September 2007

Economic Analysis of Winter Use Regulations in the Greater Yellowstone Area

Final Report

Prepared for

National Park Service
Environmental Quality Division
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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 issued a temporary winter use rule in place until 2006-2007. The NPS is now proposing a new rule for 2007 and after. 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).

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 was completed for GYA (NPS, 1990). 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. For the winters of 2004–2005 through 2006–2007, a temporary rule allowed snowcoach access and guided snowmobile access but at reduced levels from previous years.

This report describes the results of an analysis of the economic impacts of seven winter use alternatives for regulating snowmobile use in the GYA starting in the winter of 2007–2008. 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.

The quantitative results of the benefit-cost analysis are summarized in Section 3.3 for the Alternative 3b baseline. It is important to note that this analysis could not account for all costs or benefits because of 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.

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 1, 2, 3a, 4, 5, 6, and 7 relative to the Alternative 3b baseline. Section 4 provides an analysis of the impacts of the alternatives on small businesses relative to the baseline alternative.

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, 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.

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 has remained banned from the parks since 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 effective management of the winter use program. The

temporary winter use alternatives were 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.

The new alternatives under consideration are similar to the alternatives considered for the temporary rule, except that Alternatives 3a and 6 restrict snowmobiles and snowcoaches to the South Entrance; the East Entrance is closed under Alternatives 1, 2, 3a, 6, and 7; and Alternative 6 allows for commercial wheeled vehicles on plowed roads between Mammoth to the West Entrance to Old Faithful.

1.3 CURRENT SNOWMOBILE REGULATIONS

The temporary winter use rule described above governed visitation for the winter of 2006–2007. In the 2007–2008 winter season, all oversnow vehicles will be banned in the three parks in the absence of a new rule. Therefore, Alternative 3b, which bans oversnow vehicles, is the no-action baseline for this analysis.

1.4 PROPOSED REGULATIONS

NPS considered seven snowmobile management alternatives for GYA plus the no-action alternative. Table 1-1 outlines all eight alternatives.

In YNP, Alternative 1 represents current conditions under the temporary winter use rule with some small exceptions, including closing the East Entrance. Alternative 2 prohibits snowmobile access but allows for snowcoaches, while leaving the East Entrance closed. Alternative 3a allows guided snowmobile and snowcoach use, but only through the South Entrance. