the parks from unguided snowmobile use to snowcoach and guided snowmobile use, to allow continued winter use of the parks while reducing the impacts on park resources and values from snowmobile use.

Snowmobile use in national parks is subject to the provisions of various laws and regulations, principally the NPS Organic Act, the Clean Air Act, two Executive Orders, and NPS Management Policies and regulations. The three parks subject to these proposed regulations have park-specific regulations that designate areas and routes open to snowmobile and snowplane use. These new regulations will supersede the existing regulations beginning the winter use season of 2004–2005.

The Kind and Number of Small Entities to Which the Proposed Rule Will Apply. The proposed rule applies to numerous potentially affected resorts that supply snowmobile rentals, lodging, restaurants, gas, and other retail, each having $5 million or less annual sales, in addition to other small businesses in other local communities. There were 92 snowmobile rental, snowcoach rental, and cross-country ski rental establishments identified in the region. Based on data from *info*USA on estimated revenue for these companies, NPS estimates that 87 of these businesses are small businesses.

NPS estimates that the proposed rule will affect all small entities, but NPS has limited financial profile information (e.g., winter operating revenue) for the affected entities.

The Projected Reporting, Record Keeping, and Other Compliance Requirements of the Proposed Rule. There are no reporting, record keeping, or other compliance requirements for the proposed rule.

All Federal Rules that May Duplicate, Overlap, or Conflict with the Proposed Rule. NPS is unaware of any federal rules that either duplicate, overlap, or conflict with the proposed rule.

Alternatives that May Reduce the Impacts on Small Businesses. Qualitatively, Alternative 5, which has the highest daily limit and allows for 20 percent of the riders to be on noncommercially guided tours, would most likely result in the largest number of snowmobile riders visiting the park, and thus be the most beneficial to small businesses. Alternative 4 has the next highest daily limit, but requires 100 percent commercially guided tours. The daily limit under Alternative 4 for the West entrance, which would be most impacted by the alternatives, is only 40 snowmobiles less than under Alternative 5. Alternative 3 has a somewhat lower daily limit, but allows for 20 percent of the riders to be unguided after the first year. Finally, Alternative 2 has the lowest daily limits and requires 100 percent guided tours, which would likely result in the lowest visitation among the alternatives that allow for continued snowmobile access to the parks.

Anecdotally, businesses around the park indicated that it would be difficult to sustain operations with the visitation levels experienced in the winter of 2003–2004. Those visitation rates were similar to what would be experienced under Alternative 2. The EA (NPS, 2004) evaluated the impact of the alternatives on local businesses from a somewhat different perspective than the benefit-cost analysis. From that analysis, Alternative 4 is forecast to generate lower negative impacts on the local economy, behind Alternative 5.

5.3 ASSESSMENT

Based on the screening analyses above, the small entity impacts are summarized below relative to both baselines.

5.3.1 Alternative 1 Baseline (Ban on Snowmobile Use)

After considering the economic impacts of the snowmobile management alternatives under consideration on small entities, NPS concludes that management Alternatives 2, 3, 4, and 5 would mitigate the impacts on most small businesses relative to the impacts under the Alternative 1 baseline. Alternative 1 would have no incremental impacts on small businesses because it maintains baseline conditions. In cases where Alternatives 2, 3, 4, and 5 cause reduced revenues for a few specific firms compared to the Alternative 1 baseline, NPS expects that the declines would be very small. NPS made this determination using RFA implementation guidance provided by other agencies (NMFS, 2000; EPA, 1999b; SBA, 2003) and provides the following factual basis for this determination:

Do the proposed regulations have a significant negative impact on a substantial number of small entities relative to the Alternative 1 baseline?

Alternative 1: No

Alternative 2: No

Alternative 3: No

Alternative 4: No

Alternative 5: No

- These alternatives are not expected to substantially reduce area businesses' profit margins or reduce the competitiveness of the snowmobile rental and sales businesses.
- In a qualitative assessment of changes in producer surplus in Section 3.2.3, NPS projects higher total levels of revenue for firms providing goods and services related to snowmobiling under Alternatives 2, 3, 4, and 5 than under Alternative 1 baseline conditions.
- NPS expects lower levels of revenue for firms providing snowcoach or cross-country ski tours or other services to nonsnowmobile visitors under Alternatives 2, 3, 4, and 5 than under Alternative 1 baseline conditions. However, most firms providing snowcoach tours in the GYA have diversified sources of revenue from other activities such as skiing, ranch stays, and snowmobile rentals. There is no evidence suggesting that losses to businesses that cater to nonsnowmobile riders resulting from implementing Alternative 2, 3, 4, or 5 relative to the Alternative 1 baseline would be sufficiently high to affect any small firm significantly. In fact, in some cases, firms that offer both snowcoach and snowmobiling services may benefit from Alternatives 2, 3, 4, and 5 as their snowmobile revenues rise.

- NPS expects higher levels of revenue for other businesses (including hotels, restaurants, grocery stores, gas stations, and souvenir shops) in the GYA under Alternatives 2, 3, 4, and 5 compared to the Alternative 1 baseline.

5.3.2 Historical Baseline

Based on the analysis above, NPS concludes that Alternative 1 would have significant negative impacts on a substantial number of small businesses relative to the historical baseline. While Alternatives 2, 3, 4, and 5 could potentially have significant impacts on some small businesses, they are not expected to affect typical businesses above the threshold used to determine significance in this report and are not expected to have significant negative impacts on a substantial number of small businesses. However, as the discussion at the end of Section 5.2.2 indicates, Alternatives 2 though 5 will most likely have differential impacts on small businesses. NPS made this determination using RFA implementation guidance provided by other agencies (NMFS, 2000; EPA, 1999b; SBA, 2003) and provides the following factual basis for this determination:

Do the proposed regulations have a significant negative impact on a substantial number of small entities relative to the historical baseline?

Alternative 1: Yes

Alternative 2: No

Alternative 3: No

Alternative 4: No

Alternative 5: No

- Alternative 1 is expected to reduce the number of snowmobile rentals in the area by about 60 percent. This is estimated to reduce revenue for typical establishments that offer snowmobile rentals (usually as part of a broad array of goods and services) by 4.3 percent, which is above the threshold of 3 percent used here to determine significance.
- Alternative 1 is also expected to have large impacts on other local businesses. Although these impacts will not necessarily rise to the level of significant impacts on a substantial number of firms, they are expected to reduce profits and profit margins for most local businesses dependent on winter tourism.
- Alternatives 2, 3, 4, and 5 will all have negative impacts on snowmobile rentals in the region. The number of snowmobile rentals is estimated to decline by 24 to 36 percent across these four alternatives. This will lead to reductions in total revenue for businesses offering snowmobile rentals of 0.6 to 2.1 percent. While some businesses may have significant negative impacts, most businesses are expected to remain below the threshold, and none of these alternatives are expected to have

significant impacts on a substantial number of snowmobile rental businesses.

- NPS expects lower levels of revenue for other businesses (including hotels, restaurants, grocery stores, gas stations, and souvenir shops) in the GYA under Alternatives 2, 3, 4, and 5 compared to the historical baseline. However, there is no evidence suggesting that losses to these businesses resulting from implementation of Alternative 2, 3, 4, or 5 would be sufficiently high to affect any small firm significantly relative to the historical baseline.
- NPS expects higher levels of revenue for firms providing snowcoach or cross-country ski tours or other services to nonsnowmobile visitors under all five alternatives than under historical baseline conditions.

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Appendix 1: Winter 2002–2003 Visitor Survey: Yellowstone and Grand Teton National Parks

October 2003

Winter 2002–2003 Visitor Survey: Yellowstone and Grand Teton National Parks

Final Report

Prepared for

National Park Service
Environmental Quality Division
Dr. Bruce Peacock
1201 Oakridge Drive, Suite 200
Fort Collins, CO 80525

Prepared by

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Executive Summary

During the 2002–2003 winter season, RTI International, under contract with MACTEC Engineering and Consulting, Inc., BBL Sciences, and the National Park Service (NPS), conducted the Winter Visitor Survey for Yellowstone and Grand Teton National Parks. The survey was designed to provide information about

- current recreational winter use of the parks;
- expenditures and trip characteristics of current winter visitors;
- seasonal trips by snowmobile riders and other winter recreators to the parks and other sites in the region;
- the change in visitor welfare (consumer surplus) for day trips to the parks under different conditions, where the attributes of the trips are designed to capture the important effects of alternative winter management plans on winter visitor experience; and
- changes in visitation in response to alternative management plans.

The basis for the alternative winter management plans was the Final Supplemental Environmental Impact Statement (FSEIS) for winter use in Yellowstone and Grand Teton National Parks, published by NPS in February 2003. The document contained five alternative winter use plans for the parks.

Visitors to Yellowstone National Park (YNP) were sampled through out the season at all four entrances open during the winter (East, West, North and South). A sampling plan was constructed to create a probability-based sample of winter visitors that could be weighted to reflect the true population of winter visitors to the park. Winter

visitors to Grand Teton National Park (GTNP) were sampled at the Taggart Lake parking lot according to a random sampling plan.[1] Taggart Lake parking lot is primarily used by cross-country skiers to access trails in GTNP.

The survey was designed using standard methods including data from previous surveys, focus groups, and cognitive interviews. In addition, staff from YNP and GTNP, as well as expert survey consultants and the NPS Social Science Program provided input.

In total, 80 percent of the surveys mailed to YNP visitors and 83 percent of the surveys mailed to GTNP visitors were returned.

Visitors were intercepted in the parks according to the sampling plan and asked for their participation. Overall, 92 percent of visitors approached in YNP and 96 percent of visitors approached in GTNP at Taggart Lake agreed to participate in the survey. The visitors answered 2 or 3 short questions and provided their name and address. Visitors who provided their name and address were mailed the survey. In total, 80 percent of the surveys mailed to YNP visitors and 83 percent of the surveys mailed to GTNP visitors were returned.[2]

In terms of demographics, winter visitors to the two parks are relatively more educated and wealthy than the general population. The majority of visitors to both parks are from Western states. Forty-six percent of the Taggart Lake sample lived in Wyoming. The majority of visitors were employed and married, and the average age of visitors is in the mid-40s. In YNP[3], 55 percent of visitors indicated that the primary activity on their trip was riding a snowmobile without a guide. Downhill skiing outside the parks was the next most popular primary activity (17 percent of visitors). In GTNP, 62 percent of those sampled chose cross-country skiing as their primary activity. Again, downhill skiing was the next most popular primary activity (14 percent of visitors). Fifteen percent of the visitors in YNP are on day-trips compared to 40 percent in the GTNP sample. Visitors on multi-day trips to both parks spent more time outside the parks than inside the parks on their trips.

[1] Visitors were also intercepted at the Moran entrance to GTNP. The data from this entrance was not analyzed in this report because of the limited sampling hours and a low response rate.

[2] Excluding visitors who did not supply a valid address.

[3] Survey responses for YNP were weighted to reflect the total population of winter visitors. Survey responses for GTNP were not weighted and reflect the responses of the sample who returned surveys.

Finally, the survey asked visitors for one thing they would change about their trip. In YNP, 40 percent said they would not change anything about their trip. Twenty percent of nonsnowmobile riders said they would have liked fewer snowmobiles in the park, while fourteen percent of snowmobile riders wanted smoother snow on the roads. At Taggart Lake, 60 percent of visitors would not change anything about their trip.

To assess changes in visitation, the survey presented the respondent with one of three management plans and asked if they would visit more, the same number of times, less or not at all if the management plan was implemented.

The survey contained several questions to address the impact of alternative management plans on winter use and to calculate the welfare impacts on visitors of changing conditions in the parks. To assess changes in visitation, the survey presented the respondent with one of three management plans and asked if they would visit more, the same number of times, less or not at all if the management plan was implemented. The three management plans were banning snowmobiles, capping the number of snowmobiles allowed in each day and requiring all snowmobiles to be on a guided tour, and simply capping the number of snowmobiles each day. For all types of visitors, the ban elicited the largest change in behavior with a majority of snowmobile riders saying they would not visit. The majority of other visitors indicated they would not change or would increase the number of trips they took if snowmobiles were banned. The policy of capping the number of snowmobiles allowed in the park each day (but not requiring guided tours) resulted in the smallest change in behavior with 71 percent of visitors to YNP and 74 percent of visitors to GTNP answering that they would not change the number of times they visited during the season under this policy.

Welfare changes to visitors were calculated using both the travel cost method and a stated preference conjoint experiment. The travel cost model was based on information about snowmobile trips in the 2000-2001 winter season to Wyoming, Montana, and Idaho. A random utility model estimated that snowmobile riders would lose on average about $70 per trip or $32 per day if YNP and GTNP were closed to snowmobiles.

In general, policies that reduce crowding, noise and emissions and improve road conditions result in welfare gains of between $100 and $350 per day for nonsnowmobile riders.

The stated preference conjoint experiment was designed to look at how visitors trade-off different attributes of their trip including activity, crowding, cost and other park conditions such as road condition, noise and exhaust fumes. Respondents were presented with a series of choices between two hypothetical trips or the option of not visiting the parks. The trips were described by nine attributes covering the features mentioned above. The results allow calculation of changes in welfare from changes in park conditions. The data were estimated using conditional and mixed-logits. The results of the mixed logit models were used to calculate welfare changes for sample management scenarios. In general, policies that reduce crowding, noise and emissions and improve road conditions result in welfare gains of between $100 and $350 per day for nonsnowmobile riders. The gains were lower for snowmobile riders in some cases, especially snowmobile riders who own snowmobiles. For example, policies that require snowmobiles to be on guided tours result in welfare losses in most estimates. Banning snowmobiles in the parks resulted in a per day welfare loss of $32 for snowmobile riders in one model, while nonsnowmobile riders had welfare gains of $330 to $430 per day.

1 Introduction and Study Goals

This report describes the design and implementation of the 2002–2003 Winter Visitor Survey for Yellowstone and Grand Teton National Parks and the analysis of survey results.

The 2002–2003 Winter Visitor Survey for Yellowstone and Grand Teton National Parks was conducted over the entire winter 2002–2003 season from December 18, 2002, to March 3, 2003. RTI International (RTI), under contract with MACTEC Engineering and Consulting, Inc., BBL Sciences, and the National Park Service (NPS), designed and implemented the survey and analyzed the survey results.

1.1 BACKGROUND

NPS has been assessing winter use issues within the parks located in the Greater Yellowstone Area (GYA) (Yellowstone National Park [YNP], Grand Teton National Park [GTNP], and the John D. Rockefeller, Jr., Memorial Parkway [the Parkway]) for several decades. This assessment has resulted in intensive study and public involvement, and in 1990 a Winter Use Plan (NPS, 1990) was completed for GYA. In 1997, the Fund for Animals filed suit against NPS alleging that NPS had failed to conduct adequate analysis under the National Environmental Policy Act (NEPA) when developing its winter use plan for the areas, failed to consult with the U.S. Fish and Wildlife Service on the effects of winter use on threatened and endangered species, and failed to evaluate the effects of trail grooming on wildlife and other park resources. In 1997, the Department of the Interior (DOI) and the plaintiffs reached a settlement agreement in which NPS agreed to produce an environmental impact statement (EIS). The final environmental impact statement (FEIS) was published and the record of decision (ROD) was subsequently signed on November 22, 2000. The new rule was published in the Code of Federal Regulations (CFR) on

January 22, 2001 (36 CFR Part 7).[1] The regulation eliminated recreational snowmobile and snowplane use from the parks by the winter of 2003–2004.

On December 6, 2000, a lawsuit filed by the International Snowmobile Manufacturers Association asked for the pending decision, reflected in the ROD and final rule, to be set aside on the basis of NEPA process infractions. The Office of the Secretary of the Interior negotiated a procedural settlement that became final on June 29, 2001. As provided in that settlement agreement, NPS is acting as lead agency to prepare a supplemental environmental impact statement (SEIS) and added the State of Wyoming as a cooperating agency.[2] In accordance with the settlement, the SEIS would incorporate new or additional information and data, as provided by the affected public and cooperating agencies, including information regarding new snowmobile technologies, submitted with respect to a winter use plan for the parks. A Notice of Intent to prepare an SEIS was published in the *Federal Register* on July 27, 2001 (66FR39197).

To allow sufficient time to complete the SEIS and prepare a new ROD, NPS negotiated a rule that allows for a 1-year delay (the "delay rule") in implementing the existing snowmobile regulations in YNP, GTNP, and the Parkway. The "delay rule" was proposed in March 2002 and finalized in November 2002.

The 2002–2003 Winter Visitor Survey was designed in part to provide information for a benefit-cost analysis of the five alternatives considered in the FSEIS.

The final SEIS (FSEIS) was released in February 2003. The report presents the expected impacts from five alternatives. Alternative 1a is the original ban from January 2001. The baseline alternative is Alternative 1b, the delay rule, which delays implementation of the ban by one year. In addition, three other alternatives allow snowmobile access under different conditions. Table 1-1 summarizes the main features of the five alternatives. The 2002–2003 Winter Visitor Survey was designed in part to provide information for a benefit-cost analysis of the five alternatives considered in the FSEIS.

[1]The rule became effective February 21, 2001.

[2]Subsequent to the settlement, all agencies (other than the State of Wyoming) that signed cooperating agency agreements during the earlier EIS process agreed to be cooperating agencies for the SEIS and include the U.S. Forest Service, the States of Montana and Idaho, Fremont County in Idaho, Gallatin and Park Counties in Montana, and Park and Teton Counties in Wyoming. In addition, the Environmental Protection Agency (EPA) was added as a new cooperating agency.

Table 1-1. Comparison of Selected Major Features of FSEIS Snowmobile Management Alternatives

	Alt 1b—Delay Rule	Alt 1a—Ban	Alt 2	Alt 3	Alt 4—ROD
Snowmobile Maximum Daily Limits					
YNP North Entrance	2003–2004: 60 2004–2005 onward: ban	2003–2004 onward: ban	2003–2004 onward: 25	2003–2004 onward: 100	2003–2004 onward: 50
YNP West Entrance	2003–2004: 278 2004–2005: ban	2003–2004 onward: ban	2003–2004: 825 2004–2005: 725 2005–2006 onward: 600	2003–2004 onward: 330	2003–2004 onward: 550
YNP East Entrance	2003–2004: 65 2004–2005: ban	2003–2004 onward: ban	2003–2004 onward: 100	2003–2004 onward: 100	2003–2004 onward: 100
YNP South Entrance	2003–2004: 90 2004–2005: ban	2003–2004 onward: ban	2003–2004 onward: 225	2003–2004 onward: 400	2003–2004 onward: 250
The Parkway—Grassy Lake Road	2003–2004: 60 2004–2005: ban	2003–2004 onward: ban	2003–2004 onward: no limit	2003–2004 onward: 100	2003–2004 onward: 75
GTNP and the Parkway—CDST from East Entrance to Northern Park Boundary (Alt 1b) or Flagg Ranch (Alts 2–4)	2003–2004: 60 2004–2005: ban	2003–2004 onward: ban	2003–2004 onward: 75	2003–2004 onward: 100	2003–2004 onward: 75
GTNP—Jackson Lake	2003–2004 onward: ban	2002–2003 onward: ban	For fishing only, with biofuel	None permitted	2003–2004 onward: For fishing only, with air and sound emissions requirements: 40

(continued)

Table 1-1. Comparison of Selected Major Features of FSEIS Snowmobile Management Alternatives (continued)

	Alt 1b—Delay Rule	Alt 1a—Ban	Alt 2	Alt 3	Alt 4—ROD
Emission Requirements	None	NA	Rentals, 2003–2004 onward: below 200 g/kW-hr for carbon monoxide and 75 g/kW-hr for hydrocarbons Private, 2003–2006: any four-stroke and any two-stroke using biofuels and lubes Private, 2006–2007 onward: below 200 g/kW-hr for carbon monoxide and 75 g/kW-hr for hydrocarbons	All snowmobiles, 2003–2004 onward: below 120 g/kW-hr for carbon monoxide and 15 g/kW-hr for hydrocarbons	Commercially guided, 2003–2004 onward: below 120 g/kW-hr for carbon monoxide and 15 g/kW-hr for hydrocarbons Noncommercially guided, 2003–2004: none Noncommercially guided, 2004–2005 onward: below 120 g/kW-hr for carbon monoxide and 15 g/kW-hr for hydrocarbons
Sound Requirements	All snowmobiles: 78 db(A) or less	NA	Rentals: 75 dB(A) or less Private: 78 dB(A) or less	All snowmobiles: 73 db(A) or less	All snowmobiles: 73 db(A) or less with same phase in as above
Guided Tour Requirement	2003–2004: in YNP only	NA	No	Yes, in all parks	In YNP only, although 20 percent can be "noncommercial"
Adaptive Management Requirement	No	NA	Yes	Yes	Yes

1.2 WINTER VISITOR SURVEY GOALS

The survey will provide data to characterize

- current recreational winter use of the parks;
- expenditures and trip characteristics of current winter visitors;
- seasonal trips by snowmobile riders and other winter recreators to the parks and other sites in the region;
- the change in visitor welfare (consumer surplus) for day trips to the parks under different conditions, where the attributes of the trips are designed to capture the important effects of alternative winter management plans in the FSEIS (NPS, 2003) on winter visitor experience; and
- changes in visitation in response to alternative management plans in the FSEIS.

The survey is designed to provide multiple methods of calculating the visitor-day values and changes in consumer surplus needed to conduct the benefit-cost analysis, specifically the impact of the proposed alternatives on snowmobile riders and other winter visitors. Each type of data provides a different perspective on winter visitors.

The data from this survey will be used in part to conduct a benefit-cost analysis and a small business impact analysis under the Regulatory Flexibility Act (RFA) of 1980 for the alternatives in the FSEIS including the preferred alternative chosen by NPS for the final rulemaking in 2003.

The survey is designed to provide multiple methods of calculating the visitor-day values and changes in consumer surplus needed to conduct the benefit-cost analysis, specifically the impact of the proposed alternatives on snowmobile riders and other winter visitors. Each type of data provides a different perspective on winter visitors.

It is important to note that this survey reflects the views of current visitors to YNP and GTNP. It does not reflect the views of potential visitors who do not currently visit YNP or GTNP because of the snowmobiles. Nonsnowmobile visitors who currently visit the parks may have more tolerant attitudes towards snowmobiles. Furthermore, the survey is not intended to capture nonuse values for the park held by current visitors or the general public.

1.3 REPORT ORGANIZATION

The report is organized as follows. Section 2 presents the design of the samples in YNP and GTNP, while Section 3 discusses the design of the survey instrument. The data collection procedures are described in Section 4. Section 5 provides summaries of the data and Section 6 contains the results of the consumer surplus analysis.

In addition, Appendix A contains the initial Winter Visitor Contact Form, Appendix B contains a copy of the survey instrument, and Appendix C contains the formulas used to calculate weighted survey results and adjust for nonresponse.

2 Sample Design

2.1 YELLOWSTONE SAMPLE DESIGN

This section describes the procedures used to sample winter visitors in YNP and GTNP.

In YNP, the goal was to create a probability-based sample that could be weighted to reflect the true population of winter visitors to the park. We designed a sampling plan based on daily entrance records from the 2001–2002 winter season to intercept every "Nth" visitor at the four entrances open in the winter: the West, North, South, and East Entrances to YNP. In YNP, we designed the sampling strategy to yield a sample that was 60 percent snowmobile riders and 40 percent other visitors, as well as 50 percent entering from the West Entrance and 50 percent from the other three entrances combined.[1] Nonsnowmobile visitors and visitors from entrances other than the West Entrance were oversampled to facilitate comparisons among the visitor groups. Based on differences in predicted versus actual visitation in the park, we updated the sampling rates during the season to achieve the desired number of respondents.

We selected a stratified random sample of days to represent the visitors during the 2002–2003 winter season, which ran from December 18 through March 3. To ensure adequate sample representation by entrance and type of day, the sample of days was stratified by entrance and type of day, as shown in Table 2-1. Although the park was scheduled to open to oversnow vehicles on December 18, 2002, poor snow conditions prevented snowmobile

[1] In the 2001–2002 winter season, approximately 62 percent of winter visitors entered through the West Entrance and 74 percent of snowmobile passengers.

Table 2-1. Sample Days by Yellowstone National Park Sampling Stratum

Entrance	Weekday		Weekend		Holiday		All	
	Snow-mobile	Nonsnow-mobile	Snow-mobile	Nonsnow-mobile	Snow-mobile	Nonsnow-mobile	Snow-mobile	Nonsnow-mobile
North	NA	10	NA	9	NA	3	NA	22
South	7	4	5	4	2	2	14	10
East	5	NA	3	NA	3	NA	11	NA
West	19	3	9	4	5	3	33	10
Total	31	17	17	17	10	8	58	42

NA = not applicable.

We established a separate (1-in-n) sampling rate for each stratum defined by entrance, type of day, and snowmobile versus nonsnowmobile to ensure adequate nonsnowmobile sample sizes.

access from the West, North, and East Entrances until later in the season. Sampling began on December 23 at the South Entrance as planned, on December 29 at the East and West Entrances, and on January 8 at the North Entrance. Sampling continued through March 3, 2003, when the roads at the North Entrance were closed to snowmobiles so that the park could begin clearing the snow.

To be eligible to participate in the survey, visitors had to meet the following criteria:

- 18 years of age or older,
- had not already provided contact information earlier in their trip or on a previous trip, and
- not a park employee or an employee of a park concessionaire.

Eligible individuals were sampled using stratified systematic sampling. We established a separate (1-in-n) sampling rate for each stratum defined by entrance, type of day, and snowmobile versus nonsnowmobile to ensure adequate nonsnowmobile sample sizes. We adjusted the sampling rates, as necessary, to achieve adequate sample sizes. The stratum sample sizes and numbers of respondents are summarized in Tables 2-2 and 2-3.

2.2 GRAND TETON SAMPLE DESIGN

The sample collected at GTNP was not designed to be a probability-based sample representative of all winter visitors to GTNP. Instead, the sample was designed to provide information about a specific set of visitors. The sampling plan for GTNP involved intercepting visitors at the Moran Entrance and the Taggart Lake parking lot in GTNP.

Table 2-2. Sample Persons by Yellowstone National Park Sampling Stratum

Entrance	Weekday		Weekend		Holiday		All	
	Snow-mobile	Nonsnow-mobile	Snow-mobile	Nonsnow-mobile	Snow-mobile	Nonsnow-mobile	Snow-mobile	Nonsnow-mobile
North	NA	118	NA	162	NA	69	NA	349
South	124	32	95	28	43	10	262	70
East	21	NA	33	NA	40	NA	94	NA
West	470	61	208	98	137	79	815	238
Total	615	211	336	288	220	158	1,171	657

NA = not applicable.

Table 2-3. Respondents by Yellowstone National Park Sampling Stratum

Entrance	Weekday		Weekend		Holiday		All	
	Snow-mobile	Nonsnow-mobile	Snow-mobile	Nonsnow-mobile	Snow-mobile	Nonsnow-mobile	Snow-mobile	Nonsnow-mobile
North	NA	89	NA	123	NA	51	NA	263
South	84	26	64	21	35	6	183	53
East	14	NA	19	NA	21	NA	54	NA
West	321	49	138	62	77	49	536	160
Total	419	164	221	206	133	106	773	476

NA = not applicable.

Sampling days were randomly selected between December 18, 2002, and March 1, 2003.

Visitor statistics are not kept for the Taggart Lake parking lot, so the sampling rate could not be calculated based on statistics for the previous year. We set an initial sampling rate based on advice from staff at GTNP and adjusted it during the season to yield a sample of approximately 200 visitors. Visitors were intercepted according to the sampling rate.

At the Moran Entrance, we conducted sampling between 11 am and 1 pm on randomly selected days. A majority of the visitors using the Moran Entrance travel to the South Entrance to YNP. Visitors entering at Moran on their way to YNP were sampled at the South Entrance to YNP. Visitors who were only visiting GTNP were eligible to be sampled at Moran. Although visitor statistics exist for this entrance,

the statistics were not kept by the hour, and they did not distinguish between visitors staying in GTNP and those traveling on to YNP. We set the sampling rates based on assumptions about the fraction of visitors staying in GTNP and entering between 11 am and 1 pm.

To be eligible for the survey, visitors had to meet the same criteria that visitors in YNP had to meet.

3 Survey Design

This section briefly summarizes the primary steps involved in designing the 2002–2003 Winter Visitor Survey.

We designed the survey to provide information for the regulatory process, balancing the need for detailed information against the burden to the respondent. Prior to designing a draft survey instrument, we conducted two formal focus groups with individuals who engaged in winter recreation, including people who had been to YNP and GTNP in the winter for both snowmobiling and skiing. Additional information came from discussions with staff at YNP and GTNP; interviews were conducted over the last two winter seasons with local business owners in the GYA; academic consultants Dr. V. Kerry Smith, and Dr. John Loomis; and past winter visitor surveys conducted in YNP.

Based on these discussions, we created an initial draft of the survey. This version was tested through cognitive interviews with individuals at RTI. The draft was revised and tested again through nine cognitive interviews with residents of the GYA who participated in both snowmobiling and skiing. In addition, we held an on-site meeting with staff from YNP and GTNP, other NPS employees, and Dr. John Loomis in October 2002 in YNP. Based on feedback from these pretests, we created a revised draft, which we tested on a focus group conducted by Dr. Loomis in Denver, Colorado, with members of an outdoor recreation club that makes a yearly trip to YNP.

The Office of Management and Budget (OMB) reviewed the survey and provided comments on the sampling plan and survey questions. OMB officially approved the survey (OMB Approval #1024-0224 (NPS #03-004) Expiration Date: 09/30/2003).

The final version of the survey consists of two parts. First, a short survey administered in the parks asks for the visitor's name and mailing address along with two or three additional questions about his trip. Appendix A contains the questions for the contact in the park.

Following the initial contact, we mailed survey respondents the main questionnaire (Section 4 provides details on data collection).

The main questionnaire contains four sets of questions:

- questions about the visitor's trip including activities, the areas she visited, and expenditures;
- questions about the visitor's winter recreation last season (2001–2002);
- stated preference conjoint questions and a stated behavior question; and
- demographics.

Four versions of the main survey were created for local, experienced snowmobile riders; nonlocal, experienced snowmobile riders; local "all others"; and nonlocal "all others."

Respondents were sorted into groups based on their responses to the initial questions asked in the park. Four versions of the main survey were created for local, experienced snowmobile riders; nonlocal, experienced snowmobile riders; local "all others"; and nonlocal "all others" according to the following definitions:

- Local: on a day trip
- Nonlocal: on an overnight trip
- Experienced snowmobile rider: a person riding a snowmobile in the park the day he was intercepted and not his first time on a snowmobile
- All others: people not riding a snowmobile in the park the day they were intercepted or first-time snowmobile riders

The local version of the main survey grouped the expenditure questions that would apply to overnight visitors on a page that would be easy to skip if the respondent was on a day trip.[1] Experienced snowmobile riders were asked questions about the snowmobile trips they took last winter season (2001–2002), while all others were asked about winter trips for cross-country skiing, snowshoeing, hiking, and camping in winter 2001–2002. Appendix B contains the survey questions.

[1]For the first survey mailing, the local survey contained expenditure questions relevant only to day trips. However, concerns about accuracy of the answers to the screening questions led to the inclusion of expenditure questions relevant to overnight trips on one page of the local survey.

Section 6 contains more details about the stated behavior question, the question about snowmobile trips during the 2000–2001 season, and the stated preference conjoint questions.

4 Data Collection Methods

4.1 YELLOWSTONE NATIONAL PARK: COLLECTING CONTACT INFORMATION

In this section, information is provided on the data collection methodology and the survey response rates achieved.

In YNP, most visitors were sampled at the entrance gates as they entered the park according to the sample design. The exceptions were snowcoach passengers from the West Entrance, who were sampled at Madison Junction to avoid traffic flow problems at the West Entrance, and snowcoach passengers from the South Entrance, who were sampled as they exited the park. Although some of the field survey staff in YNP were off-duty park employees, all the staff recruiting survey respondents were hired and paid as temporary employees of RTI.

Survey field staff responsible for recruiting the sample counted visitors until they reached the "Nth" visitor according to the sampling plan. The staff approached this visitor to determine eligibility for the survey. The staff asked eligible visitors for their participation in the survey according to a script. Eligible visitors who provided their contact information were then asked the questions listed in Appendix A and given a scenic postcard of YNP that provided a brief description of the survey and a toll free number and email address where the respondent could get more information.

If the visitor was ineligible, the field staff marked the reason for ineligibility on their sampling sheet. If the visitor refused to stop or when stopped refused to provide contact information, the field staff noted their mode of transportation. Modes of transportation

included snowmobile, snowcoach, auto/RV/bus/van, skis, and other.

4.2 GRAND TETON NATIONAL PARK: COLLECTING CONTACT INFORMATION

In GTNP, visitors were sampled at two points as they entered the park according to the sample design. Survey field staff hired by RTI intercepted visitors at the Taggart Lake parking lot as they arrived in their cars, and on-duty park staff in the entrance booth at the Moran Entrance intercepted the visitors as they entered the park. Otherwise the procedures were the same as in YNP.

4.3 SURVEY FOLLOW-UP

All visitors who provided contact information received a package in the mail containing

- a cover letter on Department of the Interior letterhead signed by John Sacklin, the Chief of Planning at YNP, that included a toll-free number and survey email address for additional information;
- a copy of the survey;
- a postage-paid business return envelope; and
- a $5 bill as an incentive to answer the survey.

After approximately 2 weeks, visitors who had not returned their surveys were sent a scenic reminder postcard with the toll-free number and survey email address.

Visitors who had not returned their surveys after approximately one month were mailed a second package sent priority mail that included

- a cover letter on RTI letterhead signed by Carol Mansfield, the RTI project manager, and Dr. Daniel Phaneuf, a survey consultant from North Carolina State University, that included a toll-free number and survey email address for additional information;
- a copy of the survey; and
- a postage-paid business return envelope.

4.4 RESPONSE RATES

Table 4-1 provides the response rates by entrance and mode of transportation for the YNP and GTNP Taggart Lake samples.

Table 4-1. Percentage and Number of Visitors Who Agreed to Participate and Provided Contact Information by Entrance and Mode of Transportation

	Mode of Transportation				
	Snowmobile	**Snowcoach**	**Auto or Bus**	**Cross-Country Ski**	**Overall**
YNP North			98% (N = 341)		98% (N = 341)
YNP South	98% (N = 256)	96% (N = 65)		100% (N = 2)	97% (N = 323)
YNP West	90% (N = 733)	86% (N = 200)		100% (N = 5)	89% (N = 938)
YNP East	94% (N = 88)				94% (N = 88)
All YNP Entrances	**92% (N = 1077)**	**88% (N = 265)**	**98% (N = 341)**	**100% (N = 7)**	**92% (N = 1,690)**
GTNP Taggart Lake			96% (N = 266)		96% (N = 266)

Overall, 92 percent of the visitors approached in YNP provided contact information. The North Entrance is the only entrance where visitors entered by car or bus, and at this entrance all visitors enter by car or bus. At the other entrances, the majority of visitors entered the park on snowmobiles. At the East Entrance, all visitors identified as eligible for the survey entered by snowmobile. Snowcoaches only operate out of the West and South Entrances. In YNP, 55 percent of the contacts were made at the West Entrance, and visitors riding snowmobiles accounted for 64 percent of the total YNP contacts.

As of June 24, 2003, 1,567 surveys had been returned, or approximately 80 percent of the surveys.

A total of 2,032 individuals provided contact information in the two parks. Out of these, 72 provided invalid addresses, so a total of 1,960 surveys were mailed out. As of June 24, 2003, 1,567 surveys had been returned, or approximately 80 percent of the surveys. Table 4-2 provides the response rate by entrance and overall.

Although visitors were recruited at the Moran entrance to GTNP, the data from these surveys were not analyzed as part of this report. At the Moran entrance, only 43 percent of the visitors intercepted at the entrance provided their name and address, and only 76 percent of these people completed the survey. This yielded a sample of 76 people. The poor response rate and limited sampling period

Table 4-2. Percentage of Mail Surveys Returned as of June 24, 2003

Entrance	Response Rate
YNP East	68%
YNP North	82%
YNP West	81%
YNP South	77%
All YNP Entrances	**80%**
GTNP Taggart Lake	83%

(visitors were only intercepted between 11 am and 1 pm) produced a sample that would not be sufficiently representative of the population of visitors using the entrance to access GTNP.

The survey design and administration procedures yielded a very high response rate, both in the parks and to the mail survey. The high response rate should provide the basis for a sample that is representative of winter visitors to YNP and the Taggart Lake entrance to GTNP.

5 Analysis and Results

5.1 SAMPLE STATISTICS AND WEIGHTS FOR YELLOWSTONE NATIONAL PARK SAMPLE

In this section, we provide summary statistics for the YNP and GTNP survey responses.

We designed the YNP sample as a probability-based sample that could be weighted to reflect the total population of winter visitors to YNP in 2002–2003. As described in Section 2.1, the sample was stratified along three dimensions:

- four entrances (West, North, East, and South),
- two activities (snowmobile and nonsnowmobile), and
- three types of days (weekdays, weekends, and holidays).

The resulting sample has 18 strata that were used to weight the survey results.[1] Based on the sampling plan and the results of the survey we calculated two sets of analysis weights—person-day weights and person-level weights. The sample person-day weight for each person in the sample was calculated as the reciprocal of his probability of selection given the date and entrance where he was intercepted, whether he was on a snowmobile, and the type of day. After adjusting for survey nonresponse these weights can be used to estimate the total number of person-days spent in the park by people who met the eligibility criteria for the study.

Many visitors entered the park multiple times during the season, and they had a positive probability of being selected each time they

[1] Everyone at the North Entrance entered the park in a wheeled vehicle and was considered a nonsnowmobile visitor for the purposes of the sampling plan. At the East Entrance, the sampling plan allowed for sampling both snowmobile riders and nonsnowmobile riders; however, on the randomly selected sampling days only snowmobile riders came through the entrance.

entered the park. To create person-level weights, which could be used to estimate the number of unique people who entered the park during the winter season, we adjusted the person-day weights using data from the survey about the number of days each person had spent in the park so far during the season and the number of days each person anticipated spending in the park over the rest of the season. Finally, both the person-day and person-level weights were adjusted for nonresponse (where nonresponse refers to visitors who did not supply their name and address or did not return their surveys). Appendix C contains the formulas used to calculate the weights and the nonresponse adjustments.

The nonresponse-adjusted weights were calibrated (post-stratified) using the official YNP estimates of visitor-days (person-days) during the 2002–2003 winter season broken down by snowmobile and nonsnowmobile riders to match our strata.

The nonresponse-adjusted weights were calibrated (post-stratified) using the official YNP estimates of visitor-days (person-days) during the 2002–2003 winter season broken down by snowmobile and nonsnowmobile riders to match our strata. The person-day and person-level weights were adjusted to match the park visitor-day estimates. Appendix C describes the post-stratification adjustment in more detail. The official park estimate of person-days in the park is not identical to our estimate for the following reasons:

- Our sample included only visitors 18 years of age or older, while the park statistics count all visitors.
- At the North Entrance, YNP counts are based on the number of cars multiplied by a constant number of visitors per car (2.5 in December 2002 and 2.74 for January through March 2003), while our counts are based on the actual number of people in the car.
- Random variations in visitation across days due to weather or other factors will affect how closely our projections, based on the days we sampled in the park, match actual park visitation.

Table 5-1 presents the predicted total number of unique park visitors (using person-level weights) and person-days (using person-day weights) for the winter 2002–2003 season to each entrance by snowmobile and nonsnowmobile riders using both the nonresponse-adjusted weights and the post-stratified weights.[2] As expected, the nonresponse-adjusted weights result in lower total numbers of unique visitors and person-days in the park compared to

[2]All results presented in this section reflect all survey responses except three that were dropped because the respondents were not recreating on their trips. One was going to Mammoth for breakfast, one went to church in Mammoth every Sunday, and the third was assessing impacts of snowmobiles.

Table 5-1. Estimated Park Visitor and Visitor-Day Totals

	Total Visitors[a]	Total Visitor Days[b]	Total Visitors Post-Stratified[c]	Total Visitor Days, Post-Stratified[d]	Ratio of Visitors[e]	Ratio of Visitor Days[f]
North Entrance (nonsnowmobile)	3,381	8,457	4,261	9,374	1.26	1.11
East Entrance (snowmobile)	563	1,357	1,357	2,741	2.41	2.02
West Entrance (nonsnowmobile)	2,092	3,674	3,332	5,494	1.59	1.50
West Entrance (snowmobile)	16,250	29,535	25,273	40,022	1.56	1.36
South Entrance (nonsnowmobile)	1,797	1,991	2,637	2,861	1.47	1.44
South Entrance (snowmobile)	5,944	8,353	10,000	12,956	1.68	1.55

a = Person-level, nonresponse-adjusted weight total (number of unique visitors)
b = Person-day level, nonresponse-adjusted weight total (number of visitor-days)
c = Post-stratified, person-level weight total (number of unique visitors calibrated to YNP visitor counts)
d = Post-stratified, person-day-level weight total (identical to YNP visitor counts for the six weighting classes)
e = Ratio of total visitors, post stratified and total visitors
f = Ratio of total visitor days, post stratified and total visitor days

the post-stratified weights. The last two columns contain the ratio of the predictions based on the post-stratified weights to the predictions based on the nonresponse-adjusted weights. The ratio is highest for the East Entrance (a higher ratio indicates a larger difference between the estimates). The East Entrance receives the least amount of traffic of all four entrances, so the sampling plan allocated the fewest sampling days to this entrance. Projections based on fewer days are less precise.

Section 5.2 presents the results of the survey weighted by the nonresponse-adjusted weights. The weights used for individual questions were further adjusted for item nonresponse (i.e., the number of people who returned a survey but did not answer a particular question).

5.2 VISITOR AND TRIP CHARACTERISTICS

In this section, we summarize the variables from the survey concerning visitor and trip characteristics for the YNP and GTNP Taggart Lake samples.

5.2.1 Yellowstone National Park Sample

Demographics

Visitors to YNP in the winter come from all over the U.S., although a majority live in western states. In Table 5-2, column 1 lists each state, and column 2 gives the unweighted percentage of visitors from that state in the sample. Column 3 presents the weighted percentages using the person-level nonresponse-adjusted weights (see Section 5.1). The weighted percentages indicate the estimated percentage of the total population of winter visitors to YNP from each state based on the results of the survey. Montana supplied the most visitors to YNP, and a majority of visitors live west of the Mississippi River.

Overall, visitors to YNP in the winter are well educated and have a higher income compared to the general U.S. population. Compared to snowmobile riders, nonsnowmobile visitors are somewhat more educated, more of them are retired, and they earn on average somewhat less income.

Table 5-3 contains demographic information about the sample intercepted in YNP. The weighted percentages are provided for the sample as a whole and for snowmobile riders and nonsnowmobile visitors separately. Overall, visitors to YNP in the winter are well educated and have a higher income compared to the general U.S. population. Compared to snowmobile riders, nonsnowmobile visitors are somewhat more educated, more of them are retired, and they earn on average somewhat less income. Visitors are generally married with an average age between 40 and 50 years. Males compose a larger fraction of the snowmobile riders, compared to the nonsnowmobile visitors.

More than one quarter of the snowmobile riders own a snowmobile, and about 30 percent own snowmobiles that employ fuel-injected two-stroke engines or four-stroke engines. On average, snowmobile riders have been riding for 12 years. Although nonsnowmobile visitors are more likely to own cross-country skis and snowshoes, a significant percentage of snowmobile riders own other winter recreation equipment as well. In terms of club memberships, about a third of nonsnowmobile visitors belong to an environmental organization compared to 10 percent of snowmobile riders.

Activities and Trip Characteristics

Respondents were asked to indicate all the activities they participated in on their most recent trip and the location of the activity. People on day trips were given the choice of YNP and GTNP as locations. People on overnight trips were also given the

Table 5-2. Yellowstone National Park Visitation by State—All Entrances

State	Unweighted Share of Total	Weighted Share of Total[a]
AL	0.55%	0.36% (0.16%)
AR	0.39%	0.57% (0.29%)
AZ	0.70%	0.75% (0.34%)
CA	4.52%	5.97% (1.01%)
CO	2.57%	2.58% (0.67%)
CT	0.55%	0.42% (0.21%)
DC	0.23%	0.19% (0.18%)
FL	4.91%	5.99% (1.15%)
GA	3.66%	4.26% (0.82%)
IA	0.94%	0.72% (0.29%)
ID	5.77%	5.96% (0.85%)
IL	2.03%	2.08% (0.48%)
IN	1.48%	1.70% (0.51%)
KS	0.23%	0.13% (0.12%)
KY	0.39%	0.39% (0.21%)
LA	0.78%	1.18% (0.47%)
MA	0.55%	0.48% (0.21%)
MD	0.62%	0.55% (0.25%)
ME	0.31%	0.50% (0.34%)
MI	2.73%	3.02% (0.74%)
MN	4.21%	5.11% (1.33%)

(continued)

Table 5-2. Yellowstone National Park Visitation by State—All Entrances (continued)

State	Unweighted Share of Total	Weighted Share of Total[a]
MO	0.55%	0.57% (0.27%)
MS	0.23%	0.23% (0.14%)
MT	20.27%	13.75% (1.33%)
NC	1.33%	1.56% (0.41%)
ND	0.55%	0.66% (0.35%)
NE	0.39%	0.35% (0.19%)
NH	0.39%	0.21% (0.15%)
NJ	1.33%	1.72% (0.43%)
NM	0.23%	0.24% (0.15%)
NV	0.94%	1.05% (0.55%)
NY	3.04%	3.35% (0.71%)
OH	2.03%	2.07% (0.52%)
OK	0.94%	0.52% (0.26%)
OR	0.55%	0.50% (0.23%)
PA	2.10%	1.69% (0.41%)
RI	0.16%	0.18% (0.14%)
SC	0.62%	0.71% (0.25%)
SD	0.62%	0.51% (0.24%)
TN	1.71%	2.01% (0.54%)
TX	3.51%	4.43% (0.80%)
UT	5.61%	7.05% (1.52%)

(continued)

Table 5-2. Yellowstone National Park Visitation by State—All Entrances (continued)

State	Unweighted Share of Total	Weighted Share of Total[a]
VA	0.62%	0.60% (0.36%)
VT	0.62%	0.69% (0.28%)
WA	3.66%	3.98% (0.74%)
WI	2.65%	2.58% (0.56%)
WV	0.16%	0.10% (0.07%)
WY	5.53%	4.94% (1.12%)
Canada	0.55%	
Other countries	1.01%	
Other		0.85% (0.30%)

[a]Weighted estimates calculated using nonresponse-adjusted person-level weights. Numbers in parentheses are standard errors on weighted percentage calculations.

choice of recreating in the GYA outside the parks. Table 5-4 presents the percentage of visitors who indicated each activity for each location. After indicating all the activities they participated in, respondents were asked to select one activity as their primary activity for the trip. The last column of Table 5-4 lists the percentage of visitors who indicated that a particular activity was their primary activity.

A majority of winter visitors in YNP rode a snowmobile without a guide, and 55 percent indicated riding a snowmobile without a guide was the primary activity on their most recent trip. Many visitors also indicated that they rode a snowmobile outside the parks on their trip. Downhill skiing was the next most popular primary activity, indicating that many visitors to YNP come to the area to recreate outside the parks.[3] Thirteen percent of visitors indicated that they took a snowcoach tour of YNP; however, slightly less than 5 percent listed snowcoach tour as the primary activity for their most recent trip.

[3]Several respondents indicated that they went downhill skiing in YNP or GTNP, although there is no downhill skiing in the parks. It is possible these visitors did some other kind of skiing in the parks.

Table 5-3. Sample Demographics for Yellowstone National Park Sample, Weighted Estimates[a]

	Total	Snowmobilers	Nonsnowmobilers
Education			
Some high school or high school graduate	11.51% (1.09%)	12.27% (1.25%)	8.69% (1.91%)
Some college or college graduate	58.25% (1.72%)	60.91% (1.91%)	48.33% (3.71%)
Some graduate school or graduate degree	30.24% (1.58%)	26.83% (1.55%)	42.985 (4.50%)
Employment status			
Employed full-time	69.75% (1.73%)	73.60% (1.93%)	55.40% (3.03%)
Employed part-time	7.95% (0.96%)	6.91% (1.09%)	11.83% (2.08%)
Retired	12.65% (1.06%)	9.97% (1.14%)	22.64% (2.33%)
Student	1.84% (0.53%)	1.49% (0.54%)	3.12% (1.46%)
Homemaker	3.79% (0.82%)	3.84% (1.01%)	3.63% (0.93%)
Unemployed	1.36% (0.39%)	1.29% (0.43%)	1.60% (0.89%)
Other	2.67% (0.50%)	2.90% (0.57%)	1.78% (1.05%)
Married	79.84% (1.39%)	79.96% (1.65%)	79.42% (2.43%)
Age[b]	45.62 (0.53)	44.57 (0.55)	49.54 (1.27)
Number of children at home under age 18[b]	0.60 (0.04)	0.68 (0.05)	0.31 (0.04)
Male	65.39% (2.05%)	70.17% (2.01%)	47.48% (5.58%)
Total household annual income before taxes (2002)			
Less than $25,000	6.44% (1.03%)	5.38% (0.93%)	10.36% (3.35%)
$25,000 to $59,999	22.33% (1.50%)	20.40% (1.67%)	29.74% (3.28%)
$60,000 to $124,999	40.85% (2.02%)	42.12% (2.42%)	36.16% (3.32%)
More than $125,000	30.37% (1.84%)	32.09% (2.20%)	24.00% (3.01%)

(continued)

Table 5-3. Sample Demographics for Yellowstone National Park Sample, Weighted Estimates[a] (continued)

	Total	Snowmobilers	Nonsnowmobilers
Own a snowmobile	24.24% (1.98%)	29.58% (2.43%)	4.25% (1.74%)
Type of snowmobile owned			
Two-stroke engine snowmobile		67.10% (3.74%)	
Fuel-injected two-stroke engine snowmobile		23.12% (3.49%)	
Four-stroke engine snowmobile		6.13% (1.81%)	
Don't know		3.65% (1.52%)	
Own cross-country skis	21.91% (1.74%)	18.63% (1.93%)	34.18% (3.66%)
Own downhill skis	39.55% (1.82%)	40.30% (2.19%)	36.74% (2.68%)
Own snowshoes	17.29% (1.37%)	16.01% (1.57%)	22.09% (2.79%)
Years riding a snowmobile[a]		12.04 (0.46)	
Years riding a snowmobile (median)		9.08	
Belong to snowmobile club	9.03% (0.88%)	11.40% (1.15%)	0.14% (0.11%)
Belong to cross-country ski club	1.90% (0.56%)	0.66% (0.30%)	6.56% (2.22%)
Belong to environmental organization	14.06% (1.17%)	10.15% (0.99%)	28.68% (4.02%)

[a]Weighted estimates calculated using nonresponse-adjusted person-level weights. Numbers in parentheses are standard errors on weighted calculations. Definitions for "snowmobilers" and "nonsnowmobilers" based on general primary activity in the parks, summary contained in Table 5-5.

[b]Mean and standard error on mean.

Table 5-4. Trip Activities for Yellowstone National Park Sample, Weighted Estimates[a]

Activity	YNP	GTNP	Outside the Parks in the GYA	Percentage Indicating this Was His/Her Primary Activity
Snowmobiling without commercial tour guide	67.00% (2.30%)	4.85% (0.88%)	31.49% (2.61%)	55.06% (2.26%)
Snowmobiling with commercial tour guide	10.95% (1.50%)	1.85% (0.57%)	4.54% (0.79%)	7.61% (0.92%)
Cross-country skiing without tour guide	5.72% (0.85%)	1.23% (0.42%)	4.77% (1.10%)	4.54% (0.86%)
Cross-country skiing with commercial tour guide	0.15% (0.14%)		.	0.09% (0.06%)
Cross-country skiing with NPS guide	0.44% (0.24%)			
Snowshoeing	2.39% (0.49%)	1.05% (0.35%)	2.11% (0.61%)	0.50% (0.16%)
Snowcoach tour of park sights	13.28% (1.49%)	1.49% (0.59%)	0.26% (0.15%)	4.59% (0.86%)
Driving tour of park sights	9.51% (0.93%)	3.91% (0.56%)	5.26% (0.67%)	4.17% (0.57%)
Bus tour of park sights	0.72% (0.31%)	0.28% (0.26%)	0.39% (0.32%)	1.21% (0.42%)
Educational tours led by NPS guide	1.30% (0.38%)	0.75% (0.36%)	0.78% (0.38%)	0.51% (0.28%)
Winter camping	0.30% (0.12%)	0.13% (0.10%)	0.39% (0.19%)	0.34% (0.16%)
Downhill skiing	1.43% (0.41%)	3.25% (0.73%)	22.61% (1.99%)	16.90% (1.68%)
Other activity	4.18% (0.65%)	1.09% (0.37%)	8.95% (1.23%)	4.48% (0.69%)

[a]Weighted estimates calculated using nonresponse-adjusted person-level weights. Numbers in parentheses are standard errors on weighted calculations.

We assigned all visitors to one of four general activity categories based on the four major classes of activities that people do in YNP.

Using Table 5-4 and answers to other survey questions, we assigned all visitors to one of four general activity categories based on the four major classes of activities that people do in YNP. Table 5-5 contains the results for the whole sample and broken down by whether the respondents were intercepted at the West Entrance or one of the other three entrances. For visitors who did not indicate their primary activity, a primary activity was assigned according to the activity indicated for their "typical" trip on the survey (see Appendix B, page B-13 Question 20). If the respondent indicated their typical activity was "drive car to sightsee, ski, or snowshoe," we assigned a primary activity according to their answers to the questions in Table 5-4. For respondents who provided no useful information in the activity list, a primary activity was assigned based on their activity when they were intercepted in the park and the entrance where they were intercepted.

Table 5-5. Primary Activity in Yellowstone or Grand Teton National Park for Yellowstone National Park Sample, Weighted Estimates[a]

	Total	West	North/South/East
Snowmobiling	73.51% (2.05%)	87.32% (2.05%)	51.84% (2.96%)
Cross-country skiing or snowshoeing	5.85% (1.02%)	3.66% (1.24%)	9.29% (1.69%)
Snowcoach tour	8.79% (1.43%)	8.00% (1.27%)	10.02% (3.04%)
Car or bus tour	11.85% (1.24%)	1.03% (0.38%)	28.84% (2.68%)

[a]Weighted estimates calculated using nonresponse-adjusted person-level weights. Numbers in parentheses are standard errors on weighted calculations. "West" and "North/South/East" refer to the entrance where the visitor was intercepted for this survey.

Almost 75 percent of current winter visitors to YNP were classified as snowmobile riders for their primary activity. At the West Entrance, almost 90 percent of visitors were assigned snowmobile riding as their primary activity. Taking a car or bus tour was the next most popular category, and about equal numbers of visitors were classified as snowcoach tour riders or cross-country skiers/snowshoers.

According to the survey, 41 percent of visitors would not change anything about their trip. At least 5 percent of visitors identified smoother road surface, level of exhaust emissions, cost, and number of other snowmobiles as the one thing they would change.

Table 5-6 describes additional details of the individuals' trips. According to the results, about 15 percent of visitors were on day trips. The average length of an overnight trip was almost 5 days, with 1.5 days spent in YNP on average. About 65 percent of the visitors rented a snowmobile. Comparing people on day trips with people on overnight trips, just over 50 percent of day-trip visitors rented a snowmobile, while almost 70 percent of overnight visitors rented a snowmobile. The survey asked respondents what one thing about their trip would they change. According to the survey, 41 percent of visitors would not change anything about their trip. At least 5 percent of visitors identified smoother road surface, level of exhaust emissions, cost, and number of other snowmobiles as the one thing they would change.

Figure 5-1 shows the percentage of respondents who visited the GYA for different reasons. Although "Visit YNP" was the most popular reason, over one-third of the sample came to the area primarily to recreate outside the parks.

Finally Table 5-7 presents information about expenditures on the individual's trip, including the number of nights spent in different communities near the park. The cover of the survey instrument in Appendix B shows a map of the GYA including the towns listed in the table. West Yellowstone, Montana, was the most popular destination, although compared to nonsnowmobile visitors the town is much more popular with snowmobile riders. Nonsnowmobile visitors were more likely to have stayed in Gardiner, Montana, or Jackson, Wyoming. Winter visitors to YNP mostly traveled in groups with friends or family.

With respect to expenditures, 32 percent of the visitors purchased some kind of package tour. The per-day per-person expenditures presented at the end of Table 5-7 are for items not included in package tours for overnight visitors. Snowmobile riders spent more than nonsnowmobile visitors in all categories except tour and activity fees.

Table 5-6. Trip Characteristics for Yellowstone National Park Sample, Weighted Estimates[a]

	Total	Snowmobilers	Nonsnowmobilers
Percentage visitors on day trip	15.38% (1.82%)	13.68% (2.17%)	21.72% (3.24%)
Multiday trip visitors			
Number of days on trip			
Mean	4.76 (0.14)	4.76 (0.17)	4.78 (0.18)
Median	3.79	3.78	3.81
Number of days in YNP			
Mean	1.58 (0.04)	1.58 (0.04)	1.57 (0.14)
Median	0.81	0.82	0.75
Number of days in GTNP			
Mean	0.55 (0.06)	0.55 (0.07)	0.57 (0.12)
Median	0	0	0
Number of days outside the parks in GYA			
Mean	3.85 (0.35)	3.73 (0.38)	4.43 (0.75)
Median	2.31	2.23	2.64
Rented a snowmobile on trip	65.80% (2.10%)		
For day-trip visitors, percentage renting a snowmobile	52.69% (6.08%)		
Rented two-stroke	43.04% (8.42%)		
Rented four-stroke	31.71% (5.82%)		
Don't know	25.25% (6.21%)		
For overnight visitors, percentage renting a snowmobile	68.18% (2.06%)		
Rented two-stroke	51.81% (3.07%)		
Rented four-stroke	33.37% (2.33%)		
Don't know	14.82% (2.24%)		

(continued)

Table 5-6. Trip Characteristics for Yellowstone National Park Sample, Weighted Estimates[a] (continued)

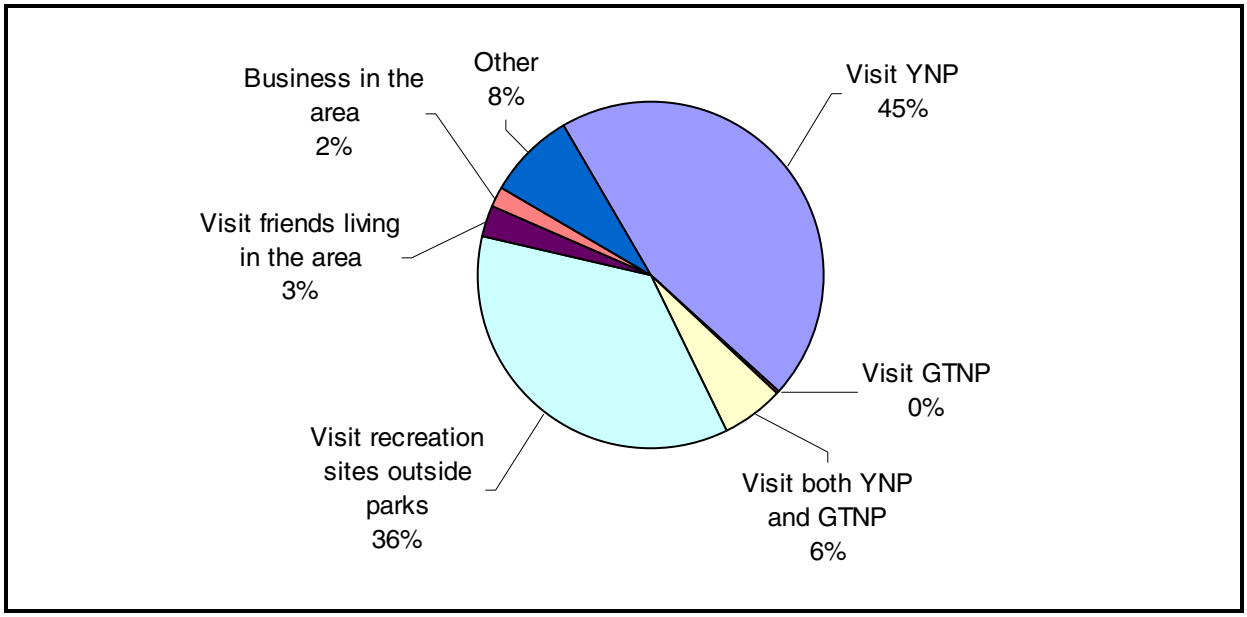
	Total	Snowmobilers	Nonsnowmobilers
Number of days in YNP so far this season and anticipated[b]			
Mean	1.57 (0.04)	1.54 (0.04)	1.66 (0.11)
Median	0.73	0.74	0.69
Number of days in GTNP so far this season and anticipated[b]			
Mean	0.57 (0.07)	0.59 (0.08)	0.48 (0.08)
What one thing about your trip would you change?			
Number of other visitors	0.75% (0.30%)	1.18%[c]	0.75%[c]
Number of other snowmobiles	5.33% (0.94%)	2.36%[c]	19.55%[c]
Number of other cars	0.26% (0.15%)	0.35%[c]	0.75%[c]
Noise level	3.07% (0.62%)	2.72%[c]	4.51%[c]
Smoother road surface	14.66% (1.56%)	14.42%[c]	7.27%[c]
Level of exhaust emissions	7.47% (1.05%)	6.50%[c]	5.26%[c]
Cost	6.83% (0.97%)	8.04%[c]	3.26%[c]
Other	20.39% (1.67%)	19.62%[c]	17.54%[c]
Wouldn't change anything	41.24% (2.48%)	44.80%[c]	41.10%[c]

[a]Weighted estimates calculated using nonresponse-adjusted person-level weights. Numbers in parentheses are standard errors on weighted calculations. Definitions for "snowmobilers" and "nonsnowmobilers" based on primary activity in the parks, summary contained in Table 5-5.

[b]Number of days so far this season and anticipated is the sum of Questions 16 to 18 (page B-9) from the survey instrument in Appendix B.

[c]Unweighted percentages.

Figure 5-1. Primary Purpose for Visit, Yellowstone National Park Sample



5.2.2 Grand Teton Taggart Lake Parking Area

Demographics

As with the YNP visitors, the people in the GTNP survey sample are well educated and have a high income. Compared to the YNP sample, they are more like the nonsnowmobile visitors than the snowmobile visitors in terms of demographics (and, as reported in later tables, in terms of activities).

We start with some basic demographics of the GTNP survey population. In Table 5-8, column 2 gives the percentage of the sample from each state. Over 45 percent of the visitors sampled at this location live in Wyoming.

Table 5-9 contains demographic information about the sample intercepted in GTNP at the Taggart Lake parking area. As with the YNP visitors, the people in the GTNP survey sample are well educated and have a high income. Compared to the YNP sample, they are more like the nonsnowmobile visitors than the snowmobile visitors in terms of demographics (and, as reported in later tables, in terms of activities). A large percentage of the sample owns cross-county skis, downhill skis, and snowshoes, while less than 5 percent own a snowmobile.

Activities

Respondents were asked to indicate all the activities they participated in on their most recent trip and the location of the activity. People on day trips were given the choice of YNP and GTNP as locations. People on overnight trips were also given

Table 5-7. Trip Characteristics and Expenditure for Yellowstone National Park Sample, Weighted Estimates[a]

	Total	Snow-mobilers	Nonsnow-mobilers	Number of Nights Spent[b]
Percentage who stayed and number of nights spent in[c]				
West Yellowstone, Montana	48.62%	60.34%	19.75%	3.44 (0.15)
Gardiner, Montana	13.38%	7.15%	28.66%	1.98 (0.11)
Jackson, Wyoming	20.11%	22.24%	14.97%	4.36 (0.25)
Pahaska Tepee, Wyoming	4.52%	6.37%	0.00%	1.33 (0.14)
Cody, Wyoming	2.40%	3.12%	0.64%	3.02 (0.44)
Old Faithful Snowlodge, YNP	8.12%	4.81%	16.24%	1.92 (0.16)
Mammoth Hot Springs, YNP	3.41%	1.95%	7.01%	1.49 (0.16)
Bozeman, Montana	9.04%	7.15%	13.69%	2.73 (0.51)
Big Sky, Montana	10.79%	9.62%	13.69%	5.72 (0.41)
Other	13.93%	13.00%	16.24%	3.28 (0.31)
What kind of group were you with on your recent trip?				
Alone	1.91% (0.48%)	1.56% (0.52%)	3.21% (1.12%)	
With family	56.59% (1.97%)	55.64% (2.25%)	60.13% (4.35%)	
With friends	44.87% (2.23%)	47.40% (2.41%)	35.45% (5.53%)	
With a club or other organized group	8.13% (1.28%)	8.32% (1.54%)	7.40% (1.68%)	
Other	2.72% (0.54%)	2.62% (0.61%)	3.11% (1.18%)	
Percentage purchasing a package tour	31.68% (2.19%)	34.77% (2.55%)	20.13% (3.60%)	
Expenditure for items not included in package tours for overnight visitors, per day per person[d]				
Lodging during stay in GYA				
Mean	$46.22 (2.42)	$50.80 (3.03)	$30.52 (3.06)	
Median	$33.13	$37.42	$18.17	

(continued)

Table 5-7. Trip Characteristics and Expenditure for Yellowstone National Park Sample, Weighted Estimates[a] (continued)

	Total	Snowmobilers	Nonsnow-mobilers
Food/drink at restaurants/bars in GYA			
Mean	$35.52 (1.45)	$38.55 (1.60)	$25.13 (3.43)
Median	$24.31	$27.84	$14.90
Food/drink from grocery/convenience stores in GYA			
Mean	$7.82 (0.60)	$8.39 (0.72)	$5.88 (0.95)
Median	$3.75	$4.41	$2.33
Transportation in GYA			
Mean	$19.08 (1.25)	$20.00 (1.39)	$15.88 (2.98)
Median	$4.94	$7.11	$1.10
Tour/activity fees			
Mean	$12.19 (1.99)	$11.11 (2.37)	$15.92 (3.50)
Median	$0.00	$0.00	$0.00
Equipment rental			
Mean	$27.52 (2.58)	$34.16 (3.22)	$4.79 (0.68)
Median	$0.00	$8.31	$0.00
Expenditure for items not included in package tours for overnight visitors, total for trip			
Transportation to GYA			
Mean	$249.53 (24.14)	$253.75 (28.67)	$233.78 (40.40)
Median	$97.33	$116.02	$43.82
Souvenirs/gifts			
Mean	$71.21 (7.50)	$78.63 (9.43)	$43.46 (6.84)
Median	$23.32	$29.54	$8.81

[a]Weighted estimates calculated using nonresponse-adjusted person-level weights except where noted. Numbers in parentheses are standard errors on weighted calculations. Definitions for "snowmobilers" and "nonsnowmobilers" based on general primary activity in the parks, summary contained in Table 5-5.

[b]Means and (standard errors) for visitors who spent at least one night in the city.

[c] Unweighted percentages because small sample size from East Entrance made weighting of Pahaska Teepee results difficult.

[d]Weighted using person-day nonresponse-adjusted weights.

Table 5-8. Grand Teton National Park Taggart Lake Sample Visitation by State

State	Share of Total
AL	0.91%
AR	0.45%
AZ	0.45%
CA	3.64%
CO	4.55%
CT	1.36%
DC	0.91%
FL	1.36%
GA	0.91%
ID	5.45%
IL	4.09%
IN	0.45%
LA	0.45%
MA	0.45%
MD	0.45%
ME	0.45%
MI	0.91%
MN	1.36%
MO	1.36%
MT	1.82%
NC	1.82%
NH	0.45%
NM	0.45%
NY	2.73%
OH	1.82%
OR	1.36%
PA	1.36%
RI	0.45%
TN	0.45%
TX	1.82%
UT	3.64%
VA	2.73%
VT	0.45%
WA	1.36%
WI	0.45%
WY	46.36%
Canada	0.45%

Table 5-9. Sample Demographics for Grand Teton National Park Taggart Lake Sample

	Total	n[a]
Education		216
Some high school or high school graduate	1.85%	
Some college or college graduate	49.54%	
Some graduate school or graduate degree	48.61%	
Employment status		215
Employed full-time	64.19%	
Employed part-time	9.30%	
Retired	11.63%	
Student	5.12%	
Homemaker	4.65%	
Unemployed	2.79%	
Other	2.33%	
Married	70.70%	215
Age[b]	44.7	213
Number of children at home under age 18[b]	0.3	204
Male	53.20%	203
Total household annual income before taxes (2002)		206
Less than $25,000	13.11%	
$25,000 to $59,999	23.30%	
$60,000 to $124,999	40.29%	
More than $125,000	23.30%	
Own a snowmobile	4.23%	213
Own cross-country skis	71.69%	219
Own downhill skis	60.09%	218
Own snowshoes	53.70%	216
Belong to snowmobile club	0.00%	212
Belong to cross-country ski club	11.79%	212
Belong to environmental organization	31.78%	214

[a]n is the number of people who answered each question; the total sample size is 220.

[b]Mean.

In contrast to the YNP sample, very few visitors rode a snowmobile. The majority of visitors cross-country skied in GTNP, while a third went snowshoeing and 20 percent went downhill skiing outside the parks.

the choice of recreating in the GYA outside the parks. Table 5-10 presents the percentage of visitors who indicated each activity for each location. In contrast to the YNP sample, very few visitors rode a snowmobile. The majority of visitors cross-country skied in GTNP, while a third went snowshoeing and 20 percent went downhill skiing outside the parks. The Taggart Lake parking lot serves as the entrance to numerous cross-country ski trails in GTNP, and the activity choices are consistent with the location. It is interesting to note how few of the visitors recreated in YNP on their trip.

After indicating all the activities they participated in, respondents were asked to select one activity as their primary activity for the trip. The last column of Table 5-10 lists the percentage of visitors who indicated that a particular activity was their primary activity. As with YNP, respondents were then assigned a primary activity inside the parks. Table 5-11 indicates the percentage of the sample for each of the four primary activities. Approximately 80 percent of the visitors said cross-country skiing or snowshoeing was their primary activity. For visitors who did not indicate their primary activity, we assigned a primary activity according to the activity indicated for their "typical" trip (see Appendix B, page B-13 Question 20). Where the activity was drive car to sightsee, ski, or snowshoe, we assigned an activity based on the activities they did during their trip as reported in Table 5-10. For respondents who did not answer this question, we designated people intercepted at Taggart Lake as cross-country skiers.

Table 5-12 describes additional details of the individuals' trips. Compared to the YNP sample, 40 percent of the GTNP visitors were on a day trip. Of those visitors on multiday trips, the average trip was 7 days long with most of that time spent in either GTNP or outside the parks. Consistent with the activities reported in Table 5-10, less than 8 percent of overnight visitors and no day-trip visitors rented snowmobiles. In terms of satisfaction with their trip, almost 60 percent reported that they would not change anything about their trip.

Table 5-10. Trip Activities for Grand Teton National Park Taggart Lake Sample

Activity	YNP	GTNP	Outside the Parks in the GYA	Percentage Indicating this Was their Primary Activity
Snowmobiling without commercial tour guide	3.21%	0.46%	1.38%	0.49%
Snowmobiling with commercial tour guide	0.46%	0.46%	1.38%	0.49%
Cross-country skiing without tour guide	8.72%	74.31%	17.89%	62.62%
Cross-country skiing with tour guide	0.46%	1.38%	0.46%	0.49%
Cross-country skiing with NPS guide	0.00%	0.92%	0.00%	0.49%
Snowshoeing	5.05%	35.78%	11.01%	10.68%
Snowcoach tour of park sights	4.13%	0.00%	0.00%	
Driving tour of park sights	3.21%	22.02%	8.26%	1.46%
Bus tour of park sights	0.00%	0.00%	0.00%	0.49%
Educational tours led by NPS guide	1.38%	0.92%	0.00%	
Winter camping	0.92%	2.75%	0.92%	0.97%
Downhill skiing	1.38%	10.09%	20.18%	14.56%
Other activity	2.29%	9.17%	7.80%	7.28%
n[a]	218	218	218	206

[a]n is the number of people who answered each question; the total sample size is 220.

Table 5-11. Primary Activity in Yellowstone or Grand Teton National Park for Grand Teton National Park Taggart Lake Sample

Activity	Percentage
Snowmobiling	2.27%
Skiing/snowshoeing	82.27%
Snowcoach tour	0.45%
Car/bus	15.00%

Table 5-12. Trip Characteristics for Grand Teton National Park Taggart Lake Sample

	Percent	Mean (Median)	n[a]
Percentage visitors on day trip	40.45%		220
Multiday trip visitors			
Number of days on trip		7.1 (6.0)	115
Number of days in YNP		0.7 (0.0)	106
Number of days in GTNP		4.0 (3.0)	113
Number of days outside the parks in GYA		4.5 (3.0)	111
Rented snowmobile			
For day trips[b]	0.00%		
For overnight trips[c]	8.40%		
Rented two-stroke	63.64%		
Rented four-stroke	18.18%		
Don't know	18.18%		
Number of days in YNP so far this season and anticipated		1.4 (0)	194
Number of days in GTNP so far this season and anticipated		9.5 (5)	215
What one thing about your trip would you change?			212
Number of other visitors	1.89%		
Number of other snowmobiles	8.96%		
Number of other cars	0.94%		
Noise level	3.77%		
Smoother road surface	3.30%		
Level of exhaust emissions	2.36%		
Cost	1.42%		
Other	17.45%		
Wouldn't change anything	59.91%		

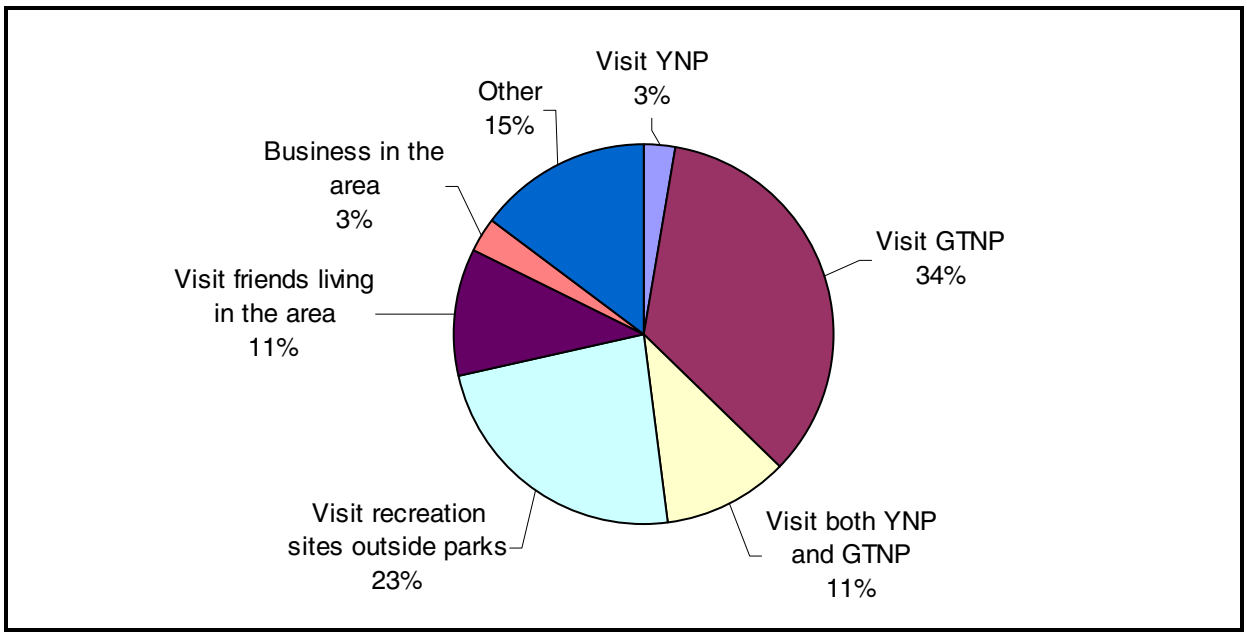
[a]n is the number of people who answered each question; the total sample size is 220, except where noted.

[b]Total sample size = 89, no one rented a snowmobile.

[c]Total sample size = 131, 11 people rented a snowmobile.

Figure 5-2 shows the percentage of respondents who visited the GYA for different reasons. The majority visited primarily to recreate in GTNP or outside the parks.

Figure 5-2. Primary Purpose for Visit, Grand Teton National Park Taggart Lake Sample



Finally, Table 5-13 presents information about expenditures on the individual's trip, including the number of nights spent in different communities near the park. Most visitors stayed in Jackson, Wyoming. Compared to YNP, a slightly larger percentage were on their trip alone, which is understandable given the large percentage of visitors on day trips. Per-day per-person expenditures were slightly higher than those for YNP nonsnowmobile visitors for lodging, food and drink in restaurants, and food and drink in grocery stores but lower for transportation in the GYA, tour fees, and equipment rental. The GTNP sample spent slightly more on transportation to the GYA and significantly more on gifts than the average visitor to YNP.

Table 5-13. Trip Characteristics and Expenditures for Grand Teton National Park Taggart Lake Sample

	Percentage	Average Nights (Median)	n[a]
Number of nights spent in[b]			
West Yellowstone	6.11%	3.9 (1)	
Gardiner	1.53%	5.5 (5.5)	
Jackson	81.68%	9.8 (5)	
Pahaska Tepee	0.00%	0.0 (0)	
Cody	2.29%	3.7 (2)	
Old Faithful Snowlodge	9.16%	2.6 (3)	
Mammoth Hot Springs	0.76%	2.0 (2)	
Bozeman	6.11%	2.6 (2)	
Big Sky	0.76%	3.0 (3)	
Other	15.27%	5.1 (5)	
What kind of group were you with on your recent trip?			220
Alone	13.18%		
With family	49.09		
With friends	41.36		
With a club or other organized group	2.27		
Other	1.36		
Percentage purchasing a package tour	8.78%		205

(continued)

Table 5-13. Trip Characteristics and Expenditures for Grand Teton National Park Taggart Lake Sample (continued)

	Percentage	Average Nights (Median)	n[a]
		Mean (Median)	
Expenditure for items not included in package tours for overnight visitors, per day per person[b]			
Lodging during stay in GYA		$41.62 ($31.25)	79
Food/drink at restaurants/bars in GYA		$27.28 ($20.00)	79
Food/drink from grocery/convenience stores in GYA		$7.81 ($4.00)	79
Transportation in GYA		$10.52 ($2.22)	79
Tour/activity fees		$7.38 ($0.00)	79
Equipment rental		$3.56 ($0.00)	79
Expenditure for items not included in package tours for overnight visitors, total for trip[b]			
Souvenirs/gifts		$148.16	79
Transportation to GYA		$252.11	79

[a]n is the number of respondents who answered the question; total sample size is 220 except where noted.

[b]Sample size = 131, overnight visitors.

6 Management and Valuation Questions

This section describes the analysis of survey results using stated behavior, revealed preference, and stated preference techniques.

A primary objective of the survey was to collect information that could be used to estimate behavioral changes in response to alternative winter management plans and willingness to pay (WTP) by park visitors for changes in key environmental variables in the parks. Because some visitors have strong opinions about the plans for alternative winter management in the parks, we attempted to design questions that would separate their opinions about management plans from their preferences for conditions in the park when they visit to limit strategic behavior in the valuation questions. To assess visitor reactions to the major alternatives for winter management proposed in the FSEIS (NPS 2003), each respondent was asked a stated behavior question that focused on how the visitor might change her travel plans in response to one of three proposed management plans. We designed three management plans to correspond with three of the management plans presented in the FSEIS (NPS, 2003).

In addition to the stated behavior question, we asked about snowmobile trips in the previous season to sites in Wyoming, Montana, and Idaho. The data from this question can be used to derive one measure of the welfare loss, or WTP, associated with banning snowmobiles from the parks. To estimate WTP for changes in key environmental and trip-related variables in the park that might change as a result of implementing alternative management plans, we also asked each respondent a series of stated preference conjoint questions. The conjoint questions asked respondents to choose between hypothetical trips, where the trips were described by variables related to activity; conditions in the park such as crowding, noise, and exhaust fumes; and cost. The data from these questions allow us to estimate the rate at which individuals make

trade-offs between activity, park conditions, and cost. These questions provide data for an estimate of welfare change resulting from changes in park conditions due to the different management plans.

The stated behavior and stated preference conjoint questions were designed to focus on simplified versions of three of the alternatives presented in Table 1-1. The three alternatives modeled were

- a ban on snowmobiles,
- a cap on the number of snowmobiles allowed in each day and a requirement that snowmobiles be on a guided tour, and
- a cap on the number of snowmobiles allowed in each day but no requirement for guided tours.

The ban represents the policy that will be enacted if no further action is taken (Alternative 1b in the FSEIS). The cap on numbers and a requirement for guided tours represents the preferred alternative in the FSEIS (Alternative 4). Finally, the cap on numbers with no guided tour requirement represents the basic structure of Alternative 2 from the FSEIS.

Below we discuss the results from the stated behavior questions, a travel cost model estimated using data about past snowmobile trips, and the stated preference conjoint experiment.

6.1 VISITATION UNDER DIFFERENT MANAGEMENT SCENARIOS

The stated behavior questions provide one estimate of how individuals would change their visits to YNP and GTNP if winter management in the parks were changed.

The stated behavior questions provide one estimate of how individuals would change their visits to YNP and GTNP if winter management in the parks were changed. The questions were intended to help estimate changes in visitation under alternative management proposals. Each respondent was presented with a single management proposal and asked about the impact of this proposal on her current trip and on trips over the entire season. Appendix B, Section B.3, contains the text of the management plan descriptions for the three management proposals.

The attributes of the management plans were designed to correspond to the major winter management alternatives outlined in the FSEIS and to the stated preference conjoint questions discussed in Section 6.3. Describing the management plans, we balanced the

length of the descriptions against the need to capture the most relevant features of the plans. For example, we chose to describe the caps as applying to all entrances but binding at the West and South Entrances to YNP rather than trying to present information on the proposed caps at all the entrances and current visitation. To facilitate comparisons, the two alternatives representing the cap on numbers of snowmobiles with and without a guided tour requirement are identical except for the guided tour requirement. The guided tour requirement corresponds to Alternative 4 in which a certain number of permits would be distributed to "noncommercial guides."

After the description of the management plan, the respondent was asked the following:

If this plan had been in effect this winter season how would your decision to make your *recent trip* to Yellowstone or Grand Teton National Park have been affected? Please check only one.

- ☐ My visit would not have been different.
- ☐ I would have stayed *fewer* days. → How many fewer days? _____
- ☐ I would have stayed *more* days. → How many more days? _____
- ☐ I would not have visited the park.

If this plan were in effect this winter season how would your *total visits* to Yellowstone and Grand Teton National Parks be affected? Please check only one.

- ☐ No change in total visits.
- ☐ I would visit *less* often. → I would take _____fewer annual trips
- ☐ I would visit *more* often. → I would take _____more annual trips
- ☐ I would not visit Yellowstone and Grand Teton National Parks.

Tables 6-1 and 6-2 present the results for these questions for the three management plans for the YNP and GTNP samples, respectively. Overall, in YNP the ban elicited the biggest changes in behavior in terms of people visiting more and visiting less. Table 6-3 contains the results for the YNP sample by primary activity in the park (see Table 5-5 for a breakdown of primary

Table 6-1. Stated Behavior Questions, Results for Yellowstone National Park Sample, Weighted Estimates[a]

	Ban on Snowmobiles	Cap on Number of Snowmobiles and Guided Tours Required	Cap on Number of Snowmobiles
Current Visit			
Increase days	5.90% (1.40%)	4.19% (1.78%)	3.40% (1.37%)
Average increase in days[b]	3.9	2.7	2.4
Visit unchanged	28.20% (2.45%)	54.21% (2.83%)	75.31% (3.35%)
Decrease days	2.92% (1.21%)	2.87% (1.12%)	0.87% (0.39%)
Average decrease in days[b]	3.8	1.9	1.5
Not visit	62.97% (2.58%)	38.73% (2.62%)	20.42% (3.04%)
Total visits this season			
Increase trips	6.35% (1.34%)	3.74% (1.16%)	5.06% (1.34%)
Average increase in trips[b]	4.0	1.8	1.9
Trips unchanged	30.22% (2.28%)	51.10% (2.67%)	70.65% (3.59%)
Decrease trips	10.49% (2.08%)	7.34% (1.48%)	3.75% (1.32%)
Average decrease in trips[b]	1.5	1.4	1.3
Not visit	52.94% (3.02%)	37.82% (3.07%)	20.53% (2.99%)

[a]Each respondent answered the questions about current visits and total visits for only one of the three management proposals. Weighted estimates calculated using nonresponse-adjusted person-level weights. Numbers in parentheses are standard errors on weighted calculations.

[b]Means of changes in number of days and trips are unweighted due to small sample size.

activities in the parks). As Table 6-3 shows, as expected, a large percentage of snowmobile riders say they would not visit the parks under the ban, while a large percentage of other visitors indicated they would visit more often. Among snowmobile riders, the policy of capping the number of snowmobiles but not requiring guided tours resulted in the smallest change in total visits compared to the current situation (68 percent would not change their total visits for the season) and the smallest number who answered that they would not visit (25 percent). The sample of snowmobiles is the largest of

Table 6-2. Stated Behavior Questions, Results for Grand Teton National Park Taggart Lake Sample[a]

	Ban on Snowmobiles	Cap on Number of Snowmobiles and Guided Tours Required	Cap on Number of Snowmobiles
Current Visit (n = 214)[b]			
Increase days	27%	9%	5%
Average increase in days	5.6	3.3	2
Visit unchanged	63%	80%	93%
Decrease days	0%	2%	0%
Average decrease in days	—	7	—
Not visit	10%	9%	2%
Total visits this season (n = 214)[b]			
Increase trips	35%	18%	24%
Average increase in trips	3.0	3.4	1.6
Trips unchanged	53%	68%	74%
Decrease trips	8%	5%	2%
Average decrease in trips	3.3	5.0	2.0
Not visit	5%	9%	0%

[a]Each respondent answered the questions about current visits and total visits this season for only one of the three management proposals.

[b]n is the number of people who answered the question.

the four primary activities, and the responses are estimated with the greatest precision.

Cross-country skiers and snowshoers represent a small group of respondents, and many of the weighted percentages have large standard errors. Overall the ban on snowmobiles elicited the largest increase in trips for these respondents, followed closely by the cap/guide policy. However, large standard errors on the percentages make firm conclusions difficult. Over 80 percent of visitors who indicated a snowcoach tour was their primary activity would not change the number of trips they took in a season under any of the proposed policies. Finally, visitors on auto/sightseeing tours in YNP, which would occur in the northern part of the park mostly, present a slightly more mixed response. Fifty percent or more would leave their trips per season unchanged in response to any of the policies. However, under a ban over 30 percent would reduce the number of

Table 6-3. Stated Behavior Questions, Results for Yellowstone National Park Sample by Primary Activity, Weighted Estimates[a]

	Snowmobile Rider			Cross-country Skier/Snowshoer			Snowcoach Tour			Auto-tour/Sightsee		
	Ban	Caps/ Guides	Caps	Ban	Caps/ Guides	Caps	Ban	Caps/ Guides	Caps	Ban	Caps/ Guides	Caps
Current visit												
Increase days	1.75% (1.18%)	1.45% (0.73%)	2.49% (1.75%)	19.75% (9.10%)	18.81% (12.46%)	12.49% (8.03%)	7.03% (4.16%)	34.12% (18.00%)	1.30% (0.74%)	16.74% (5.56%)	2.50% (1.56%)	7.07% (5.62%)
Average increase in days[b]	2.3	2	2.8	3.9	3.8	2.3	2.6	2.4	2.5	5	2	2
Visit unchanged	12.64% (2.12%)	47.83% (3.21%)	69.82% (4.17%)	62.97% (8.83%)	69.89% (13.21%)	76.85% (6.43%)	79.36% (8.43%)	62.47% (17.08%)	95.63% (2.57%)	48.47% (8.61%)	91.76% (3.67%)	89.75% (6.33%)
Decrease days	3.55% (1.72%)	3.61% (1.45%)	1.06% (0.52%)	0.73% (0.75%)			0.33% (0.32%)		0.84% (0.87%)	2.85% (1.94%)		
Average decrease in days[b]	5	1.9	1.7	1					1	1		
Not visit	82.06% (1.93%)	47.11% (2.87%)	26.63% (3.84%)	16.55% (7.88%)	11.30% (7.10%)	10.66% (5.62%)	13.28% (5.94%)	3.40% (2.33%)	2.23% (2.04%)	31.95% (7.18%)	5.74% (3.36%)	3.18% (3.19%)
Total visits this season												
Increase trips	2.09% (1.21%)	1.66% (0.73%)	2.62% (1.32%)	27.18% (9.51%)	26.98% (12.23%)	15.33% (9.15%)	6.07% (3.20%)	15.27% (9.54%)	7.26% (3.55%)	14.36% (4.89%)	4.59% (3.65%)	14.49% (7.66%)
Average increase in trips[b]	1.5	1.3	1.8	4	2	2.6	1.3	1.3	1.5	5.1	2.3	1.5
Trips unchanged	15.87% (2.22%)	43.86% (2.84%)	67.96% (4.42%)	55.61% (9.08%)	61.44% (12.69%)	74.73% (6.31%)	80.58% (7.26%)	82.16% (8.93%)	86.98% (4.28%)	49.73% (8.22%)	83.31% (6.01%)	68.67% (10.22%)
Decrease trips	12.98% (2.82%)	8.00% (1.89%)	4.69% (1.75%)	1.40% (1.05%)	2.94% (3.00%)		6.89% (4.82%)		1.41% (0.90%)	6.46% (3.24%)	8.15% (4.55%)	1.86% (1.57%)
Average decrease in trips[b]	1.5	1.3	1.2	3	2		0		1	1.3	1.7	1.5
Not visit	69.05% (3.56%)	46.48% (3.36%)	24.73% (3.66%)	15.81% (7.82%)	8.64% (6.40%)	9.94% (5.82%)	6.46% (2.81%)	2.57% (2.21%)	4.36% (3.54%)	29.44% (7.68%)	3.96% (3.28%)	14.98% (8.43%)

[a]Weighted estimates were calculated using nonresponse-adjusted person-level weights. Numbers in parentheses are standard errors on weighted calculations.

[b]Means in changes in days and trips are unweighted because of the small sample size.

trips or not visit at all, compared to 14 percent who would increase their trips.

However, the people who would increase their trips indicated they would increase their trips by more than any other group of visitors (an average increase of five trips per season).

In the GTNP Taggart Lake sample, most visitors are cross-country skiers. As Table 6-2 shows, most people would increase or not change the number of visits they make in a season under the three proposed management plans. Similar to the YNP sample, the ban would prompt the largest changes, although in GTNP on average people would be visiting more rather than less. The results for the other two policies, the cap with the guided tour requirements and the cap on numbers, are generally similar. However, more visitors indicated they would not visit under the cap with guided tours than under the cap alone.

Many visitors to YNP and GTNP have strong feelings about winter management in the parks and snowmobile access in particular. It is possible that the answers to these questions may contain an element of strategic behavior. For example, it is not completely clear why 25 percent of snowmobile riders in YNP who answered the question about visits under a plan that capped the number of snowmobiles allowed in the park daily said they would not visit under such a policy. However, the description of the policy capping the number of snowmobiles included a requirement that all snowmobiles must have a four-stroke engine. Snowmobile riders, especially those who currently ride their own two-stroke engine machines in the park, may not want to visit because of the technology constraint.

Because of the potential for strategic behavior by survey respondents, the survey was designed to separate respondents' feelings about the management proposals from their preferences for conditions in the park when they visited. The stated behavior questions focused on the management plans and we recognize there may be some strategic bias in the results. Responses to stated behavior questions will be the primary basis for estimating how many visitors will come to the park under different management scenarios, while the revealed preference and stated preference results will be used to estimate the welfare changes associated with changes in visitation and park conditions. However, the revealed

preference and stated preference model results will also be used to check the reasonableness of the visitation changes implied by the stated behavior questions.

6.2 MULTIPLE SITE RANDOM UTILITY MODEL

This section describes the standard travel cost model we used to estimate the value of a snowmobile trip to YNP and GTNP. Travel cost models are one type of revealed preference model, so named because they are based on observed behavior. We collected data to allow application of a random utility maximization (RUM) model. The RUM model is a travel cost model designed to analyze a person's visitation decision on a choice occasion from a set of available recreation sites. The sites are differentiated by their implicit price of getting to the site (the travel cost) and the attributes of the individual sites. When choosing a site, the potential visitor compares prices and attributes of the available sites to arrive at a decision. The strength of the RUM model is its ability to characterize the substitutability of the available sites by modeling this decision process. Using the estimated RUM model we are able to assess the value of a trip to a given site, given the availability of alternative sites that may (or may not) provide similar recreation opportunities.

6.2.1 Model Development

The premise of the RUM model is that, on a given choice occasion, the person will visit the site that provides the highest level of utility.

The premise of the RUM model is that, on a given choice occasion, the person will visit the site that provides the highest level of utility. We define the utility a person receives for a visit to site j by

$$u_j = v_j + \varepsilon_j, \; j = 1,\ldots, J, \tag{6.1}$$

where v_j is the observable component of utility that depends on the travel cost of reaching the site and other site characteristics. The term ε_j is a random error representing the component of utility that is unobservable from the perspective of the analyst but known to the individual. The goal of the model is to estimate the utility function up to the unobserved error term and use this estimate to assess the value of the recreation site.

Under the assumption of utility maximization the person will choose to visit site j on a given choice occasion if $u_j \geq u_k \; \forall k \neq j$. Because total utility is unobserved by the analyst, this choice is

random from the perspective of the model, and we can only state the probability that a site will be chosen. In general terms this probability is given by

$$\begin{aligned} pr(u_j \geq u_k) &= pr(v_j + \varepsilon_j \geq v_k + \varepsilon_k) \\ &= pr(\varepsilon_k - \varepsilon_j \leq v_j - v_k) \end{aligned} . \tag{6.2}$$

Estimation of the model proceeds using assumptions for the form of the deterministic component of utility and the error distribution.

In the most common version of the model, the deterministic component of utility is given by $v_j = \beta p_j + \delta q_j$, where p_j is the travel cost of reaching the site, q_j is a vector of site attributes, and β and δ are parameters to be estimated. If it is assumed that the error terms are distributed independent Type I extreme value, the specific form of the probability that site j is visited is given by

$$pr(u_j \geq u_k) = \frac{\exp(v_j)}{\sum_{k=1}^{J} \exp(v_k)} . \tag{6.3}$$

Given a sample of observed choices, maximum likelihood is used to recover estimates of the utility function parameters.

The estimated parameters provide a characterization of the utility function that allows calculation of the WTP (consumer surplus) for changing site attributes or maintaining the availability of particular sites. For example, under the assumptions of the model the per-trip consumer surplus for a trip to the first site is given by

$$cs = \frac{1}{\hat{\beta}} \left(\ln \left[\sum_{j=1}^{J} \exp(\hat{v}_j) \right] - \ln \left[\sum_{j=2}^{J} \exp(\hat{v}_j) \right] \right), \tag{6.4}$$

where $\hat{v}_j = \hat{\beta} p_j + \hat{\delta} q_j$, and $\hat{\beta}$ and $\hat{\delta}$ are the coefficient estimates.

Implementation of this model requires data on trips made by people over the course of a recreation season to sites included in a researcher-defined choice set and prices for each of the sites for each person in the sample. The following section describes how the survey was designed to provide this information.

6.2.2 Choice Set Definition and Survey Design

Because the parks sit at the intersection of Wyoming, Montana, and Idaho we decided these three states would form the basis for the choice set.

The RUM model requires defining the set of available sites from which individuals choose on a given recreation occasion. In our case the objective was to gauge the importance of YNP and GTNP as a snowmobile destination. Thus, our aim was to construct a choice set that would adequately represent the set of alternatives that would be available to potential YNP and GTNP visitors. Because the parks sit at the intersection of Wyoming, Montana, and Idaho we decided these three states would form the basis for the choice set. We designed the choice set by examining each state individually. Information on snowmobile destinations in each state is readily available on the Internet through official state sites, private promotions, and club postings. We relied heavily on these web sites to arrive at the lists of snowmobile sites and areas for each state.[1]

For Montana, we relied on a state-sponsored web site listing the primary snowmobile destinations in the state. These are referenced primarily by cities, and our Montana site list includes nearly all destinations that were listed. For Wyoming, we again relied on a state-sponsored web site listing and describing the main snowmobile areas in the state. These tend to be referenced by geographical areas. Finally, for Idaho we relied on a club web site describing the main destinations in the state by aggregate region. Because of the large number of destinations in each region, we designed the Idaho choice set as a mixture of specific destinations within regions that contained the largest number of trail miles and regional areas to indicate other destinations in the state.[2]

These decisions resulted in a choice set containing 52 alternatives (including YNP and GTNP as one alternative) for which respondents could indicate visits. The names of the alternatives and a map showing their locations throughout the three-state area can be found in the survey contained in Appendix B, page B-10. In Question 19 on page B-11, we solicited information from all respondents on the

[1]We are also grateful for advice on choice set construction from Chris Bastian, who previously conducted a survey of snowmobile riders in Wyoming. Our Wyoming choice set decisions in particular were influenced by his experience.

[2]The web sites used for choice set definition included http://skimt.com/snomobl.htm (MT), http://wyotrails.state.wy.us/snow/snomap.htm (WY), and www.idahosnowbiz.com/club.htm (ID).

number of trips they made during the 2001–2002 winter season to the sites included in the choice set. We used 2001–2002 as the base year to ensure that all respondents provided a season's worth of data. This information provided the basic visitation data used to estimate the model. One of the reviewers of this report suggested that it may have been appropriate to limit the choice set further for individual respondents through the addition of survey questions designed to elicit their willingness to travel for snowmobiling. Unfortunately, this type of information is not available from the survey data. In the absence of this adjustment, coefficient estimates may be underestimated through the inclusion of infeasible alternatives (Swait, 1984). However, studies exist (see e.g., Parsons and Hauber, 1998) that suggest welfare estimates in RUM models are not sensitive to including distant irrelevant sites because the predicted probabilities are close to zero.

6.2.3 Data Formatting and Summary

The final questionnaire consisted of four survey versions tailored for local versus distant respondents and snowmobile versus nonsnowmobile riders. The survey provided information from 625 individuals from around the county who answered the "snowmobile" version of the questionnaire from the YNP and GTNP Taggart Lake samples. Because the travel cost model constructs the implicit cost of a visit based on the road travel cost of site access, we were concerned about including people in the sample for whom driving to one of the sites was not an obvious option. The RUM model requires calculation of the travel costs for each person in the sample not only for the site visited, but also for the other 51 sites in the choice set. Thus, a consistent distance-based measure of travel costs is needed for all sites. As a result, this modeling approach is not well-suited for modes of travel other than driving, especially when there are mixed modes of travel (i.e., visitors traveling to the site via different forms of transportation). In addition, many visitors arriving from east of the Mississippi fly into the GYA on multiple purpose trips, where snowmobiling in YNP and/or GTNP is just one of several trip purposes and may not be the primary purpose. The travel cost model breaks down when we cannot assume that the activity of interest is at least the primary reason for travel. It would be incorrect to use the entire trip cost in the travel cost model as a

cost paid for snowmobiling in the parks (Haspel and Johnson, 1982; Mendelsohn et al., 1992; Smith and Kopp, 1980).

Those park visitors within a day's drive are more likely to be undertaking the trip for the primary purpose of snowmobiling in the parks. Thus, we made the decision to include only people living west of the Mississippi River in our sample. This ensures that most of the people in the sample can reach one of the sites in a little more than a day's driving time. Furthermore, many of the respondents did not visit a site in the choice set during the 2001–2002 winter season. Because we are interested in the value of access to a site conditional on making a trip, these respondents were also not included in the sample. Using these two filters we arrived at a sample of 191 people who report taking 1,677 trips. These trips serve as the units of observation in the model. The consumer surplus value per day calculated using this sample will be applied to all snowmobilers in the parks, so that the total snowmobile recreation benefits will be accounted for. The idea behind this filtering decision is to apply the model to the subsample of snowmobilers that meet the assumptions of the RUM model so that valid estimates of recreation benefits for snowmobilers in YNP and GTNP are obtained and then use that value as the best available approximation of what all snowmobilers in the parks receive.

Calculation of travel cost typically includes the round trip out-of-pocket travel costs and a monetary value for the opportunity cost of travel time. Using the commercial software package *PCMiler* we calculated the round trip distance (in miles) and travel time (in hours) between each person's home zip code and each of the 52 sites in the choice set. The imputed price for each site was computed based on the formula:

$$\text{price} = \$0.33 \times \text{distance} + (\text{income} / 2000) \times \text{time}.$$

The $0.33/mile out-of-pocket cost is based on the current American Automobile Association figure.[3] A very important consideration in calculating travel cost is the specification of the opportunity cost

[3] This cost reflects the cost per vehicle. Alternatively, the cost could have been adjusted downward to reflect the fact that out-of-pocket expenses would be shared among group members. However, we did not collect data on group composition for trips taken to all sites in the choice set.

associated with travel time, but the debate on the correct shadow value of time in recreation demand models has not yet been settled. While using a fraction of the wage rate a long tradition in empirical studies, use of the full wage rate is supported by recent empirical and conceptual work. Larson (1993) provides arguments for using the full wage rate even when workers face a fixed work schedule. More recently, Feather and Shaw (1999) provide an attractive method for inferring the shadow value of time from labor market choices and answers to stated behavior questions. Their empirical results suggest the shadow value of time for most respondents is closer to the full wage rate than the fractions typically used in the literature. Finally, recent conceptual work on dual constraint models from Larson and Shaikh (2001) supports the use of the full average wage rate if it is assumed that time costs are exogenous. Thus, the opportunity cost of time for this analysis is based on the full average wage rate (calculated using an average of 2,000 working hours in a year).[4] Income was calculated using the midpoint of the income ranges included in the survey. For the small number of observations that had missing income values we used the median of those included in the sample.

The people included in the sample are relatively avid snowmobile riders, taking an average of 8.78 trips per year.

Several summary statistics give a sense of the data. The people included in the sample are relatively avid snowmobile riders, taking an average of 8.78 trips per year. The median number of trips is 3, suggesting the average is influenced by a few people taking a larger number of trips but supporting the notion that the sample consists of relatively active users of snowmobile trails. The average income in the sample is $80,188. Because the respondents' homes and choice set sites are geographically dispersed, the average travel cost of site access for any given site is quite large and does not give a sense of the access costs actually incurred. More informative is the average cost of access for the 1,677 observed trips. For these visits, the average imputed price is $879, with a standard deviation of 947 and a median of $543.

Table 6-4 provides a summary of the visits and average price and distance for the 10 most frequently visited sites. The most visited

[4] The way that household income is used to calculate the average wage rate implicitly assumes a single worker in the household. An alternative method would have been to use the number of working people in the household to compute an average wage rate. This would have resulted in a smaller shadow value of time and smaller per-trip WTP measures.

Table 6-4 provides a summary of the visits and average price and distance for the 10 most frequently visited sites. The most visited Table 6-4. Top Ten Most Visited Sites[a]

Site Name	Observed Visits	Average Price[a]	Average Distance In Miles
Yellowstone/Grand Teton National Parks, WY	224	$1,330	1,332
Continental Divide Togwotee, WY	199	$719	888
West Yellowstone, MT	190	$1,066	1,014
Big Springs Area Trails, ID	109	$790	741
Bozeman/Big Sky, MT	77	$562	485
Ashton Area Trails, ID	74	$457	453
Continental Divide Gros Ventre, WY	70	$983	1,239
Bear Tooth, WY	56	$1,555	2,054
Wyoming Range Afton, WY	55	$1,125	1,021
Snowy Range, WY	54	$377	424

[a]Those prices include only transportation costs (out-of-pocket and opportunity cost of time), not the costs of lodging, meals, equipment rentals, etc.

site in our sample is YNP, with 224 observed visits.[5] This is followed by the Continental Divide (Togwotee) in Wyoming and West Yellowstone in Montana.

6.2.4 Estimation and Results

Based on our preliminary investigations, we arrived at the following specification for the utility function in the RUM model:

$$u_i = \beta price_i + \delta_1 YNP + \delta_2 WEST + \delta_3 DIVIDE + \delta_4 ID + \delta_5 MT + \varepsilon_i, \quad i=1, \ldots, 52, \tag{6.5}$$

where $price_i$ is the travel cost for the ith site calculated as described above. The remaining variables are dummies defined as follows:

- *YNP* is a fixed effect for trips to YNP/GTNP.
- *WEST* is a fixed effect for trips to West Yellowstone.
- *DIVIDE* is a fixed effect for trips to Continental Divide Togwotee.

[5]Of course, this is probably an artifact of the sample design, because a respondent had to be visiting YNP to be included in the sample. YNP would not necessarily be the most frequently visited site in the three-state area of Idaho, Montana, and Wyoming based on a random sample of all snowmobilers in those states. The sample is consistent with our objective of measuring the impact of policy changes on current park users, but should be kept in mind when interpreting the results.

- *ID* is a fixed effect for the site being in Idaho.
- *MT* is a fixed effect for the site being in Montana.

This implies trips to Wyoming are the omitted category. The three site-specific dummy variables represent the three most frequently visited sites and are intended to capture the effects of the unique characteristics of these sites relative to the others. They are included because a priori we believe there are nonprice aspects of these sites that may account for their higher visitation levels. The maximum likelihood parameter estimates from this model are reported in Table 6-5.

Table 6-5. Model Estimation Results

Parameter	Estimate (t-statistic)
β_{PRICE}	–0.0021 (–23.70)
δ_{1YNP}	2.511 (28.80)
δ_{2WEST}	2.549 (24.48)
$\delta_{3DIVIDE}$	2.204 (25.13)
δ_{4ID}	0.145 (2.03)
δ_{5MT}	–0.514 (–5.62)
Log likelihood	–5536
Pseudo R^2	0.1645

In general we find plausibly signed and statistically significant coefficient estimates.

In general we find plausibly signed and statistically significant coefficient estimates. For example, the price coefficient is negative as expected, suggesting that all else being equal people prefer to travel to a closer site than a more distant one. The fixed effects for YNP/GTNP, West Yellowstone, and the Continental Divide are positive and significant, suggesting that the price variables do not fully account for some attractive features of these sites. Finally, the state-specific dummy variables indicate that people are more likely to visit Idaho sites than sites in Wyoming or Montana and more likely to visit Wyoming than Montana.

Using the formula given above we can calculate the consumer surplus for a trip to YNP or GTNP by looking at the welfare impacts of eliminating YNP/GTNP from the choice set. Using this model, the mean WTP per trip (conditional on making a trip) to keep YNP/GTNP in the choice set is $70. We used the Krinsky-Robb

(1986) method for computing the standard error of this welfare measure. This involves taking draws from the estimated distribution for the parameter vector and computing the welfare measure for each draw. This gives an empirical distribution of the WTP statistic from which we can calculate the standard error. Using 200 draws of the parameter vector and the associated WTP we get an estimate of 4.94 for the standard error of the welfare measure. By way of comparison, the welfare estimate for West Yellowstone is $59 and $62 for the Continental Divide. The standard errors are 5.41 and 5.02, respectively.

6.2.5 Interpretations and Limitations

The analysis given above suggests a per-trip consumer surplus estimate of $70. Many of the trips in the sample, however, are for more than 1 day. For purposes of comparison to other analyses included in the report, we can assess the rough value of a day spent snowmobiling at YNP or GTNP using additional data gathered in the survey. Specifically, for the 91 people included in the sample who visited YNP/GTNP to snowmobile, the average days/trip was 2.21. Thus, a rough value per day is $32 per day.

It is important to note a number of caveats and limitations when interpreting these estimates. Most importantly, because the travel cost model relies narrowly on the imputed cost of travel to construct the price of site access. It is likely that our consumer surplus estimates understate the value of a trip to any of the sites in the model.

It is important to note a number of caveats and limitations when interpreting these estimates. Most importantly, because the travel cost model relies narrowly on the imputed cost of travel to construct the price of site access, ignoring several expense categories (such as accommodations, food, entry fees, and equipment rentals), it is likely that our consumer surplus estimates understate the value of a trip to any of the sites in the model. Because many of the omitted expense categories are endogenously determined or unobservable, we decided that the model would be most useful (and provide a reliable lower bound) if we focused only on the travel costs. Ward (1984) and Fix et al. (2000) demonstrate that you will get a biased estimate of consumer surplus if endogenously chosen travel costs are included in a travel cost model. In addition, costs for items such as lodging would most likely net out because they probably do not vary with distance traveled. As long as these costs are approximately equal, they will cancel out in calculating the difference in utility and will not affect the parameter estimates.

Furthermore, as noted above we have included in the sample only individuals who made a trip to one of the sites in the choice set

during the model year and have not attempted to describe the decision to make a trip or not. This conditions the interpretation of our welfare measure to be specific to a person who has already decided to make a trip to the three-state area during the season. In practice this implies our sample reflects the more avid riders. We made this decision to best gauge how those most likely to be affected would value a change in snowmobile access to YNP. Including the nontrip takers would change the interpretation, and likely the value, of the consumer surplus measure. This would be equivalent to adding another substitute to the model, which tends to decrease the value of any given option because more choices are available. That conclusion is tempered here, though, because the opt-out option is a very broad good that includes the possibility of doing anything other than taking a snowmobile trip to the sites included in the choice set, including both close substitutes such as similar trips to sites outside the choice set and poor substitutes such as indoor recreation. The WTP measure probably would decline with the addition of an opt-out option, but it is difficult to speculate as to the magnitude of the impact.

Another important caveat is that, for decisions concerning specification of the travel cost, we have tended to use figures on the high end of the range. To the extent that the cost per mile per person is overstated, this may lead to WTP estimates of per-trip consumer surplus which, conditional on other assumptions in the model, are an upper bound on WTP for access to a site in the choice set.

6.3 STATED PREFERENCE CONJOINT SURVEY

After reviewing previously published literature, pretesting the instrument, and meeting with park staff, we chose nine attributes to characterize winter trips to YNP and GTNP.

Choice-format conjoint surveys are a type of stated preference survey that allows researchers to value a variety of trips (or other goods) under conditions that can be similar to or different from current conditions. In this type of stated preference survey, researchers construct a set of attributes or features of a good, in this case a winter trip to YNP or GTNP. Each of these attributes can take on one of several possible levels. For example, the attribute "congestion" could occur as "high," "moderate," or "low." The levels of these attributes are varied to create trips with different characteristics. When combined in a series of choice tasks according to an appropriate experimental design, the pattern of

responses reveals the respondents' subjective, relative evaluation of various attribute levels. If cost is included as an attribute, these importance weights or utilities can be scaled by the incremental utility of a dollar to obtain the dollar equivalence or WTP for a change in utility from the status quo to a particular alternative.

The survey contains a series of conjoint tasks in which respondents were offered choices between different trips to YNP and GTNP. The attributes of the trips describe important features of visitors' trips that may be affected by changes in winter management of the parks.

6.3.1 Designing the Stated Preference Questions

The first step in developing a conjoint survey to value trips with different attributes is to specify a list of the most important factors that influence trip value. After reviewing previously published literature, pretesting the instrument, and meeting with park staff, we chose nine attributes to characterize winter trips to YNP and GTNP. These attributes are designed to capture features of an individual's trip to the parks that will be affected by the proposed management alternatives. The attributes focus on the outcomes in terms of conditions in the parks (e.g., noise, road conditions, congestion, and air quality), rather than the tools used to achieve those outcomes (e.g., rules for access and technology requirements). The size of the attribute set attempts to balance the cognitive burden of the survey for the respondent against the need to include all the factors that are important to visitors and affected by the management alternatives.

We created the descriptions of the noise and exhaust levels based on feedback from pretests and discussions with park staff, as well as advice from the NPS Social Science Program.

Table 6-6 presents the attributes and levels of the attributes used in the survey. The complexity of the experimental design increases with the number of levels for each attribute, so we constrained the attributes to have no more than four levels. The levels of the attributes should capture the full range of possible outcomes. We based the levels for the two snowmobile traffic variables on average, minimum, and maximum snowmobile traffic at each entrance and in the park as a whole for weekdays, weekends, and holidays during the 2001–2002 winter season. We created the descriptions of the noise and exhaust levels based on feedback from pretests and discussions with park staff, as well as advice from the NPS Social Science Program. The trip cost attribute presented a particular challenge. Although guided snowmobile and snowcoach tours can

Table 6-6. Attributes and Levels for Conjoint Questions

Attributes	Levels
Activity	• Snowmobile • Snowcoach tour • Snowcoach shuttle to cross-country ski or hike • Drive car to auto-tour, cross-country ski, or hike
Entrance where trip starts	• Yellowstone West near West Yellowstone, MT • Yellowstone North near Gardiner, MT • Yellowstone South near Flagg Ranch • Grand Teton National Park
Guided tour or not	• Guided tour • Unguided tour
Daily snowmobile traffic at the entrance where you started	• I did not see any snowmobiles near the entrance where my trip started • Low, 200 or fewer snowmobiles (typical North and East Entrances on all days and South Entrance on most weekdays and weekends) • Moderate, 300 to 600 snowmobiles (typical West Entrance on weekdays and South Entrance on busy holiday weeks) • High, 800 to 1,500 snowmobiles (typical West Entrance on a holiday or crowded weekend)
Snowmobile traffic at most crowded part of trip	• I did not see any snowmobiles on my most recent trip • Low, 200 or fewer snowmobiles (very uncrowded days at Old Faithful) • Moderate, 300 to 600 snowmobiles (typical Old Faithful on less crowded weekdays and weekends) • High, 800 to 1,500 snowmobiles (typical Old Faithful on a holiday and busy weekends or weekdays in late January and February)
Condition of snow on the road or trail surface for all or most of the trip	• Smooth • Bumpy and rough
Highest noise level experienced on trip	• Low noise, occasional • Moderate, you would need to raise your voice to talk to someone standing next to you, noise like a busy city street • Loud, standing next to the road you could not converse with someone standing next to you, noise level similar to standing next to a gas-powered lawn mower or a busy highway
Exhaust emission levels	• I did not notice any exhaust emissions • Noticeable for some of the trip • Very noticeable for most or all of the trip
Total cost for day per person	• Varied according to whether the trip was a car trip or unguided or guided tour.

Note: The descriptions in Table 6-6 are from the initial, practice conjoint question (see Appendix B, Question 20, page B-13). Shorter descriptions were used in the other conjoint questions to reduce the amount of text on the page based on feedback from pretests. Some of the attribute levels presented in the practice conjoint question were not included as part of the design of the conjoint questions. Only the levels included in the conjoint design are presented in Table 6-6.

cost over $100 and sometimes over $200 per person per day, the cost of an unguided car trip could be as low as the entrance fee to the park (which is currently $20). We created three cost ranges for car trips ($20 to $75), unguided tours ($75 to $150), and guided tours ($75 to $230). We adjusted these ranges after analyzing the results from the first 100 surveys returned to unguided tours ($50 to $150) and guided tours ($50 to $230). The cost ranges were designed around the prices for different types of unguided and guided trips currently offered by businesses around YNP and GTNP. To ensure respondents will trade off cost against other features of the trip, the upper end of the cost range is somewhat higher than the costs current visitors typically pay.

Ideally, from the standpoint of the experimental design, the attribute levels will vary independently. However, the choices also need to be realistic to the respondents. Based on current conditions in the park and results from pretesting, the following restrictions were placed on attribute levels:

- The activity "Drive car" was always unguided.
- The activity "Take a snowcoach tour" was always guided (but the snowcoach shuttle to cross-county ski or hike could be guided or unguided).
- The level of snowmobile traffic "No snowmobiles in the park" at the entrance always appeared with "No snowmobiles in the park" at the most crowded point in the trip.
- The snowmobile traffic level "No snowmobiles in the park" always appeared with low noise and not noticeable
- emissions, but low noise and emissions also appeared with other levels of snowmobile traffic.
- No car trips originated from the South and West Entrances.
- No snowcoach trips originated from GTNP.
- Crowding at the entrance was always less than or equal to crowding at the most crowded part of the trip.

Much of the debate about the snowmobile regulations in the parks has focused on whether current snowmobile riders will still visit the parks if they cannot snowmobile. The stated preference survey was designed to evaluate respondents' willingness to substitute among activities, so Trip A and Trip B always presented different activities.

In this survey, respondents were asked a series of six choice questions. In each question, they were asked to choose among two trips (Trip A and Trip B) plus the option of not visiting (the "opt-out" option). To reduce respondents' cognitive burden, only seven of the nine attributes varied in any given pair of trips. Much of the debate about the snowmobile regulations in the parks has focused on whether current snowmobile riders will still visit the parks if they

cannot snowmobile. The stated preference survey was designed to evaluate respondents' willingness to substitute among activities, so Trip A and Trip B always presented different activities. Appendix B (survey Questions 22 through 27, pages B-15 through B-20) contains an example set of conjoint questions.

The opt-out option was included because it is a realistic option for current visitors. If the visitor selected the opt-out option, she was asked a follow-up question about what she would most likely do instead. The choices were:

- Stay at home; I would not travel to the GYA
- Travel to the GYA to snowmobile outside the parks
- Travel to the GYA to cross-county ski outside the parks
- Travel to the GYA to downhill ski at Big Sky or one of the ski areas near Jackson Hole
- Other

Each of the attribute levels was defined in the introduction to the survey. To familiarize the respondents with the attributes and levels and to help them think about what they liked and did not like about their trips, we first asked the respondents to describe their most recent trip using the attributes and levels from the stated preference questions (see Appendix B, Question 20 page B-13 for the text of this question). Respondents then were offered an alternative trip and the option of not visiting and asked whether they would prefer the trip they just took, the alternative trip, or whether they would stay home. After this question, respondents were asked about one thing they would change about their most recent trip (see Table 5-6 for the answers to this question).

Most current marketing stated preference applications use an approximately orthogonal design to reduce the number of paired comparisons to the smallest number necessary for efficient estimation of utility weights (Dey, 1985). Huber and Zwerina (1996) list four properties of efficient designs:

- Level balance: levels of an attribute occur with equal frequency
- Orthogonality: the occurrences of any two levels of different attributes are uncorrelated
- Minimal overlap: cases where attribute levels do not vary within a choice set should be minimized

- Utility balance: the probabilities of choosing alternatives within a choice set should be as similar as possible

Most current stated preference studies in the academic literature only investigate small attribute-level spaces. Unfortunately, it is often not possible to achieve both level balance and orthogonality in small designs. Thus, design optimality generally requires trading off potential incompatibilities between these criteria. However, Kuhfeld, Tobias, and Garratt (1994) show that it is possible to produce relatively efficient designs that are neither balanced nor orthogonal. Such efficient designs can be produced using an iterative computer algorithm.

The experimental design for the stated preference questions was based on an algorithm that searches for D-efficient designs in the full factorial (Zwerina, Huber, and Kuhfeld, 1996; Huber and Zwerina, 1996). The experimental design program was run for 5,000 iterations. The ultimate design for the experiment was chosen from the five designs with the highest D-efficiency scores based on balance and correlation between attribute levels.

6.3.2 Conditional and Mixed Logit Estimates of Respondent Preferences

Respondents evaluated six choice tasks in which they chose among two trips and the option of not visiting the parks (the opt-out option). The data form a panel that can be analyzed using stochastic utility maximization theory.

Respondents evaluated six choice tasks in which they chose among two trips and the option of not visiting the parks (the opt-out option). The data form a panel that can be analyzed using stochastic utility maximization theory.

We estimate trip preferences with RUM models, including both conditional and mixed or random-parameters logit. The RUM model assumes the utility associated with a particular choice alternative is expressed as a function of individual characteristics and the attributes of the alternative. The RUM format is the same as that used for the multiple-site RUM described in Section 6.2. We present the model again to provide detail on the types of variables used in the conjoint analysis. Under the assumptions of the RUM model, individual indirect utility is expressed as a function of trip attributes and personal characteristics:

$$U_{jt}^{i} = V^{i}(X_{jt}, Z^{i}, p_{jt}; \beta^{i}, \delta^{i}) + e_{jt}^{i} \qquad (6.6)$$

where

U^i_{jt} is individual i's utility for a trip, where j = 0, 1, 2, denoting the three alternative trips in each choice set, and t = 1,...,6;

$V^i(\cdot)$ is the nonstochastic part of the utility function;

X_{jt} is a vector of attribute levels for the trip;

Z^i is a vector of personal characteristics;

p_{jt} is the cost of the trip;

β^i is a vector of attribute parameters;

δ^i is the marginal utility of money; and

e^i_{jt} is a disturbance term.

The linear specification of utility for the three alternatives is

$$\begin{aligned} U^i_{jt} &= V^i_{jt} + e^i_{jt} = \gamma^i_0 + e^i_{jt} \quad j = 0 \\ U^i_{jt} &= V^i_{jt} + e^i_{jt} = X_{jt}\beta^i + p_{jt}\delta^i + e^i_{jt} \quad j = 1, 2 \end{aligned} \tag{6.7}$$

where U^i_{jt}, j = 0, 1, 2 is the utility of each of the three trip alternatives. U^i_{0t} is the utility of the opt-out choice, which in a simple model is just γ_0, an alternative-specific constant for the opt-out choice. The utility of Trip A is U^i_{1t} and the utility of Trip B is U^i_{2t}.

Stochastic utility maximization asserts that individual i will choose alternative j from among the full set of available alternatives K if, and only if, alternative j provides a higher overall level of utility than all other alternatives in the choice set.[6] Assuming the disturbance term follows a Type I extreme-value error structure, the probability that alternative j will be selected from choice set t is the standard conditional-logit expression:

[6]Mathematically, individual i will choose alternative j from among the set of alternatives K,

if $U^i_{jt} > U^i_{kt}$ for all j in K, $j \neq k$

substituting for U^i_{jt} from Eq. (6.6), and rearranging terms we have

$V^i_{jt} - V^i_{kt} > e^i_{kt} - e^i_{jt}$.

$$Prob[C_t^i = j] = \frac{\exp\left(V_{jt}^i\right)}{\sum_{k=0}^{2}\exp\left(V_{kt}^i\right)} \qquad (6.8)$$

where C_t^i is the selected alternative in each of six choice sets and V_{jt}^i is the determinate part of the utility of alternative j.[7] The probability that an alternative will be selected is the ratio of the exponentiated utility that alternative provides, relative to the exponentiated sum of the utilities that each alternative in the choice set provides. Individual characteristics do not vary among choices, and thus must be interacted with trip attributes or alternative-specific constants.

The conditional logit model specified by Eqs. (6.7) and (6.8) is estimated using maximum-likelihood. That is, given the characteristics of the alternatives in the choice sets presented to the respondents, the model estimates coefficients that maximize the likelihood that we would observe the actual choices in the sample. Thus, the coefficients show the relationship between the probability of selecting a trip and the attributes of that trip.

Conditional logit models are known to be subject to violations of the restrictive "independence of irrelevant alternatives" (IIA) assumption. This condition requires that the ratio of probabilities for any two alternatives be independent of the attribute levels in the third alternative. If IIA is violated, parameter estimates are biased. Second, the conditional logit models assume that differences in respondents' tastes are fully accounted for in the model specification and thus differences in value to respondents arise only from differences in probability of selecting choice alternatives. Finally, conditional logit does not account for correlations within each subject's series of choices.

Revelt and Train (1998) have proposed using random-parameter or mixed logit for stated preference data. Mixed logit is not subject to the IIA assumption,[8] accommodates correlations among panel observations, and accounts for unobserved heterogeneity in tastes across subjects.

[7]The basic exposition of the properties of this model can be found in McFadden (1981).

[8]Technically, this is only true when the definition of one or more stochastic effects is shared across alternatives.

Modifying Eq. (6.7) to introduce subject-specific stochastic components for each β,

$$\begin{aligned} U^i_{jt} &= V^i_{jt} + e^i_{jt} \equiv \left(\gamma^i_0 + \eta^i_0\right) + e^i_{jt} && j = 0 \\ U^i_{jt} &= V^i_{jt} + e^i_{jt} \equiv X_{jt}\left(\beta + \eta^i\right) + \delta^i P_{jt} + e^i_{jt} && j = 1, 2 \end{aligned} \tag{6.9}$$

Eq. (6.8) now becomes

$$\text{Prob}[C^i = (C^i_{j1}, C^i_{j2}, \ldots, C^i_{j6})] = \prod_{t=1}^{6}\left[\frac{\exp[V^i_{jt}(\beta^*)]}{\sum_{k=0}^{2}\exp[V^i_{kt}(\beta^*)]}\right] \tag{6.10}$$

where now $\beta^* = (\beta + \eta^i)$. In contrast to conditional logit, the stochastic part of utility now may be correlated among alternatives and across the sequence of choices via the common influence of η^i. McFadden and Train (2000) show that any RUM model can be approximated by some mixed logit specification.

The heterogeneity of preferences among winter visitors in YNP represents a challenge for estimating welfare impacts using the results of the stated preference questions. The biggest differences in the summary statistics presented in Section 5.2 appear to be between snowmobile riders and other winter visitors. To control for the heterogeneity, we estimated separate models for these two groups where snowmobile riders are those whose general primary activity was riding a snowmobile on their most recent trip and other winter visitors indicated their general primary activity as either snowcoach tour, auto touring, or cross-country skiing/snowshoeing (see Table 5-5).[9]

Cost is the only continuous variable in the model. The other variables, except the "No crowding at the entrance/destination" and opt-out variables, are modeled using effects coding instead of traditional dummy variables. Using effects coding, the base level of the variable (the excluded category in the regression) is coded as –1. The value of the excluded category is the negative sum of the coefficients for the other levels. Thus zero is normalized as the

[9] Each of the models assumed stochastic effects are normally distributed.

mean effect and statistical significance tests relate to the mean effect rather than the omitted category. "No crowding at the entrance/destination" and opt out are defined as a traditional dummy variable where 1 indicates that there were no snowmobiles in the park or that opt out was chosen, respectively.

Snowmobile Rider Results

Starting with the snowmobile riders, column 2 of Table 6-7 contains the results from a simple conditional logit, while column 3 contains the same specification estimated using the mixed logit. The mixed logit provides an estimate of both the parameter and the standard deviation for each variable except cost, which is held constant. Thus the mixed logit results indicate the degree of taste heterogeneity by the relative size of the standard deviation parameters relative to the corresponding point estimates.

Looking at Table 6-7, there are some differences between the two models in terms of the significance of the coefficients, but overall the models provide similar qualitative results. In both models, cost is negative and significant. In terms of activities, not surprisingly snowmobile riders were more likely to select snowmobile trips and less likely to select cross-country ski trips. In the mixed logit, a large and significant standard deviation indicates that there is considerable preference heterogeneity among the respondents.

Although snowmobile riding increases utility for most riders, some riders get very high levels of enjoyment from the activity compared to other visitors.

Looking at the activity variables, the standard deviation on snowmobiling is significant, indicating that, although snowmobile riding increases utility for most riders, some riders get very high levels of enjoyment from the activity compared to other visitors. Although the coefficient on snowcoach tours is insignificant, the significant standard deviation is more than twice the size of the coefficient. Again there appears to be diverse preferences for the activity. Some people receive positive utility from snowcoach tours and others do not. Being part of a guided tour reduces utility on average, but again a large and significant standard deviation indicates that being on a guided tour provides positive utility to some portion of the sample. The *opt-out* option has a positive and significant coefficient as does its standard deviation. Compared to the other coefficients, the opt-out coefficient is large, suggesting that not visiting the parks was an attractive option for many people in

Table 6-7. Parameters of Conditional and Mixed Logit Models for Snowmobilers and Nonsnowmobilers

	Snowmobiler		Nonsnowmobiler	
	Conditional Logit	Mixed Logit	Conditional Logit	Mixed Logit
Attribute	Model 1 Coefficient[a]	Model 2 Coefficient[a]	Model 1 Coefficient[a]	Model 2 Coefficient[a]
Cost	–0.002**	–0.007***	–0.004***	–0.011***
	(0.001)	(0.002)	(0.001)	(0.002)
Entrance[b]				
West	0.182**	0.092	0.064	0.010
	(0.079)	(0.134)	(0.086)	(0.145)
Standard deviation		*0.505****		*0.389**
		(0.124)		*(0.211)*
North	–0.032	–0.124	0.004	0.021
	(0.056)	(0.098)	(0.069)	(0.114)
Standard deviation		*0.508****		*0.753****
		(0.153)		*(0.139)*
South	–0.102	0.139	–0.092	–0.002
	(0.076)	(0.131)	(0.103)	(0.163)
Standard deviation		*0.181*		*0.252*
		(0.195)		*(0.156)*
Grand Teton[c]	–0.048	–0.108	0.024	–0.029
	(0.103)	(0.174)	(0.122)	(0.205)
Activity[b]				
Snowmobiling	1.051***	2.146***	–0.459***	–0.697***
	(0.078)	(0.166)	(0.097)	(0.165)
Standard deviation		*1.902****		*1.276****
		(0.133)		*(0.142)*
Snowcoach tour	–0.078	0.239	–0.129	–0.058
	(0.097)	(0.160)	(0.104)	(0.173)
Standard deviation		*0.576****		*0.648****
		(0.169)		*(0.219)*
Skiing/hiking	–0.434***	–0.349***	0.178**	0.309**
	(0.074)	(0.117)	(0.077)	(0.127)
Standard deviation		*0.186*		*0.017*
		(0.159)		*(0.194)*
Auto tour[c]	–0.539	–2.036	0.410	0.446
	(0.146)	(0.279)	(0.173)	(0.282)

(continued)

Table 6-7. Parameters of Conditional and Mixed Logit Models for Snowmobilers and Nonsnowmobilers (continued)

	Snowmobiler		Nonsnowmobiler	
	Conditional Logit	Mixed Logit	Conditional Logit	Mixed Logit
Attribute	Model 1 Coefficient[a]	Model 2 Coefficient[a]	Model 1 Coefficient[a]	Model 2 Coefficient[a]
Guided Tour[b]				
Guided tour	–0.432***	–0.879***	0.069	0.138
	(0.044)	(0.096)	(0.068)	(0.114)
Standard deviation		*1.279****		*0.952****
		(0.102)		*(0.101)*
Unguided tour[c]	0.432	0.879	–0.069	
	(0.044)	(0.096)	(0.068)	–0.138
Crowding at Entrance[b]				(0.114)
Low traffic	0.205***	0.296**	0.330***	0.444***
	(0.070)	(0.117)	(0.085)	(0.128)
Standard deviation		*0.388***		*0.513****
		(0.160)		*(0.125)*
Moderate traffic	–0.018	0.025	–0.042	0.010
	(0.070)	(0.120)	(0.083)	(0.132)
Standard deviation		*0.256**		*0.069*
		(0.134)		*(0.191)*
High traffic[c]	–0.187	–0.321	–0.287	–0.455
	(0.061)	(0.101)	(0.086)	(0.138)
Crowding at Destination[b]				
Low traffic	0.241**	0.187	0.436***	0.709***
	(0.095)	(0.154)	(0.100)	(0.164)
Standard deviation		*0.182*		*0.202*
		(0.140)		*(0.149)*
Moderate traffic	0.084	0.069	–0.021	–0.104
	(0.065)	(0.111)	(0.083)	(0.129)
Standard deviation		*0.142*		*0.151*
		(0.139)		*(0.143)*
High traffic[c]	–0.325	–0.256	–0.415	–0.604
	(0.094)	(0.156)	(0.127)	(0.201)
Road Condition[b]				
Smooth	0.148***	0.318***	0.070	0.223***
	(0.040)	(0.072)	(0.044)	(0.069)
Standard deviation		*0.078*		*0.129*
		(0.145)		*(0.097)*
Bumpy and rough[c]	–0.148	–0.318	–0.070	–0.223
	(0.040)	(0.072)	(0.044)	(0.069)
Noise Level[b]				
Low	–0.007	0.110	0.158	0.210
	(0.073)	(0.122)	(0.087)	(0.138)
Standard deviation		*0.392***		*0.739****
		(0.174)		*(0.144)*

(continued)

Table 6-7. Parameters of Conditional and Mixed Logit Models for Snowmobilers and Nonsnowmobilers (continued)

	Snowmobiler		Nonsnowmobiler	
	Conditional Logit	Mixed Logit	Conditional Logit	Mixed Logit
Attribute	Model 1 Coefficient[a]	Model 2 Coefficient[a]	Model 1 Coefficient[a]	Model 2 Coefficient[a]
Moderate	–0.175**	–0.236**	–0.121	–0.058
	(0.069)	(0.109)	(0.064)	(0.100)
Standard deviation		*0.291*		*0.066*
		(0.154)		*(0.127)*
High[c]	0.181	0.126	–0.036	–0.151
	(0.091)	(0.149)	(0.109)	(0.173)
Emissions Level[b]				
Not noticeable	–0.059	0.089	0.057	0.399**
	(0.099)	(0.164)	(0.117)	(0.195)
Standard deviation		*0.501****		*0.775****
		(0.138)		*(0.169)*
Noticeable	0.193***	0.360***	0.106	0.143
	(0.068)	(0.118)	(0.084)	(0.139)
Standard deviation		*0.158*		*0.027*
		(0.121)		*(0.092)*
Very noticeable[c]	–0.134	–0.449	–0.164	–0.542
	(0.075)	(0.126)	(0.099)	(0.166)
No Crowding at Entrance/Destination Dummy	0.189	0.147	1.270***	2.112***
	(0.153)	(0.271)	(0.180)	(0.301)
Standard deviation		*0.019*		*0.820****
		(0.449)		*(0.165)*
Opt–Out Dummy	1.127***	1.586***	0.625***	0.432
	(0.140)	(0.260)	(0.177)	(0.296)
Standard deviation		*2.931****		*2.535****
		(0.146)		*(0.142)*
Number of choices	5,115	5,115	3,814	3,814
Log likelihood	–4,393.7269	–0.6949[d]	–3,418.1261	–0.7661[d]
LR $\chi^2(19)$	2,451.35		1,543.96	
Probability > χ^2	0.0000		0.0000	
Pseudo R^2	0.2181		0.1842	

[a]Standard errors are in parentheses.

[b]Attributes with multiple levels are coded using effects codes.

[c]The base level for the effects-coded variable. The value of the base level for the effects coded variable is minus the sum of the coefficients on the other categories. The standard error is calculated from the variance-covariance matrix using as the square root of $\text{var}\left(\sum X_i\right) = \sum \text{var}(X_i) + 2 \cdot \sum_{i>j}^{n} \sum_{j=1}^{n-1} \text{cov}(X_i, X_j)$ where the X_is are the other levels of the variables.

[d]Indicates mean log likelihood.

*** Statistically different from 0 at the 0.01 level of significance.

** Statistically different from 0 at the 0.05 level of significance.

* Statistically different from 0 at the 0.1 level of significance.

the sample given the other trip choices. In fact, overall opt out was selected almost 54 percent of the time.

Two crowding variables appear in the attribute list. For both variables, the coefficient on low crowding provides the largest increase in utility, moderate crowding is in the middle, and high crowding reduces utility.

Two crowding variables appear in the attribute list. For both variables, the coefficient on low crowding provides the largest increase in utility, moderate crowding is in the middle, and high crowding reduces utility. Low crowding at the entrance is significantly different from zero (the mean effect). Moderate crowding is not different from the mean effect (which is set to 0 for effects-coded variables); however, high crowding significantly lowers utility compared to moderate crowding. Both low and moderate crowding have large and significant standard deviations. In terms of crowding at the most crowded part of the trip, low and moderate crowding are not significantly different from the mean effect in the mixed logit (although in the conditional logit, low crowding has a significant positive coefficient), but high crowding significantly lowers utility compared to the mean effect. A final variable related to crowding is "No crowding at entrance/destination," which was described as no snowmobiles at the entrance or the most crowded part of the visit. Not surprisingly, this variable is not significantly different from the mean effect. Crowding affects road conditions, and in pretesting, many people mentioned the importance of smooth road conditions to an enjoyable trip. The results from both the conditional logit and mixed logit confirm the importance of smooth roads with a positive and significant coefficient.

The attribute describing the level of noise from snowmobiles may seem somewhat puzzling at first glance. Low noise has a positive but insignificant coefficient, indicating that this coefficient is not different from the mean effect, while moderate noise has a significant and negative effect. However, high noise has a positive coefficient, implying the snowmobile riders get utility from noise. Both low and moderate noise have large, significant standard deviations as well. There are several possible explanations. Snowmobile riders may enjoy the noise associated with riding snowmobiles. In addition, the respondents may be interpreting the variable more broadly. For example, using current technology, lower noise might be associated with a four-stroke engine snowmobile, which is also less powerful than the more commonly used two-stroke engine snowmobile. The preference for high noise

may actually indicate a preference for two-stroke engine snowmobiles. Finally, moderate emissions bring higher utility than low emissions, possibly for similar reasons, while high emissions decrease utility.

We ran several other specifications not presented in this report because the results were very similar both quantitatively and qualitatively. However, one interesting result observed in an alternate specification concerns the noise variables. When interacted with snowmobile ownership, it turns out that snowmobile owners have a large, positive coefficient on high noise. Snowmobile riders who do not own snowmobiles prefer low and moderate noise to high noise. This result lends support to the contention that snowmobile owners may be expressing a preference for technology rather than noise.

Nonsnowmobile Visitor Results

Table 6-7 presents the results from the conditional and mixed logits for other visitors. Again the coefficient on cost is negative and significant for all models. Looking at Models 1 and 2, the activity snowmobile reduces utility, while cross-country skiing and auto tours have positive and significant coefficients. Guided tour also has the opposite sign from the snowmobile models. Guided tour has a positive coefficient, although it is not significantly different from the mean effect. However, the standard deviation on guided tour is large and significant.

Turning to the crowding variables, the coefficients on both entrance crowding and crowding on the trip are ordered as expected. Lower crowding yields the highest utility, while high crowding yields the lowest utility, with all the levels significantly different from each other. For these visitors, the variable representing no snowmobiles in the park has a large positive and significant coefficient. Like snowmobile riders, these visitors also have a preference for smooth road conditions.

Low noise provides the highest level of utility; however, none of the coefficients on the noise levels are significant in Model 2, the mixed logit results. In addition, the noise coefficients have large standard deviations. In Model 2, the emission variables are also ordered as expected: low emissions provide positive utility and high emissions decrease utility.

Again, we ran a number of additional models to investigate the effects of alternative specifications. In particular, we were interested in the cost coefficient and emissions variable. Combining low and moderate emissions yields a positive and significant coefficient. Otherwise, the results are similar.

6.3.3 Testing for Consistency in Stated Preference Conjoint Data

Unlike contingent value surveys, the responses to conjoint surveys often allow the analyst to test whether individual stated preferences conform to the basic tenets of utility theory.

Recovering valid welfare measures from stated preference data requires that respondents' preferences be complete, monotonic, and transitive. In addition, we expect preferences to be stable at least within the conjoint survey. We refer collectively to monotonicity, transitivity, and stability as preference consistency. Unlike contingent value surveys, the responses to conjoint surveys often allow the analyst to test whether individual stated preferences conform to the basic tenets of utility theory. The design of the conjoint questions in this survey allowed us to test the conjoint data for monotonicity and preference stability. Monotonic preferences require that, holding costs constant, individuals should prefer more to less of any normal good. Stability requires that, in general, if respondents prefer A to B at the beginning of the one point in the sequence of questions, then they should prefer A to B at any subsequent point.

There are two possible tests for monotonicity. The first is a dominant-pair comparison. This test requires that all the attributes of one profile in a choice set be unambiguously better than all the attributes of the other profile in the comparison. Including a dominant-pair comparison in a conjoint survey provides a simple test of respondent consistency. However, including this simple test reduces overall design efficiency because a dominant-pair provides no information on respondents' willingness to accept trade-offs among attributes.

We employed an alternative test of monotonicity that involves comparing respondents' choices across two choice sets. This test requires that respondents see a particular profile at least twice. In addition, it requires that one of the profiles compared to the repeated profile is either unambiguously better or worse than the other comparison profile. For example, suppose that a respondent sees two sets of pairs, Option X versus Option Y, and Option X

versus Option Z. Further suppose that Options Y and Z are identical in all attributes but cost, and Option Z costs less. Given that a respondent prefers Option Y to Option X in the first pair, that individual should prefer Option Z to Option X at least as strongly, because Option Z provides the same utility at a lower cost.

If the experimental design permits, preference stability can be tested as well. For example, one could repeat questions at the beginning of the series and the end, although this version of the test reduces the efficiency of the overall experimental design. We used a stability test that compared the responses to two choice sets where Options X and Y are the same in both sets, but the third option is different. If respondents choose Option X in the first set, then preference stability requires that they not choose Option Y in the second set.

RTI has developed software that extracts consistency tests from a conjoint data set. For the monotonicity test, the data allowed for 853 tests that resulted in only 24 failures (and no respondents failed the test more than once). A total of 1,154 stability tests were performed resulting in only 123 failures (again, no respondents failed the test more than once). Results of such tests should be interpreted carefully, however. Conjoint tasks are cognitively challenging. Even the most attentive respondents with well-behaved preferences may report some inconsistent responses, particularly for cases where the utilities of two profiles are nearly equal. The low failure rate for the monotonicity and stability tests in this survey supports the reliability of the data.

6.3.4 Welfare Estimates

Once we have estimated the utility functions, we can determine the effect of changes in various attributes on individual utility. We will also be able to monetize changes in utility. Let X_j^0 represent the status quo vector of attribute levels. X_j^* represents a different vector of attribute levels. The WTP for a given change in commodity attributes $(X_j^* - X_j^0)$ is the amount of money $(p_j^* - p_j^0)$ that would leave respondent i indifferent between paying for the change in attribute levels or remaining in the status quo state at no cost. Mathematically, this is the level of p_j^* that satisfies

$$V^i[\mathbf{X}_j^*, \mathbf{Z}^i, p_j^*; \beta^i, \delta^i(p, \mathbf{Z}^i)] = V^i[\mathbf{X}_j^0, \mathbf{Z}^i, p_j^0; \beta^i, \delta^i(p, \mathbf{Z}^i)]. \quad (6.11)$$

The negative of the estimated coefficient on the cost term ($-\delta$) can be interpreted as the marginal utility of money (i.e., the utility derived from having additional dollars). Therefore,

$$WTP^i\left(X^* - X^0\right) = p_j^* - p_j^0 = \frac{\left(X^* - X^0\right)\beta^i}{-\delta^i} \qquad (6.12)$$

For both groups of visitors, moving from Baseline High (with high levels of crowding, noise, and emissions) to Baseline Moderate or to a Cap-Only policy that resulted in low crowding noise and emissions improves utility and yields similar WTP between $150 and $350.

We used the mixed logit models to calculate the changes in welfare associated with different trips according to Eq. (6.12) for changes in the levels of the attributes. In Table 6-8 we present welfare changes for some sample scenarios. These welfare calculations are based on one set of possible outcomes associated with the proposed management changes in the FSEIS (NPS, 2003).

Table 6-9 presents the per-day WTP for the specified changes. To estimate the WTP of snowmobile riders, we used the numbers from snowmobilers Model 2, and we used the numbers from nonsnowmobiler Model 2 for the nonsnowmobiler welfare estimates. For both groups of visitors, moving from Baseline High (with high levels of crowding, noise, and emissions) to Baseline Moderate or to a Cap-Only policy that resulted in low crowding noise and emissions improves utility and yields similar WTP between $150 and $350. Snowmobile riders lose utility if snowmobiles are banned. If the snowmobile riders did not visit the parks and instead chose opt out under the ban, their utility declines by $32. On the other hand, a policy that bans snowmobiles results in a welfare gain for nonsnowmobile riders of $437. One possible explanation for the large disparity in the magnitude of impacts between snowmobilers and nonsnowmobilers is that the model is set up as a day trip model and it appears that on any given day snowmobilers prefer snowmobile use outside the parks to snowmobiling in the parks. However, snowmobilers may still place a high value on being able to visit the parks as part of their visit to the GYA. Without the ability to snowmobile in the parks, many snowmobilers may choose to travel to a region other than the GYA for snowmobiling trips. Thus, the loss reported for restricting use in the park may understate welfare losses by focusing on the losses for a given day.

Table 6-8. Sample Scenarios for Welfare Change Calculations

Attribute	Baseline Moderate	Baseline High	Ban	Cap and Guided Tours Low	Cap Only Low
Guided tour required?				Yes for snowmobiles	
Crowding at entrance	Moderate	High		Low	Low
Crowding at destination	Moderate	High		Low	Low
No snowmobiles in park			Yes		
Road condition	Rough	Rough	Smooth	Smooth	Smooth
Noise level	Moderate	High	Low	Low	Low
Emissions level	Noticeable	Very noticeable	Not noticeable	Not noticeable	Not noticeable

Table 6-9. Per-Day WTP Estimates for Sample Scenarios Using Results from Model 2[a]

	Baseline Unguided Snowmobile Trip	Baseline Snowcoach, Cross-Country Ski or Auto Trip
Baseline high to baseline moderate	$163	$155
Baseline high to cap only low	$323	$352
Baseline high to ban		$437
Baseline high to opt out	–$32	
Baseline high to cap and guided tours low	$67	$352
Baseline moderate to cap and guided tours low	–$96	$197

[a]These sample WTP estimates are point estimates calculated using parameter means.

Finally, a policy that requires snowmobile riders to be on guided tours (and results in low crowding, noise, and emissions) would increase welfare for snowmobile riders compared to a high crowding situation (Baseline High) but reduces welfare if Baseline Moderate is used. On average, guided tours reduce utility for snowmobile riders. However, snowmobile riders prefer low crowding over high crowding enough that welfare increases under the Cap and Guided Tours policy when Baseline High is the

baseline. In contrast, moving from a moderate crowding baseline to required guided tours reduces utility. The disutility of the guided tours is larger than the utility gains from lower crowding. In this model, the guided tour requirement for snowmobiles does not affect the utility of nonsnowmobilers, so the utility of moving from Baseline High to Cap and Guided Tours Low is the same as moving to Cap Only Low.

6.3.5 Interpretations and Limitations

The welfare estimates presented in Section 6.3.3 suggest a range of WTP values for snowmobile riders and nonsnowmobile riders that vary according to the baseline conditions in the park and the alternative scenario under consideration. As a point of comparison, the travel cost RUM model results reported in Section 6.3.4 concluded with an estimate of $32 per day of welfare loss associated with removing YNP/GTNP from the choice set for snowmobile riders. This number matches the welfare estimate from Model 2 in Table 6-9 for snowmobile riders who would choose to recreate outside the parks (the opt-out option) if a ban on snowmobiles were instituted.

There are some important considerations to keep in mind when interpreting these welfare estimates. First, the welfare estimates were calculated using the mean point estimates of the coefficients. Several of the coefficients in the mixed-logit models have large and significant standard deviations. For example, the standard deviation on the guided tour variable for snowmobile riders is large and significant compared to the size of the coefficient itself. On average, being on a guided tour reduces utility for snowmobile riders, but for some riders it increases utility. Using the mean coefficients to calculate welfare estimates masks this variation. In addition, the conjoint design did not include an attribute describing whether all the snowmobiles were on tours. As discussed above, this implies that the model will not predict any change in utility for nonsnowmobile riders if the snowmobiles are all on guided tours. As a result, the welfare estimates may either under- or overstate the benefits of requiring guided tours. Nonsnowmobile riders might prefer to have snowmobiles on tours if, for example, the result is that all the snowmobiles travel at slower speeds. However, if the policy resulted in larger groups of people arriving all at once at various sites or rest stops, it might be an inconvenience to

nonsnowmobile riders. Finally, the stated preference survey measures stated preferences over hypothetical alternatives. Although it is reassuring that the Model 2 snowmobile welfare estimate matches the travel cost estimate, the responses to the survey could differ from actual behavior.

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Appendix A: Winter Visitor Contact Form

1. On this trip, are you staying away from home overnight?
   ____ Yes, I am staying away from home overnight on this trip
   ____ No, I am here on a day trip

2. Are you snowmobiling in the park during this trip [if visitor is in a wheeled vehicle]?
   ____ Yes
   ____ No

3. If you are riding a snowmobile on this trip, is this trip the first time you have ridden a snowmobile?
   ____ Yes, this trip is my first time on a snowmobile
   ____ No, I have ridden a snowmobile before

_____

First Name Last Name

_____ _____

Street Address Email address

_____ _____ _____

City State Zip Code

Staff Use: Indicate mode of transportation **Date:**_____
____Snowmobile ____Snowcoach ___Auto, bus, van, RV ___Skis
___Other_____

Appendix B:
Survey Instrument

Section B.1 contains a copy of one version of the survey—the version for nonlocal, experienced snowmobile riders. The other versions of the survey contained mostly identical questions with the following exceptions:

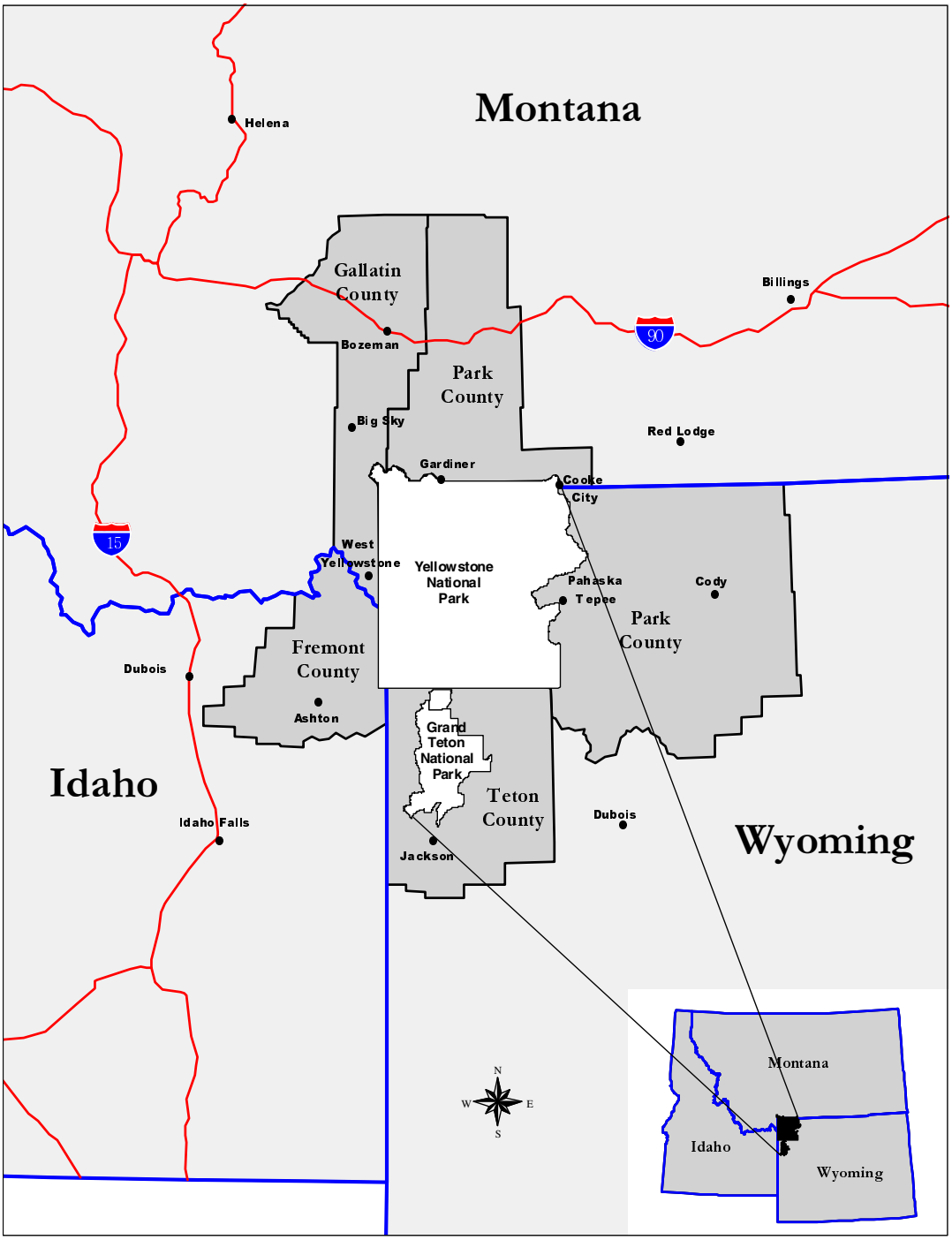
- The version for local visitors on day trips contains the same questions, except in a different order.[1]
- Question 19 was different for nonsnowmobile riders or for first-time snowmobile riders. Section B.2 contains the text of the alternative question asking about winter recreation trips.
- Questions 22 through 27 are the stated preference conjoint questions. The attributes of Trip A and Trip B varied according to an experimental design that was used to create four blocks of six questions each. The four blocks were randomized across respondents. The survey in this appendix contains one of the four blocks. The other blocks were similar. Section 5 contains more details on the design of the stated preference conjoint questions and the analysis of the data from these questions.
- Questions 28 and 29 are the stated behavior questions. There were three versions of the stated behavior questions. Each respondent only answered one of the three questions, and the three questions were distributed randomly across respondents. The survey in Section B.1 contains the stated behavior question based on a proposed winter management plan that would cap the number of snowmobiles allowed in YNP and GTNP each day. The text of the other two stated behavior questions is contained in Section B.3. The two other questions describe two additional proposed winter management plans: one banning snowmobiles from the parks and the other capping the number of snowmobiles allowed in the parks every day and requiring snowmobiles to be on a guided tour.

[1]For the first survey mailing, the local survey contained expenditure questions relevant only to day trips. However, concerns about accuracy of the answers to the screening questions led to the inclusion of expenditure questions relevant to overnight trips on one page of the local survey.

SECTION B.1

National Park Winter Recreation Survey

Greater Yellowstone Area including Yellowstone and Grand Teton National Parks and the 5 surrounding counties



ID # NLS_____
3Ac

16 U.S.C. 1a-7 authorizes collection of this information. This information will be used by park managers to better serve the public. Response to this request is voluntary. No action may be taken against you for refusing to supply the information requested. Your name is requested for follow-up mailing purposes only. When analysis of the questionnaire is completed, all name and address files will be destroyed. Thus permanent data will be anonymous. Data collected through visitor surveys may be disclosed in aggregate form without any personal identifying information to the Department of Justice when relevant to litigation or anticipated litigation, or to appropriate Federal, State, local or foreign agencies responsible for investigating or prosecuting a violation of law. Your name and address will remain totally confidential. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Burden estimate statement: Public reporting for this form is estimated to average 30 minutes per response. Direct comments regarding the burden estimate or any other aspect of this form to the Information Collection Clearance Officer, WASO Administrative Program Center, National Park Service, 1849 C Street, NW, Washington, D.C. 20240.

OMB Approval #1024-0224 (NPS #03-004)
Expiration Date: 09/30/2003

INTRODUCTION

Thank you for agreeing to take this survey. Your answers are important for future decisions about winter management of the parks and will help the National Park Service better understand winter visitation in Yellowstone and Grand Teton National Parks and the Greater Yellowstone Area. The "Greater Yellowstone Area" includes the five counties surrounding Yellowstone and Grand Teton National Parks: Teton and Park counties in Wyoming, Park and Gallatin counties in Montana, and Fremont county in Idaho. This area is shown on the map on the cover of the survey.

PLEASE TELL US ABOUT YOUR RECENT TRIP

1. What was the date of your trip to the Greater Yellowstone Area on which you agreed to take this survey?

   Date the trip started _____

   Date the trip ended _____

In this survey, when we ask you about **your recent trip**, we are talking about the trip during which we contacted you about this survey.

2. How long was your recent trip to the Greater Yellowstone Area?

   ☐ Multiple days

   ☐ One day, ***please skip to Question 4***

3. If you were on a multiple day trip:

   3a. How many days or parts of a day did you spend in the Greater Yellowstone Area **in total (see cover map)**? _____

   3b. How many days or parts of a day did you spend inside **Yellowstone National Park**? _____

   3c. How many days or parts of a day did you spend inside **Grand Teton National Park**? _____

   3d. How many days or parts of a day did you spend in the Greater Yellowstone Area **outside the parks**? _____

4. Which of the following statements ***best*** describes how you decided to visit the Greater Yellowstone Area on your recent trip?

   ☐ Limited planning was necessary since I live relatively close.

   ☐ I decided on a winter trip to the Greater Yellowstone Area, and then decided how many days to stay.

☐ I decided to spend a fixed number of days on a winter vacation, and then chose the Greater Yellowstone Area over a number of other alternatives.

☐ Other (please describe) _____

5. Which of the following statements ***best*** describes how you chose your activities on your recent trip?

☐ I decided to visit the Greater Yellowstone Area and then looked for available activities to try.

☐ I decided to visit the Greater Yellowstone Area based on a particular activity I wanted to do there.

☐ Other (please describe) _____

6. What was the **primary purpose** of your recent trip to the Greater Yellowstone Area? (***please check only one box).***

☐ Visit Yellowstone National Park

☐ Visit Grand Teton National Park

☐ Visit both Yellowstone and Grand Teton National Parks

☐ Visit recreation sites outside Yellowstone or Grand Teton National Parks (for example, downhill skiing, cross-country skiing, or riding a snowmobile in the National Forests or other areas around the parks)

☐ Visit friends living in the area

☐ Business in the area

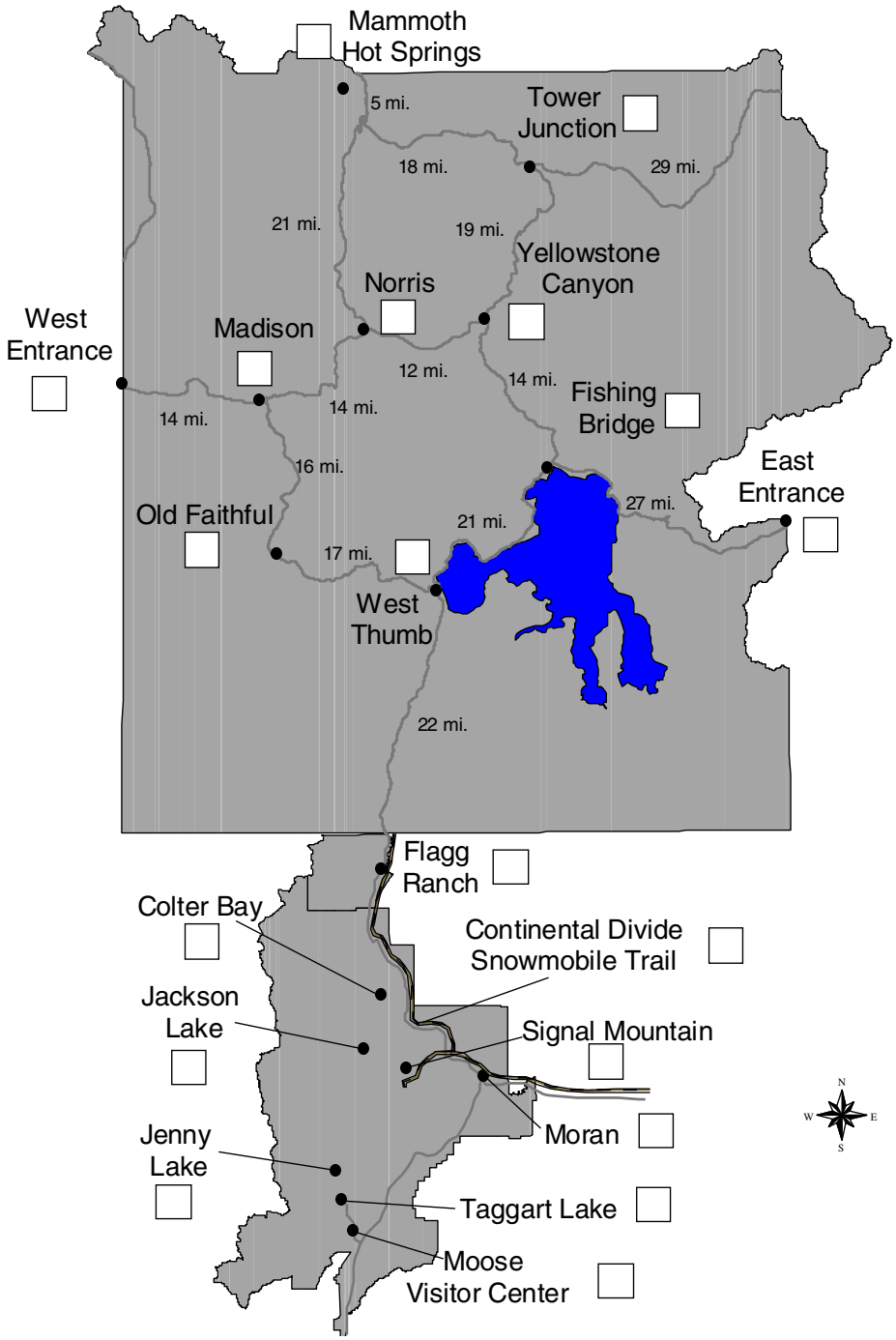
☐ Other (please describe) _____

7. We are interested in all the activities you did during your most recent trip to the Greater Yellowstone Area, both inside and outside the parks. **For each activity, please check all the locations that apply. If you did not participate in a particular activity leave that line blank.**

	Yellowstone National Park	Grand Teton National Park	Outside the Parks in the Greater Yellowstone Area
a. Snowmobiling without a commercial tour guide	☐	☐	☐
b. Snowmobiling with a commercial tour guide	☐	☐	☐
c. Cross-country skiing without a tour guide	☐	☐	☐
d. Cross-country skiing with a commercial tour guide	☐	☐	☐
e. Cross-country skiing with a National Park Service guide	☐	☐	☐
f. Snow Shoeing	☐	☐	☐
g. Snowcoach tour of park sights	☐	☐	☐
h. Driving tour of park sights in a car	☐	☐	☐
i. Bus tour of park sights	☐	☐	☐
j. Educational tours led by a National Park Service guide	☐	☐	☐
k. Winter Camping	☐	☐	☐
l. Downhill Skiing	☐	☐	☐
m. Other, please specify _____	☐	☐	☐

8. Looking at the activities you selected in Question 7, please write the letter or name of the activity that you consider the ***primary* activity** of your most recent trip to the Greater Yellowstone Area? (For example, write "K" for winter camping.) **Please choose only one.** _____

9. On the map below, check **all** the places you and your group visited during your recent trip to the Greater Yellowstone Area. Simply check the box beside each place you visited. If you did not visit a place, leave the box blank.



The following questions are for visitors who ride a snowmobile. Please skip to Question 15 on the following page if you have never ridden a snowmobile.

10. Do you own your own snowmobile?

- ☐ Yes
- ☐ No, skip to Question 12

11. If you own your own snowmobile, do you own a

- ☐ 2-stroke engine snowmobile
- ☐ A fuel-injected 2-stroke engine snowmobile
- ☐ 4-stroke engine snowmobile
- ☐ Don't know

12. Approximately how many years have you been riding a snowmobile? _____

13. Did you rent a snowmobile for your recent trip?

- ☐ Yes
- ☐ No, skip to Question 15

14. Which type of snowmobile did you rent?

- ☐ 2-stroke engine snowmobile
- ☐ 4-stroke engine snowmobile
- ☐ Don't know

15. How much time have you spent visiting the **Greater Yellowstone Area** so far this winter season (including your most recent trip)?

_____ total number of *trips*

_____ total number of *days*

16. How many of these days were spent inside **Yellowstone National Park**?

_____days

17. How many of these days were spent inside **Grand Teton National Park**?

_____days

18. Approximately how much ***additional*** time (if any) do you plan to spend visiting the **Greater Yellowstone Area** during the rest of this winter season?

_____ total number of **trips**

_____ total number of **days**

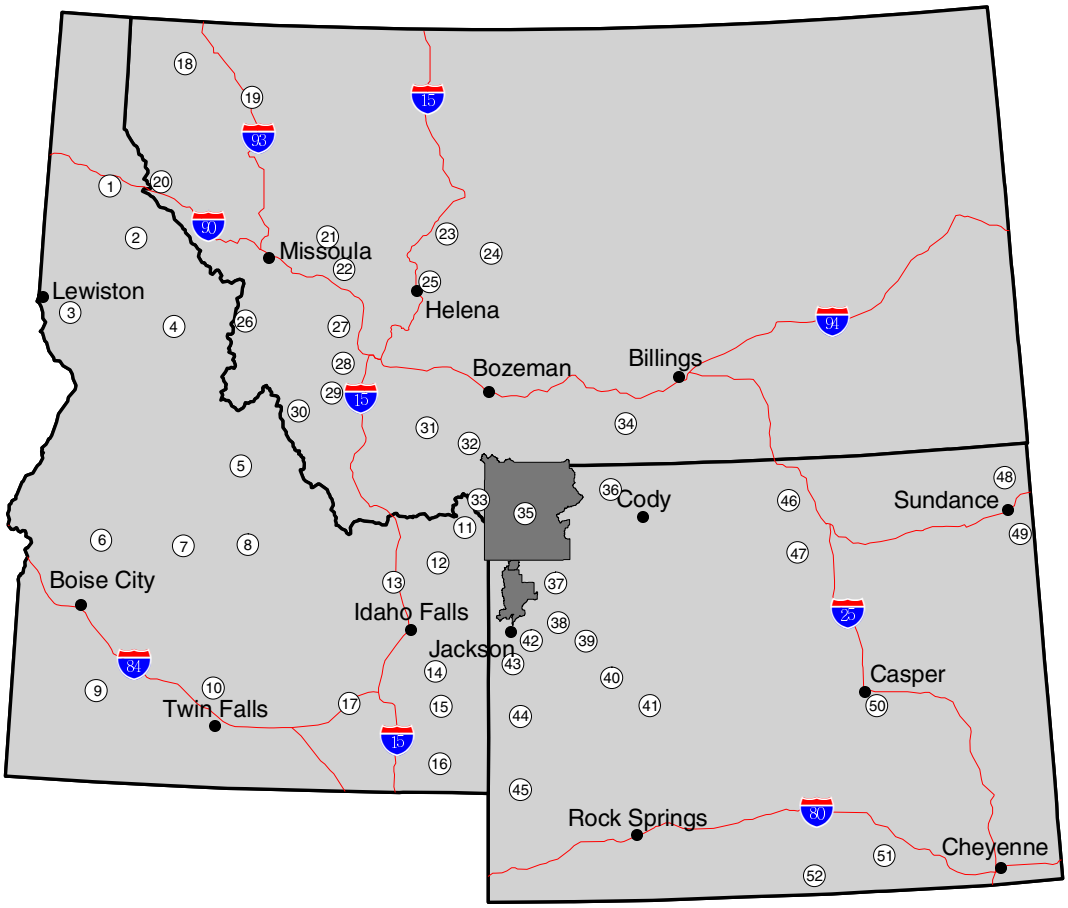
18a. How many of these days do you **plan** to spend inside **Yellowstone National Park**?

_____days

18b. How many of these days do you **plan** to spend inside **Grand Teton National Park**?

_____days

We would now like to ask about your snowmobiling activity* last *winter (December 2001-March 2002). We will ask you about trips you made to areas in Idaho, Wyoming, and Montana using the map and general area list on this page for reference.



Idaho

1. Wallace Area Trails
2. Northern Idaho Trails
3. Grangeville Area Trails
4. North-Central Idaho Trails
5. Salmon/Challis Area Trails
6. Smith's Ferry Area Trails
7. Stanley Area Trails
8. Central Idaho Trails
9. South-Western Idaho Trails
10. South-Central Idaho Trails
11. Big Springs Area Trails
12. Ashton Area Trails
13. Eastern Idaho Trails
14. Bone Snowmobile Trails
15. Pocatello Area Trails
16. Bear Lake Area Trails
17. South-Eastern Idaho Trails

Montana

18. Kootenai Country
19. Flathead Valley
20. Haugan
21. Seeley Lake
22. Garnet
23. Lincoln
24. Kings Hill/Little Belts
25. Helena
26. Lolo Pass
27. Georgetown Lake
28. Wise River
29. Dillion/Polaris
30. Wisdom/Jackson/Sula
31. Virginia City/Ennis
32. Bozeman/Big Sky
33. West Yellowstone
34. Cooke City/Silver Gate

Wyoming

35. Yellowstone/Grand Teton National Parks
36. Bear Tooth
37. Continental Divide Togwotee
38. Continental Divide Gros Ventre
39. Continental Divide Dubois
40. Wyoming Range Kemmerer
41. Continental Divide Lander
42. Granite Hot Springs
43. Wyoming Range Alpine
44. Casper Mountain
45. Wyoming Ranger Kemmerer
46. North Big Horn Mountains
47. South Big Horn Mountains
48. Bear Lodge Mountains
49. Black Hills of WY
50. Wyoming Range Afton
51. Snowy Range
52. Sierra Madre Mountains

19. Please list the numbers corresponding to the areas you visited last winter (December 2001–March 2002) and indicate the number of trips you made to that area and the total days you spent in the area on all the trips. If during a single trip you visited multiple areas list the area where you spent most of your time. If you visited an area not included on this list, please add this under the "other areas" category.

Snowmobile Areas	Number of Trips	Total Days
Montana		
Areas from list (numbers):		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
Other areas (please name area and nearest city):		
_____	_____	_____
Idaho		
Areas from list (numbers):		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
Other areas (please name area and nearest city):		
_____	_____	_____
Wyoming		
Areas from list (numbers):		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
Other areas (please name area and nearest city):		
_____	_____	_____

ACTIVITY CHOICES

We will now ask you to think about different activities you might do for a day inside Yellowstone or Grand Teton National Parks. To begin, we will ask you to describe a typical day on your own recent trip to Yellowstone or Grand Teton National Park (the trip when we contacted you about the survey).

Instruction 1: Look at the table on the next page. Each row describes a different feature of your trip. Think about one day on your recent trip that was typical of your experience. In the column called "Your Trip," **please answer the questions in rows "a" through "h" by choosing the category that best describes conditions on one day during "Your Trip" in Yellowstone or Grand Teton National Parks.**

We describe the level of snowmobile traffic at two points on "Your Trip"—the number of snowmobiles that enter the park each day at the entrance where you entered the park, which captures congestion at the entrance and along the roads near the entrance, and the number of snowmobiles at the most crowded area of the park you visited.

Instruction 2: In the row labeled "Cost" (row i), please enter your best estimate of the cost for you of the day's activities inside the park including park entrance fees, supplies, equipment rentals , gas, and guided tour charges, **but do not include the cost of food or lodging**.

Instruction 3: After you fill out the table, look at the columns for "Your Trip" and "Trip B." **Imagine that "Your Trip" and "Trip B" were the only trips inside Yellowstone or Grand Teton National Park that you could choose from.**

Please check the box in the last row of the table (row j) indicating which trip you would prefer. If you did not enjoy your trip and you do not like "Trip B," you should choose the "Not Visit" option. "Not Visit" means you would stay home or you would still visit the Greater Yellowstone Area, but just not enter either of the parks.

20.

Features of Trip	Your Trip (please check ONE BOX in each row that best describes Your Trip)	Trip B	Not Visit
a. Activity?	☐ Snowmobile ☐ Snowcoach tour ☐ Snowcoach Shuttle to ski or snowshoe ☐ Drive car to sightsee, ski or snowshoe ☐ Other	Snowmobile	**I would not enter Yellowstone or Grand Teton National Park if these were my only choices**
b. Entrance where you started the day?	☐ Yellowstone West near West Yellowstone, MT ☐ Yellowstone East near Cody, WY ☐ Yellowstone North near Gardiner, MT ☐ Yellowstone South near Flagg Ranch ☐ Grand Teton Moose entrance near Jackson Hole, WY ☐ Grand Teton Moran entrance near Flagg Ranch ☐ Other (please describe)	Yellowstone West Entrance	
c. Did you take a guided tour?	☐ Yes ☐ No	Unguided	
d. Daily snowmobile traffic at the entrance where you started?	☐ High, 800 to 1,500 snowmobiles (typical West Entrance on a holiday or crowded weekend) ☐ Moderate, 300 to 600 snowmobiles (typical West Entrance on weekdays and South entrance on busy holiday weeks) ☐ Low, 200 or fewer snowmobiles (typical North and East entrances on all days and South entrance on most weekdays and weekends) ☐ I did not see any snowmobiles near the entrance where my trip started	Low, 200 or fewer snowmobiles	
e. Level of snowmobile traffic at the most crowded area of the park you visited?	☐ High, 800 to 1,500 snowmobiles (typical Old Faithful on a holiday and busy weekends or weekdays in late January and February) ☐ Moderate, 300 to 600 snowmobiles (typical Old Faithful on less crowded weekdays and weekends) ☐ Low, 200 or fewer snowmobiles (very uncrowded days at Old Faithful) ☐ I did not see any snowmobiles on my most recent trip	Moderate 300 to 600 snowmobiles	
f. Condition of snow on road or trail surface?	☐ Bumpy and rough for all or most of the trip ☐ Bumpy and rough for some of the trip ☐ Smooth	Smooth	
g. Noise level at the noisiest part of the park you visited?	☐ Loud, standing next to the road you could not converse with someone standing next to you, noise level similar to standing next to a gas-powered lawn mower or a busy highway ☐ Moderate, you would need to raise your voice to talk to someone standing next to you, noise like a busy city street ☐ Low noise, occasional	Moderate	
h. Level of exhaust emissions during your day?	☐ Very noticeable for most or all of the trip ☐ Noticeable for some of the trip ☐ I did not notice any exhaust emissions	Noticeable for some of the trip	
i. Cost per person for day?	$_____	$100	
j. I would choose… (check only one)	Your Trip ☐	Trip B ☐	Not Visit ☐

21. If you could change **one** thing about your trip, what would you change?

- ☐ Number of other visitors
- ☐ Number of other snowmobiles
- ☐ Number of other cars
- ☐ Noise level
- ☐ Smoother road surface
- ☐ Level of exhaust emissions
- ☐ Cost
- ☐ Other, please describe _____
- ☐ I would not change anything about my trip

The next 6 questions offer similar choices. There are no right or wrong answers. We are interested in the activities and other features of the trips that appeal to you.

Please indicate your choice in each question by checking the box at the bottom of the column.

Please assume you are staying close to the entrance where the trip starts, rather than where you stayed on your recent trip. The maps on the cover and on page 5 of the survey may help if you are not familiar with all the entrances. The map on page 5 provides mileage between roads in Yellowstone National Park.

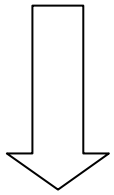
We know that these are not the only choices of activities to do in Yellowstone and Grand Teton National Parks, however as you answer each question please assume that the two trips describe your only two choices, in addition to the option of not entering the parks.

22. CHOICE 1: Which do you prefer—Trip A, Trip B or "Not Visit"?

Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B or Not Visit. If you choose Trip A or Trip B, write the number of days you spend on a trip doing only that activity.

Note that we shaded the boxes that are the same for both trips. The conditions and prices described in this question may be different than what the parks are like today.

		Trip A	Trip B	Not Visit
Activity		Take a guided snowcoach tour to see park sights in Yellowstone starting at the South entrance (near Flagg Ranch)	Take an unguided snowmobile trip in Yellowstone starting from the West entrance (near West Yellowstone)	**I would not enter Yellowstone or Grand Teton National Park if these were my only choices**
Conditions during day trip	**Daily snowmobile traffic at the entrance where you started**	High (800 to 1,500 snowmobiles)	Moderate (300 to 600 snowmobiles)	
	Snowmobile traffic at most crowded part of the trip	High (800 to 1,500 snowmobiles)	Moderate (300 to 600 snowmobiles)	
	Condition of snow on the road or trail surface for all or most of the trip	Smooth	Bumpy and rough	
	Highest noise level experienced on trip	Loud (Like a gas-powered lawn mower or a busy highway)	Loud (Like a gas-powered lawn mower or a busy highway)	
	Exhaust emission levels	Very noticeable	Very noticeable	
	Total Cost for DAY per person	$230	$50	
I would choose… (check only one)		☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ **go to Question 22b below**



22b. Answer this question if you chose "Not Visit": What would you likely do instead?

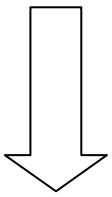
- ☐ Stay at home; I would not travel to the Greater Yellowstone Area
- ☐ Travel to the Greater Yellowstone Area to snowmobile outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to cross-country ski outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to downhill ski at Big Sky or one of the ski areas near Jackson Hole.
- ☐ Other, please describe activity _____
  location _____

23. CHOICE 2: Which do you prefer—Trip A, Trip B or "Not Visit"?

Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B or Not Visit. If you choose Trip A or Trip B, write the number of days you spend on a trip doing only that activity.

Note that we shaded the boxes that are the same for both trips. The conditions and prices described in this question may be different than what the parks are like today.

		Trip A	Trip B	Not Visit
Activity		Take a guided snowcoach tour to see park sights in Yellowstone starting at the West entrance (near West Yellowstone)	Drive your car to auto-tour, cross-country ski or hike unguided in Grand Teton National Park	**I would not enter Yellowstone or Grand Teton National Park if these were my only choices**
Conditions during day trip	**Daily snowmobile traffic at the entrance where you started**	Moderate (300 to 600 snowmobiles)	Moderate (300 to 600 snowmobiles)	
	Snowmobile traffic at most crowded part of the trip	Low (200 or fewer snowmobiles)	Moderate (300 to 600 snowmobiles)	
	Condition of snow on the road or trail surface for all or most of the trip	Smooth	Bumpy and rough	
	Highest noise level experienced on trip	Moderate (Like a busy city street)	Low noise, occasional	
	Exhaust emission levels	Noticeable	Noticeable	
	Total Cost for DAY per person	$100	$20	
I would choose… (check only one)		☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ **go to Question 23b below**



23b. Answer this question if you chose "Not Visit": What would you likely do instead?

- ☐ Stay at home; I would not travel to the Greater Yellowstone Area
- ☐ Travel to the Greater Yellowstone Area to snowmobile outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to cross-country ski outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to downhill ski at Big Sky or one of the ski areas near Jackson Hole.
- ☐ Other, please describe activity _____
  location _____

24. CHOICE 3: Which do you prefer—Trip A, Trip B or "Not Visit"?

Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B or Not Visit. If you choose Trip A or Trip B, write the number of days you spend on a trip doing only that activity.

Note that we shaded the boxes that are the same for both trips. The conditions and prices described in this question may be different than what the parks are like today.

		Trip A	Trip B	Not Visit
Activity		Take a guided tour into Yellowstone on a snowcoach shuttle to cross-country ski or hike starting at the West entrance (near West Yellowstone)	Drive your car to auto-tour, cross-country ski or hike unguided in Grand Teton National Park	**I would not enter Yellowstone or Grand Teton National Parks if these were my only choices**
Conditions during day trip	**Daily snowmobile traffic at the entrance where you started**	Moderate (300 to 600 snowmobiles)	No snowmobiles in the park	
	Snowmobile traffic at most crowded part of the trip	Moderate (300 to 600 snowmobiles)	No snowmobiles in the park	
	Condition of snow on the road or trail surface for all or most of the trip	Smooth	Smooth	
	Highest noise level experienced on trip	Loud (Like a gas-powered lawn mower or a busy highway)	Low noise, occasional	
	Exhaust emission levels	Not noticeable	Not noticeable	
	Total Cost for DAY per person	$150	$75	
I would choose… (check only one)		☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ **go to Question 24b below**

24b. Answer this question if you chose "Not Visit": What would you likely do instead?

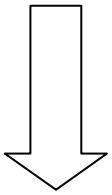
- ☐ Stay at home; I would not travel to the Greater Yellowstone Area
- ☐ Travel to the Greater Yellowstone Area to snowmobile outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to cross-country ski outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to downhill ski at Big Sky or one of the ski areas near Jackson Hole.
- ☐ Other, please describe activity _____
  location _____

25. CHOICE 4: Which do you prefer—Trip A, Trip B or "Not Visit"?

Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B or Not Visit. If you choose Trip A or Trip B, write the number of days you spend on a trip doing only that activity.

Note that we shaded the boxes that are the same for both trips. The conditions and prices described in this question may be different than what the parks are like today.

		Trip A	Trip B	Not Visit
Activity		Take an unguided snowmobile trip in Yellowstone starting at the North entrance (near Gardiner)	Take a guided tour into Yellowstone on a snowcoach shuttle to cross-country ski or hike starting at the West entrance (near West Yellowstone)	**I would not enter Yellowstone or Grand Teton National Park if these were my only choices**
Conditions during day trip	**Daily snowmobile traffic at the entrance where you started**	Low (200 or fewer snowmobiles)	Moderate (300 to 600 snowmobiles)	
	Snowmobile traffic at most crowded part of the trip	Low (200 or fewer snowmobiles)	Low (200 or fewer snowmobiles)	
	Condition of snow on the road or trail surface for all or most of the trip	Bumpy and rough	Smooth	
	Highest noise level experienced on trip	Moderate (Like a busy city street)	Low noise, occasional	
	Exhaust emission levels	Noticeable	Noticeable	
	Total Cost for DAY per person	$150	$100	
I would choose… (check only one)		☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ **go to Question 25b below**



25b. Answer this question if you chose "Not Visit": What would you likely do instead?

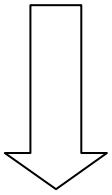
- ☐ Stay at home; I would not travel to the Greater Yellowstone Area
- ☐ Travel to the Greater Yellowstone Area to snowmobile outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to cross-country ski outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to downhill ski at Big Sky or one of the ski areas near Jackson Hole.
- ☐ Other, please describe activity _____
  location _____

26. CHOICE 5: Which do you prefer—Trip A, Trip B or "Not Visit"?

Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B or Not Visit. If you choose Trip A or Trip B, write the number of days you spend on a trip doing only that activity.

Note that we shaded the boxes that are the same for both trips. The conditions and prices described in this question may be different than what the parks are like today.

		Trip A	Trip B	Not Visit
Activity		Take a guided tour into Yellowstone on a snowcoach shuttle to cross-country ski or hike starting at the West entrance (near West Yellowstone)	Drive your car to auto-tour, cross-country ski or hike unguided in Yellowstone starting at the North entrance on the road to Cooke City (from Gardiner to Cooke City)	**I would not enter Yellowstone or Grand Teton National Park if these were my only choices**
Conditions during day trip	**Daily snowmobile traffic at the entrance where you started**	No snowmobiles in the park	Moderate (300 to 600 snowmobiles)	
	Snowmobile traffic at most crowded part of the trip	No snowmobiles in the park	Moderate (300 to 600 snowmobiles)	
	Condition of snow on the road or trail surface for all or most of the trip	Smooth	Smooth	
	Highest noise level experienced on trip	Low noise, occasional	Low noise, occasional	
	Exhaust emission levels	Not noticeable	Noticeable	
	Total Cost for DAY per person	$100	$20	
I would choose… (check only one)		☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ **go to Question 26b below**



26b. Answer this question if you chose "Not Visit": What would you likely do instead?

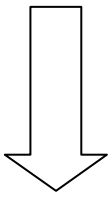
- ☐ Stay at home; I would not travel to the Greater Yellowstone Area
- ☐ Travel to the Greater Yellowstone Area to snowmobile outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to cross-country ski outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to downhill ski at Big Sky or one of the ski areas near Jackson Hole.
- ☐ Other, please describe activity _____
  location _____

27. CHOICE 6: Which do you prefer—Trip A, Trip B or "Not Visit"?

Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B or Not Visit. If you choose Trip A or Trip B, write the number of days you spend on a trip doing only that activity.

Note that we shaded the boxes that are the same for both trips. The conditions and prices described in this question may be different than what the parks are like today.

		Trip A	Trip B	Not Visit
Activity		Take an unguided snowmobile trip in Yellowstone starting from the North entrance (near Gardiner)	Drive your car to auto-tour, cross-country ski or hike unguided in Grand Teton National Park	**I would not enter Yellowstone or Grand Teton National Park if these were my only choices**
Conditions during day trip	**Daily snowmobile traffic at the entrance where you started**	Low (200 or fewer snowmobiles)	High (800 to 1,500 snowmobiles)	
	Snowmobile traffic at most crowded part of the trip	Low (200 or fewer snowmobiles)	High (800 to 1,500 snowmobiles)	
	Condition of snow on the road or trail surface for all or most of the trip	Bumpy and rough	Bumpy and rough	
	Highest noise level experienced on trip	Moderate (Like a busy city street)	Loud (Like a gas-powered lawn mower or a busy highway)	
	Exhaust emission levels	Noticeable	Very noticeable	
	Total Cost for DAY per person	$125	$35	
I would choose… (check only one box)		☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ **go to Question 27b below**



27b. Answer this question if you chose "Not Visit": What would you likely do instead?

- ☐ Stay at home; I would not travel to the Greater Yellowstone Area
- ☐ Travel to the Greater Yellowstone Area to snowmobile outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to cross-country ski outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to downhill ski at Big Sky or one of the ski areas near Jackson Hole.
- ☐ Other, please describe activity _____
  location _____

As you may know Yellowstone and Grand Teton National Parks are evaluating the way winter access to the parks is managed. The parks are making plans for next winter season, but plans in future seasons may change. The following question will help us understand how you feel about one possible management option.

One proposed winter management plan for Yellowstone or Grand Teton National Parks would be phased in over several years.

- **Set daily limits on the number of snowmobiles allowed in the park that would primarily affect the West and South entrances to Yellowstone**
  - 550 per day from the West entrance and 250 per day from the South entrance. The current daily average at the West entrance is 538 snowmobiles each day and at the South 176 each day. Visitation is higher on holidays and weekends
- **Require all snowmobiles to be equipped with 4-stroke engine technology**
- **The average cost of entering the park for you could change (your actual costs might be somewhat higher or lower):**
  - Renting a 4-stroke snowmobile would cost on average $100 per day per person
  - A park entrance fee of $35 per person
- **Snowmobile trails and access in the surrounding National Forest areas would be unchanged.**
- **Expected changes in traffic, road conditions, noise, and level of exhaust fumes as a result of this plan are**:
  - Snowmobile traffic at the most crowded parts of Yellowstone National Park would be reduced from High (800 to 1,500) to Moderate (300 to 600) on a typical Saturday
  - Road conditions on a typical Saturday would generally be bumpy from the West entrance, but smooth from all other entrances
  - Noise levels on a typical Saturday would be reduced from high to moderate
  - Level of exhaust emissions on a typical Saturday would be reduced from very noticeable to noticeable some of your trip

28. If this plan had been in effect this winter season how would your decision to make your *recent trip* to Yellowstone or Grand Teton National Park have been affected? Please check only one.

- ☐ My visit would not have been different.
- ☐ I would have stayed *fewer* days. → How many fewer days? _____
- ☐ I would have stayed *more* days. → How many more days? _____
- ☐ I would not have visited the park.

29. If this plan were in effect this winter season how would your *total visits* to Yellowstone and Grand Teton National Parks be affected? Please check only one.

- ☐ No change in total visits.
- ☐ I would visit *less* often. → I would take _____fewer annual trips
- ☐ I would visit *more* often. → I would take _____more annual trips
- ☐ I would not visit Yellowstone and Grand Teton National Parks.

The questions below will be used to calculate the economic impact of park visitors on the local communities.

30. Where did you stay on your most recent trip to the Greater Yellowstone area? The map on the cover of the survey shows the location of the cities listed. **Please check all that apply and indicate the number of nights spent in each place.**

☐	West Yellowstone	→ number of nights _____
☐	Gardiner	→ number of nights _____
☐	Jackson	→ number of nights _____
☐	Pahaska Tepee at the East Entrance to Yellowstone	→ number of nights _____
☐	Cody	→ number of nights _____
☐	Old Faithful Snowlodge in Yellowstone National Park	→ number of nights _____
☐	Mammoth Hot Springs Hotel in Yellowstone National Park	→ number of nights _____
☐	Bozeman	→ number of nights _____
☐	Big Sky	→ number of nights _____
☐	Other	→ number of nights _____

31. Please indicate how you **traveled** from your home **to the Greater Yellowstone Area on your recent visit**. **Please check all that apply.**

- ☐ Personal vehicle
- ☐ Plane
- ☐ Rental car
- ☐ Other, please specify _____

32. If you drove, what type of vehicle did you drive from your home to get to the Greater Yellowstone Area?

- ☐ Car
- ☐ Minivan
- ☐ Sport utility vehicle (SUV)
- ☐ Pick-up truck
- ☐ Recreational vehicle (RV) or motor home
- ☐ Snowmobile
- ☐ Other _____
- ☐ I did not drive

33. On your recent trip, what kind of group were you with? **Please check all that apply**:

- ☐ Alone, please go to Question 35
- ☐ With family
- ☐ With friends
- ☐ With a club or other organized group
- ☐ Other _____

34a. If you were not alone how many adults (age 18 or older) were in your group? _____

34b. If you were not alone how many children (under age 18) were in your group? _____

35. Did you share expenses with people in the group on your most recent trip?

- ☐ Yes, I shared expenses with the other people in the group
  How many people did you share expenses with? _____
- ☐ No, I paid my own expenses and no one else's.
- ☐ Someone else paid for my trip expenses.

36. Did you reserve part or all of your recent trip to the Greater Yellowstone Area as a package?

- ☐ No, I purchased services individually
- ☐ Yes, I purchased a package

  How much did the package cost per person? _____

  Please check all the items that were included in the package:

  - ❑ Lodging → number of nights _____
  - ❑ Snowmobile rental → number of days _____
  - ❑ Snowmobile guided tour → number of days _____
  - ❑ Snowcoach tour → number of days _____
  - ❑ Meals → number of meals _____
  - ❑ Park entry fees
  - ❑ Other, please indicate _____

37. On your recent trip, what was the cost just for you in each of the categories below or what was your share of the expenses? For example, if you shared a hotel room that cost $100 with one other person, your share is $50. If you did not spend any money on an item, please write 0. You do not need to repeat information about items included in a package trip from Question 36.

		My cost was
a. Lodging during my stay in the Greater Yellowstone Area	$	
b. Lodging during **travel to** the Greater Yellowstone Area	$	
c. Food/drink at restaurants or bars during my stay in the Greater Yellowstone Area	$	
d. Food/drink from grocery or convenience stores during my stay in the Greater Yellowstone Area	$	
e. Transportation (airfare, gas, etc.) to **travel to** the Greater Yellowstone Area	$	
f. Transportation in the Greater Yellowstone Area (rental vehicle or other transport including gas)	$	
g. Park entry fees	$	
h. Souvenirs or gifts	$	
i. Tour or activity fees Please describe _____	$	
j. Equipment rental Please describe _____	$	
k. Other expenses Please specify _____	$	

Finally we would like to ask a few questions about you. These questions are needed to make sure our sample is representative of all types of visitors. Your answers will be kept strictly confidential.

38. What is your home zip code? _____

39. Which of the following categories best represents your level of schooling?

- ☐ Some high school
- ☐ High school graduate
- ☐ Some college or technical school
- ☐ College graduate
- ☐ Some graduate school
- ☐ Graduate degree

40. Which of these categories best describes your household employment status? Please check all that apply.

	You	***Spouse/Partner***
Employed full time	☐	☐
Employed part time	☐	☐
Retired	☐	☐
Student	☐	☐
Full time homemaker	☐	☐
Unemployed	☐	☐
Other (please specify)	_____	_____

41. If you are currently employed, do you have the option of working additional hours to increase your total income?

- ☐ No
- ☐ Yes, at $____ per _____.

42. If you are employed, how many weeks of vacation do you get annually? _____

43. If you are currently employed and you had the opportunity to work fewer hours and receive less income or work more hours and receive more income at your current rate of pay, would you change your hours? Please indicate the appropriate response.

- ☐ I would work more hours and receive more income
- ☐ I would work less hours and receive less income
- ☐ I would not change my working time.

44. Do you belong to any of the following (check all that apply):

- ☐ Snowmobile club or association
- ☐ Cross-country ski club or association
- ☐ Environmental organization
- ☐ Civic or business organization
- ☐ Other, _____

45. Do you own any of the following (check all that apply):

- ☐ Snowmobile
  Make, model, and year _____
- ☐ Cross-country skis
- ☐ Downhill skis
- ☐ Snowshoes
- ☐ Other winter activity equipment (please list) _____

46. Marital/family status:

- ☐ Married/long term relationship
- ☐ Single
- ☐ Divorced

47. What is your age? _____ years old

48. Number of children under age 18 living at home _____

49. What is your approximate total household annual income (before taxes) in 2002?

- ☐ Under $15,000
- ☐ $15,000–$24,999
- ☐ $25,000–$34,999
- ☐ $35,000–$44,999
- ☐ $45,000–$59,999
- ☐ $60,000–$74,999
- ☐ $75,000–$99,999
- ☐ $100,000–$124,999
- ☐ Over $125,000

50. If you are currently employed, are you paid by the hour or are you paid a fixed salary? (If you are not currently employed, please skip.)

- ☐ Hourly
- ☐ Salary

51. Are you?

- ☐ Male
- ☐ Female

Thank you very much for your help. Is there anything else you would like to tell us about winter use of Yellowstone National Park or Grand Teton National Park? Please use the space below if you would like to provide any additional information. Once you are done, please mail this completed questionnaire back to us in the postage-paid return envelope. If you have any questions, you can contact us toll-free at 1-866-590-7462 or email us at yellowstone_survey@rti.org.

COMMENTS:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Thank you for taking time to complete this survey.

B.2 Alternative to Question 19: Winter Recreation Trips

We would like to ask about your cross-country skiing, snowshoeing, winter hiking, and winter camping trips during the previous winter season (December 2001–March 2002).

11. Did you cross-country ski, snowshoe, winter hike, or winter camp during the previous winter season (December 2001–March 2002)? **Please check all that apply.**

- ☐ Cross-country ski
- ☐ Snowshoe
- ☐ Winter hiking
- ☐ Winter camping
- ☐ No, I did not participate in these activities last winter—please skip to page 10.

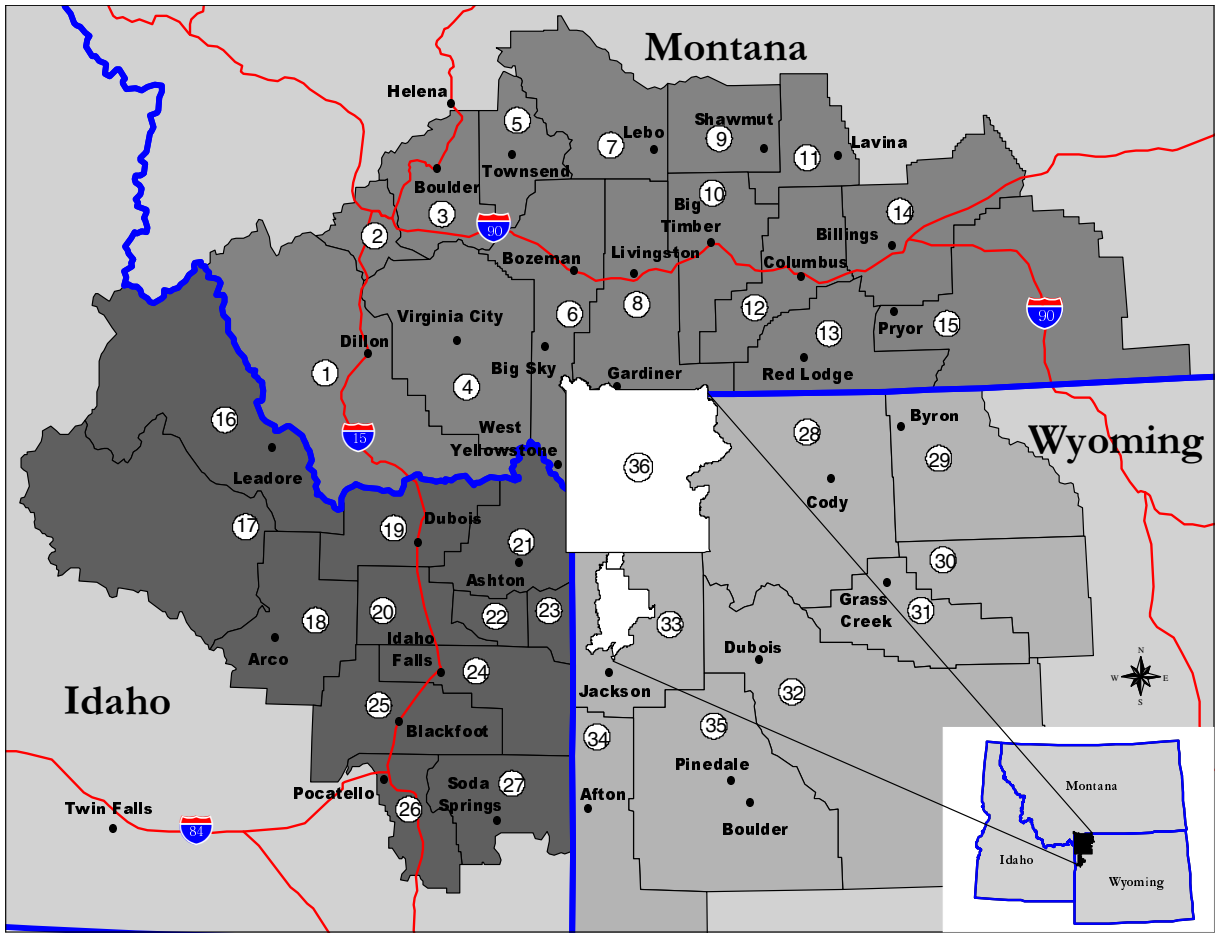
12. Looking at the map on the next page, did you make any trips in the counties in or around Yellowstone and Grand Teton National Parks during the previous winter season (December 2001–March 2002)?

- ☐ Yes—please fill out the following table using the map on the next page for reference.
- ☐ No—please skip to page 10.

Using the map and county list on the following page for reference please indicate the counties you visited and the number of trips you made in this county during the previous winter season for cross-country skiing, snowshoeing, winter hiking, and winter camping. If you visited more than one county on a trip please list the county where you spent the most time. Trips can be a day outing or a longer visit.

Counties Visited for Winter Recreation	# Trips	Total Days
(List numbers from map)		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Counties Surrounding Yellowstone and Grand Teton National Parks



Montana

1. Beaverhead
2. Silver Bow
3. Jefferson
4. Madison
5. Broadwater
6. Gallatin
7. Meagher
8. Park
9. Wheatland
10. Sweet Grass
11. Golden Valley
12. Stillwater
13. Carbon
14. Yellowstone
15. Big Horn

Idaho

16. Lemhi
17. Custer
18. Butte
19. Clark
20. Jefferson
21. Fremont
22. Madison
23. Teton
24. Bonneville
25. Bingham
26. Bannock
27. Caribou

Wyoming

28. Park
29. Big Horn
30. Washakie
31. Hot Springs
32. Fremont
33. Teton
34. Wyoming
35. Sublette
36. Yellowstone and Grand Teton National Parks

B.3: Two Alternatives to Questions 28 and 29

As you may know Yellowstone and Grand Teton National Parks are evaluating the way winter access to the parks is managed. The parks are making plans for next winter season, but plans in future seasons may change. The following question will help us understand how you feel about one possible management option.

Under one proposed management plan snowmobiles would not be allowed in either Yellowstone or Grand Teton National Parks. This plan would impact visitors as follows:

- **Snowmobiles would be prohibited.**
- **The average cost of entering the park for you could change (your actual costs might be somewhat higher or lower):**
  - A snowcoach tour would cost on average $135 per person for a full day trip
  - A park entrance fee of $35 per person
- **Snowmobile trails and access in the surrounding National Forest areas would be unchanged.**
- **Expected changes in traffic, road conditions, noise, and level of exhaust fumes as a result of this plan are:**
  - Snowmobile traffic would be eliminated
  - Road conditions would be smooth for snowcoach travel
  - Noise levels would be low
  - Level of exhaust emissions would not be noticeable

28. If this plan had been in effect this winter season how would your decision to make your *recent trip* to Yellowstone or Grand Teton National Park have been affected? Please check only one.

- ☐ My visit would not have been different.
- ☐ I would have stayed *fewer* days. → How many fewer days? _____
- ☐ I would have stayed *more* days. → How many more days? _____
- ☐ I would not have visited the park.

29. If this plan were in effect this winter season how would your *total visits* to Yellowstone and Grand Teton National Parks be affected? Please check only one.

- ☐ No change in total visits.
- ☐ I would visit *less* often. → I would take _____fewer annual trips
- ☐ I would visit *more* often. → I would take _____more annual trips
- ☐ I would not visit Yellowstone and Grand Teton National Parks.

As you may know Yellowstone and Grand Teton National Parks are evaluating the way winter access to the parks is managed. The parks are making plans for next winter season, but plans in future seasons may change. The following questions will help us understand how you feel about one possible management option.

One proposed winter management plan for Yellowstone or Grand Teton National Parks would be phased in over several years.

- **Set daily limits on the number of snowmobiles allowed in the park. The limits would primarily affect the West and South entrances to Yellowstone.**
  - New limit would be 550 snowmobiles per day from the West entrance and 250 per day from the South entrance. The current daily average at the West entrance is 538 snowmobiles each day and at the South 176 each day. Visitation is higher on holidays and weekends
- **Require all snowmobiles to be part of a guided tour in both parks.**
  - You could become a "non-commercial" guide by taking a 2 hour training course offered by the park
- **Require all snowmobiles to be equipped with 4-stroke engine technology**
- **The average cost of entering the park for you could change (your actual costs might be somewhat higher or lower):**
  - A commercially guided snowmobile trip would cost on average $135 per day per person
  - Renting a 4-stroke snowmobile would cost on average $100 per day per person
  - A park entrance fee of $35 per person
- **Snowmobile trails and access in the surrounding National Forest areas would be unchanged.**
- **Expected changes in traffic, road conditions, noise, and level of exhaust fumes as a result of this plan are:**
  - Snowmobile traffic at the most crowded parts of Yellowstone National Park would be reduced from High (800 to 1,500) to Moderate (300 to 600) on a typical Saturday
  - Road conditions on a typical Saturday would generally be bumpy from the West entrance, but smooth from all other entrances
  - Noise levels on a typical Saturday would be reduced from high to moderate
  - Level of exhaust emissions on a typical Saturday would be reduced from very noticeable to noticeable for some of the trip

28. If this plan had been in effect this winter season how would your decision to make your *recent trip* to Yellowstone or Grand Teton National Park have been affected? Please check only one.

- ☐ My visit would not have been different.
- ☐ I would have stayed *fewer* days. → How many fewer days? _____
- ☐ I would have stayed *more* days. → How many more days? _____
- ☐ I would not have visited the park.

29. If this plan were in effect this winter season how would your *total visits* to Yellowstone and Grand Teton National Parks be affected? Please check only one.

- ☐ No change in total visits.
- ☐ I would visit *less* often. → I would take _____fewer annual trips
- ☐ I would visit *more* often. → I would take _____more annual trips
- ☐ I would not visit Yellowstone and Grand Teton National Parks.

Appendix C: Statistical Analysis Weights for the Survey of Winter 2002–2003 Visitors to Yellowstone National Park

STATISTICAL ANALYSIS WEIGHTS FOR THE SURVEY OF WINTER 2002–2003[1] VISITORS TO YELLOWSTONE NATIONAL PARK

C.1 Person-Day Design Weights

Let r = 1,2,3,4 represent the entrances (N,S,E,W)

Let s = 1,2,3 represent weekdays, weekends, and holidays

Let t = 1,2 represent snowmobile and nonsnowmobile queues

Let i = 1,2,…, $M(r,s,t)$ represent the dates the r-th entrance was open within stratum (s,t)

Let $\pi_i(r,s,t)$ = probability of selection of day i within stratum (r,s,t)

Let j = 1,2,…, $N_i(r,s,t)$ represent the visitors aged 18 or older entering the park on day i in stratum (r,s,t)

Let $\pi_{j|i}(r,s,t)$ = probability of selection of visitor j within stratum (r,s,t), given that day i was selected

The design weight for the j-th visitor on day i in stratum (r,s,t) is the reciprocal of the overall probability of selection for the (i,j)-th person-day.

$$W_1(i,j|r,s,t) = \frac{1}{\pi_i(r,s,t)\,\pi_{j|i}(r,s,t)}$$

C.2 Multiplicity Adjustment to Produce Person-Level Weights

Let $m(i,j|r,s,t)$ = reported number of days that person j entered (or planned to enter) the park during the winter 2002–2003 season.

Let $\bar{m}(r,s,t) = \frac{1}{m(r,s,t)} \sum_{i=1}^{M(r,s,t)} \sum_{j=1}^{N_i(r,s,t)} m(i,j|r,s,t)\; I_R(i,j|r,s,t)$

[1]The winter season was defined to be:
North Entrance: January 5, 2003 – March 2, 2003
East Entrance: December 28, 2002 – March 2, 2003
South Entrance: December 18, 2002 – March 2, 2003
West Entrance: December 28, 2002 – March 3, 2003

where $I_R(i, j|r,s,t) = \begin{cases} 1 \text{ if person j is a respondent on day i} \\ 0 \text{ otherwise} \end{cases}$

and $m(r,s,t) = \sum_{i=1}^{M(r,s)} \sum_{j=1}^{N_i(r,s,t)} I_R(i, j|r,s,t)$

= number of stratum (r,s,t) respondents

Then, the multiplicity adjustment for the j-th sample member is

$$W_2(i, j|r,s,t) = \begin{cases} \dfrac{1}{m(i, j|r,s,t)} & \text{if person j is a respondent on day i} \\ \dfrac{1}{\bar{m}(r,s,t)} & \text{otherwise } [2] \end{cases}$$

The person-level design weight for the j-th sample members, adjusted for multiplicity, is then

$$W_3(i, j|r,s,t) = W_1(i, j|r,s,t)\, W_2(i, j|r,s,t)$$

C.3 Weighting Class Adjustment for Nonresponse

If there were at least 50 respondents within each stratum (r,s,t) at the end of data collection, we could have used them as weighting classes. Instead, we collapsed strata over type of day, "s," to form six weighting classes because the three different types of day had comparable response rates.

Let c=1,2,…, C represent the weighting classes.

The weighting class adjustment for nonresponse for all members of weighting class c is the following for the person-level weights:

$$W_4(c) = \frac{\sum_{j \varepsilon c} W_3(i, j|r,s,t)}{\sum_{j \varepsilon c} W_3(i, j|r,s,t)\, I_R(i, j|r,s,t)}$$

The adjusted weight for the k-th sample member is then

$$W_5(i, j|r,s,t) = W_3(i, j|r,s,t)\, W_4(c)\, I_R(i, j|r,s,t)$$

so that

[2] These averages were computed for the 18 unique, nonmissing levels of (r,s,t).

$$\sum_{j \varepsilon c} W_5(i, j|r, s, t) = \sum_{j \varepsilon c} W_3(i, j|r, s, t)$$

In addition, W_1 was used in place of W_3 above to produce an adjustment factor, W_{4A}, for the person-day weights. The person-day weight adjusted for nonresponse is

$$W_{5A}(i, j|r, s, t) = W_1(i, j|r, s, t)\, W_{4A}(c)\, I_R\,(i, j|r, s, t)$$

C.4 Poststratification Adjustment

Let $\mathrm{P}\,(r, s, t)$ represent the Park Service count of all visitors who entered the park during the winter 2002–2003 season through stratum (r, s, t). This count includes visitors under age 18 (who do not belong to the study population) and counts people each time they enter the park.

Two survey estimates of the number of entrances to the park by people age 18 or older during the winter 2002–2003 season through stratum (r, s, t) are given by

$$\sum_i \sum_j W_5(i, j|r, s, t)\, m(i, j|r, s, t)$$

and

$$\sum_i \sum_j W_{5A}(i, j|r, s, t)$$

These estimates should be uniformly smaller than the corresponding Park Service counts. If $\hat{P}_{18}$ is an estimate of the proportion of winter visitors who are 18 years of age or older, the ratio of the survey estimates to the Park Service estimates should be about this proportion. Hence, we reviewed those ratios:

$$\hat{P}_{18}(r, s, t) = \frac{\sum_i \sum_j W_5(i, j|r, s, t)\, m(i, j|r, s, t)}{P(r, s, t)}$$

and

$$\hat{P}_{18A}(r, s, t) = \frac{\sum_i \sum_j W_{5A}(i, j|r, s, t)}{P(r, s, t)}$$

If we ignore the fact that the Park Service counts include ineligible people (those under age 18), the post-stratification adjustment factors are

$$W_6(r,s,t) = \frac{P(r,s,t)}{\sum_i \sum_j W_5(i,j|r,s,t)\ m(i,j|r,s,t)}$$

$$W_{6A}(r,s,t) = \frac{P(r,s,t)}{\sum_i \sum_j W_{5A}(i,j|r,s,t)}$$

for the person-level and person-day-level weights, respectively.

So, the post-stratified person-level and person-day-level weights are, respectively

$$W_7(i,j|r,s,t) = W_5(i,j|r,s,t)\, W_6(r,s,t)$$

and

$$W_{7A}(i,j|r,s,t) = W_{5A}(i,j|r,s,t)\, W_{6A}(r,s,t)$$

Appendix 2: Social Benefits and Costs of Snowmobiling Restrictions

The purpose of benefit-cost analysis is to evaluate the social welfare implications of a proposed action—in this case, the regulation of snowmobile use in national parks. That is, it assesses whether the action imposes costs on society (losses in social welfare) that are less than the benefits (gains in social welfare). The following sections provide a description of the range of social benefits and social costs that may result from snowmobiling restrictions, the ways in which these benefits and costs can be conceptualized and measured, and a discussion of the economics literature estimating the monetary value of these benefits.

2.1 SOCIAL BENEFITS OF SNOWMOBILING RESTRICTIONS

Snowmobiling in national parks may be associated with a number of negative impacts on environmental resources and ecosystems. One result of any negative impacts that occur is that they impose welfare losses on individuals who value the parks' environmental resources. The benefits of snowmobiling restrictions can therefore be thought of and measured as the reduction in these losses to society. In addition, snowmobiling

may negatively affect society in ways that are not directly related to the environment; therefore, the benefits of snowmobiling restrictions must also include reductions in these nonenvironmental losses. Potential natural resource impacts are discussed in detail in Section 2.7. Both broad categories of benefits—environmental and nonenvironmental—are discussed in more detail below.

2.1.1 Environmental Benefits

The use of snowmobiles may have adverse impacts on the aesthetic qualities of the park, on human health, and on the park's ecosystems. The benefits associated with avoiding these impacts are described below.

Aesthetic Benefits

Among the largest and most directly damaging impacts associated with snowmobile use in national parks are its effects on the aesthetic qualities of park air and specifically the park soundscape. The natural soundscape is considered a natural resource of the park, and NPS attempts to prevent or minimize unnatural sounds that adversely affect the natural soundscape. National parks are especially valued for their pristine and undisturbed environments, which are often experienced by visitors through natural vistas and through the relative absence of visible or audible human activity (NPS, 2000b). The improvement or preservation of these aesthetic qualities, either in the form of reduced noise pollution or improved visibility, is therefore a potentially important source of benefits from reducing snowmobile use.

Noise Reduction. Perhaps the most noticeable and intrusive aspect of snowmobiles is the level of sound they emit during normal operation. Section 2.7 discusses the potential for noise-related disamenities as a result of snowmobile use. Those who are most likely to benefit from reductions in snowmobile-related noise pollution in national parks are other park visitors and recreators, in particular those engaged in other winter recreational activities inside the park, such as cross-country skiers, snowshoers, snowcoach passengers, or winter hikers.

Several studies have shown that noise from motorized vehicles diminishes the recreational experience of other users. Jackson

and Wong (1982) and others have specifically documented conflicts between cross-country skiers and snowmobilers; noise levels are an important contributor to this conflict (Irwin, 1973; Knopp and Tyger, 1973; Lucas, 1964; Stankey, 1973). Several other studies have found similar types of disamenities associated with other forms of mechanized recreational activities or other "technology-related" noises in recreation areas (Beal, 1994; Ivy, Stewart, and Lue, 1992; Bury and Luckenbach, 1983; Baldwin, 1970; Bury, Wendling, and McCool, 1976; Dunn, 1970; Lucas and Stankey, 1974; O'Riordan, 1977; Sheridan, 1979; Wagar, 1977).

Relatively few studies have specifically estimated the (negative) value of noise externalities on other recreators. One exception is a recent analysis conducted by the Federal Aviation Administration (FAA) to estimate the benefits of a regulation to restrict commercial air tours in Grand Canyon National Park (GCNP) (FAA, 2000). Using visitor-day value estimates from existing studies ranging from $37 to $92 (for backcountry, river, and other users of the park), the analysis assumed that these visitor day values would be reduced in relation to the how much aircraft noise interfered with the enjoyment of GCNP. Information about how aircraft noise affected different recreators was provided by a separate survey study of GCNP visitors. The survey found, for example, that for backcountry visitors 21 percent were "slightly" affected and 2.5 percent were "extremely" affected by the aircraft noise. In the FAA analysis, visitor value-days were assumed to be reduced by 20 to 80 percent depending on the percentage of respondents who indicated that their enjoyment of the park was "slightly," "moderately," "very," or "extremely" affected by the noise.

Another example of such a study is one that has examined the losses that personal watercraft (jet ski) users impose on other beach recreators (Komanoff and Shaw, 2000). This study assumed that an average beach day (per person) is worth between $10 for a popular beach and $30 for a secluded one and that each 10 dB increase in background noise decreases these values by 10 percent. Assuming also that each 1 dB noise level increment reduces the value of a beach day by 1 percent, the study found that beachgoers suffer an average

loss in recreation value of between $0.50 and $7.40 per jet ski cluster (1.6 jet skis over the course of a day) per person per day.

These values from these two studies are not directly transferable to the case of snowmobiles; nevertheless, they provide a useful point of reference for gauging noise-related losses for other winter recreators.

Other evidence regarding the noise-related losses imposed by snowmobiles can be gleaned from studies that have examined the effects of congestion on recreation values. In these studies, congestion is often measured as the number of encounters with other recreators, which may be thought of as being roughly equivalent to hearing the sound of snowmobiling. For example, in a study of backcountry recreators in the Caribou-Speckkled Mountain Wilderness in Maine, Michael and Reiling (1997) found that weekend visitors experienced losses of $22.3 (in 1990 dollars) per visit if they encountered more groups than expected. An older study of winter recreators (cross-country skiers and mountaineers) in the High Peaks area of the Adirondack Mountains found that each unit increase in the number of expected encounters decreased individuals' recreation value (per trip willingness to pay [WTP]) by 14 percent (Menz and Mullen, 1981).

Visibility Improvements. Several studies by NPS and others have demonstrated the importance of visual air quality for visitors' (and nonvisitors') enjoyment and appreciation of national parks. Emissions from snowmobiles in these parks are one of many potential (albeit, a relatively small) sources of these visibility impairments.

Several studies have investigated U.S. households' values for improvements in visibility at various national parks across the country. All of these studies have found a significant WTP by both users and nonusers for visibility improvements. A meta-analysis of visibility studies at national parks (Smith and Osborne, 1996) found values ranging from $5.52 to $111.24 (in 1990 dollars) per household per year for visibility improvements. The variation in these values arises largely due

to differences in study methodology, study area, and the proportionate change in visibility being valued.

Human Health Benefits

In addition to NO_X and PM, snowmobile emissions typically contain a number of other pollutants. Restrictions on snowmobile use in national parks are expected to reduce harmful exposures to park visitors and workers, particularly for individuals who spend extended periods in high-use areas. The benefits of these restrictions can be expressed as the value of reductions in the incidence (i.e., the number of cases avoided) of harmful health effects. As mentioned in Section 2.7, the total number of avoided health effects is not known; however, using information from a recent EPA study of the benefits of air pollution regulations (EPA, 1997), Table 2-1 provides a summary of "unit" values for selected health effects. Based on a review and synthesis of several health valuation studies, these values represent best estimates of individuals' average WTP to avoid a single case of the health effect. In the absence of more complete information on the total health benefits of reducing snowmobile use, these values provide a rough sense of the magnitude and relative size of the benefits associated with avoiding specific health effects that may result from acute exposures.

Table 2-1. Unit Values for Selected Health Effects

Health Effect	Unit Value (mean estimate) (1999$)[a]
Acute Bronchitis	$57
Acute Asthma	$41
Acute Respiratory Symptoms	$23
Shortness of Breath (one day)	$6.8

[a]All amounts inflated using the consumer price index available from the Bureau of Labor Statistics (<http://146.142.4.24/cgi-bin/surveymost>).

Ecosystem Protection Benefits

As illustrated in Figure 3-2, snowmobile use can cause damage to park ecosystems through a variety of media and pathways. As described above, snowmobile use leads to increased noise and air pollutant emissions. Noise may disrupt wildlife use

patterns and terrestrial habitat may be disturbed, particularly when snowmobiles trespass off of the designated trails into areas with sensitive habitat. In addition, emissions deposited in the snowpack may migrate into the park's water resources and, if present in high enough concentrations, they may adversely affect aquatic ecosystems. To the extent that these types of damages to park ecosystems occur, their cumulative effect is to reduce the "ecological services" that these systems provide to individuals and households across the country. National park ecosystems are particularly valued for their unique biological, cultural, and geological resources and the recreational and other services they provide.

A vast majority of park visitors (i.e., users) experience and enjoy the natural systems of the park through a wide variety of recreational activities (wildlife viewing, hiking, skiing, as well as snowmobiling). However, even individuals who are not park visitors (i.e., nonusers) can benefit from the knowledge that park resources are being protected and preserved. These nonuse values can stem from the desire to ensure others' enjoyment (both current and future generations) or from a sense that these resources have some intrinsic value. Evidence of such nonuse values for the protection of unique species and ecosystems has been documented in numerous studies (see e.g., Pearce and Moran [1994] for a review of such studies). Restrictions on snowmobile use in national parks can therefore provide benefits to both users and nonusers in a number of ways by protecting the parks' ecological resources.

2.1.2 Nonenvironmental Benefits

Restrictions on snowmobile use in national parks can also improve societal welfare in ways that are not directly related to environmental quality in and around the parks. These potential nonenvironmental benefits are described below.

Public Safety Benefits

As with many forms of motorized recreation, snowmobiling can involve increased risks to personal safety, both for snowmobile users and for others. According to the Consumer Product Safety Commission, the most common types of injuries nationwide involve being thrown or flipped from a snowmobile

or striking a stationary object (Rice, Alvanos, and Kenney, 2000). Excessive speed and/or alcohol use are often contributing factors to these incidents. Recent statistics have also shown that snowmobiling has grown to be the most common cause of avalanche fatalities in the United States (Colorado Avalanche Information Center, 2000).

Aggregate statistics for snowmobile accidents are not available, but, as one would expect, in parks such as YNP, where snowmobile use has increased over the last decade, the number of incidents has also increased. In fiscal year 1998, snowmobilers comprised 2 percent of the year's total visitation, but were involved in 9 percent of that year's motor vehicle accidents (NPS, 2002). From December through March 1995–2001, 154 individuals required emergency medical assistance related to snowmobile activities (NPS, 2002).

Restrictions on snowmobiles in national parks would certainly reduce the number of such incidents in the parks.[1] The primary beneficiaries would be the snowmobilers themselves, whose safety would be protected; however, these benefits may be implicitly accounted for in the consumer surplus changes (see Section 2.2) that these recreators experience as a result of the restrictions.[2] Other winter recreators (nonsnowmobilers) might also benefit if they would otherwise be at risk of being involved in accidents with snowmobiles. In addition, snowmobile accidents can impose costs on NPS and other state and local government agencies that are responsible for providing medical, rescue, and related assistance. Reductions in snowmobile accidents in national parks would therefore allow some of the resources devoted to these activities to be diverted to other publicly beneficial uses.

Avoided Infrastructure Costs

Allowing snowmobiles in national parks requires NPS to develop, maintain, and operate an infrastructure to support

[1]The benefits of these reductions may be offset to some degree by increased snowmobile usage and accidents in areas outside the parks.

[2]To the extent that snowmobilers are aware of the safety risks they face, the potential losses to themselves from accidents should already be factored into their consumer surplus from snowmobiling. This implies that the safety benefits to these individuals from reducing snowmobile use are implicitly accounted for (i.e., deducted from) the consumer surplus losses to these recreators.

these activities. In particular, snowmobile trails must be designated, maintained, and monitored. The costs associated with these activities vary widely across parks, depending on the physical characteristics of the parks and the level of snowmobile use permitted.

By restricting snowmobile use, some of these infrastructure-related costs can be avoided or reduced. As a result, some of the resources devoted to these activities can also be diverted to other publicly beneficial uses.

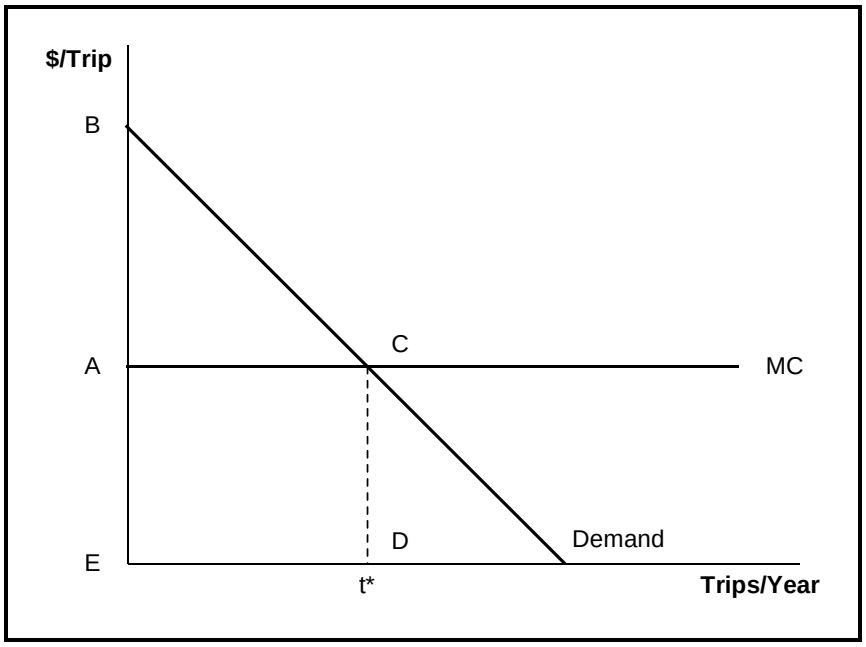
2.2 SOCIAL COSTS OF SNOWMOBILING RESTRICTIONS

The primary losses associated with snowmobiling restrictions in national parks will accrue to:

- snowmobilers, in particular individuals who will not snowmobile in the park as a direct result of the restrictions, and
- providers of snowmobile-related services for park visitors.

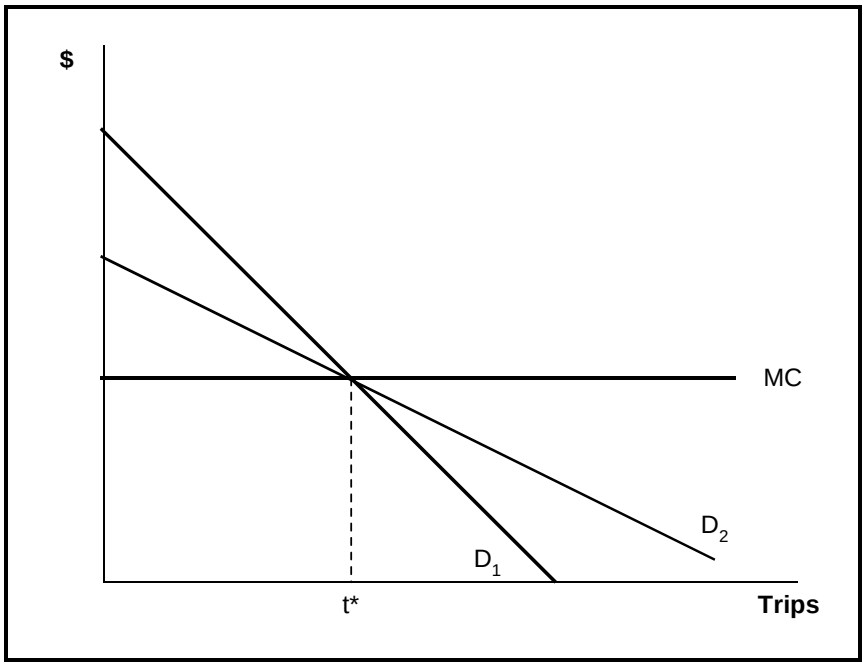
The welfare losses to individual consumers (snowmobile riders) are measured by their loss in consumer surplus. Consumer surplus is measured as the difference between the total cost of a product or activity to the consumer and the total amount the individual would be willing to pay for that activity. In the context of recreation activities, Figure 2-1 depicts an individual demand curve for snowmobile trips, the marginal cost of a trip (MC, assumed to be constant), and the optimal number of trips per year, t*. The triangle ABC measures the consumer surplus associated with this optimal number of trips—the difference between what the individual paid for the trips, ACDE, and the total WTP for the trips (the area underneath the demand curve), EBCD.

Figure 2-1. Consumer Surplus



The extent of the welfare loss to an individual rider depends crucially on the availability of substitute activities. Figure 2-2 depicts two alternative demand curves for snowmobile trips to a particular trail. The slope of the demand curve reflects the number of substitute activities available to a particular individual and the preferences of that individual toward those substitutes. The flatter demand curve, D_2, indicates that this individual has a variety of close substitutes for riding on the trail (these substitutes could include snowmobile riding on a different trail or participating in a different activity such as cross-country skiing). The individual with the steeper demand curve, D_1, has fewer substitute activities he/she enjoys as much as snowmobiling on this trail. If both individuals choose the same number of trips, as in Figure 2-2, the person with the steeper demand curve, D_1 (fewer substitutes for snowmobiling) receives greater consumer surplus from riding on the trail and thus will experience a greater loss in welfare if the trail is closed.

Figure 2-2. Consumer Surplus and Substitute Activities



In addition to the study conducted in the GYA by Duffield and Neher (2000), several additional studies that measure the consumer surplus associated with a day of snowmobile riding were identified. Walsh, Johnson, and McKean (1988) reviewed all types of outdoor recreation demand and found studies of snowmobiling by Keith et al. (1978) and Keith (1980). A later meta-analysis produced by Rosenberger and Loomis (2000) reports the value from one additional study by May et al. (1997) in which the values come from her Master's thesis. Based on the May thesis findings, Coupal et al. (1999) present data from snowmobile owners in Wyoming. Using the travel cost method, they estimated the average consumer surplus associated with the riders' self-defined favorite areas. The regression accounted for the travel cost and quality of the next best area as defined by each respondent. From the regression, the authors generated an average consumer surplus value of $68 per trip (in 1996 dollars). The authors calculated average consumer surplus per day by dividing the $68 consumer surplus per trip by the average length of a trip in their sample (1.57 days). Average consumer surplus per day was $43 (in 1996 dollars), but consumer surplus per day ranged from $12 to $49

for subsamples representing individuals with different motivations for snowmobiling.

The change in welfare for businesses is measured by producer surplus, or the area AP*B in Figure 2-3, where P* is the market price of the good (e.g., a snowmobile rental). Producer surplus measures the difference between total revenue and the minimum revenue required for the firm to be willing to supply the product (integral of the area under the supply curve up to r'). If the firms face an upward-sloping marginal cost (MC) curve, then a decrease in demand, indicated in Figure 2-4 by a shift from D to D', will result in lower producer surplus for snowmobile rental companies.

If snowmobile riding decreases as a result of the regulation, then the suppliers of snowmobile and other tourism-related services will be adversely affected, including rentals and sales of snowmobiles and snowmobile accessories, lodging, meals, and other tourism-related expenditures. If demand for other types of winter activities (e.g., cross-country skiing) increases, then some businesses may experience an offsetting increase in producer surplus.

Figure 2-3. Producer Surplus

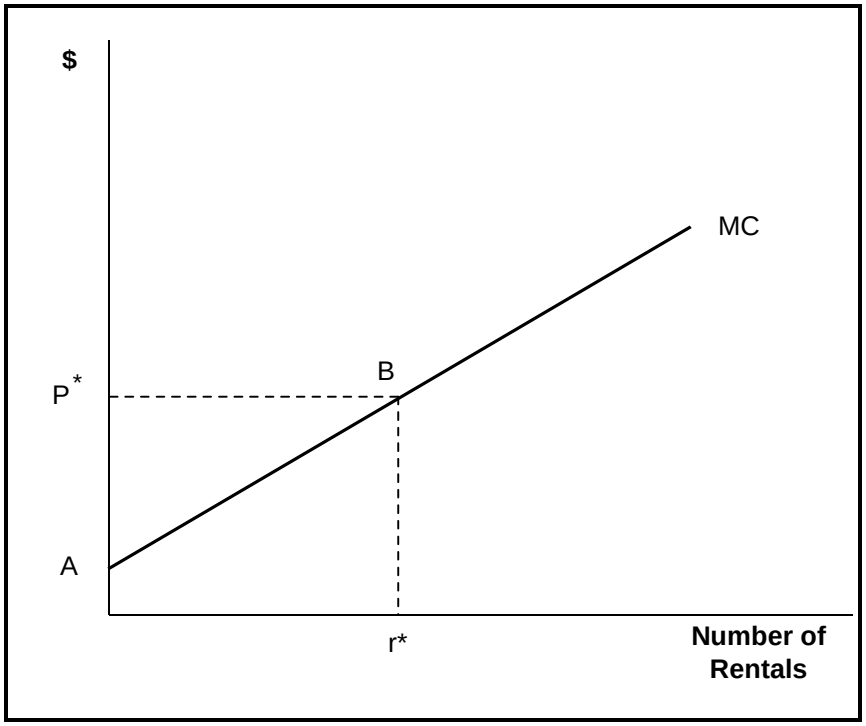


Figure 2-4. Producer Surplus and a Change in Demand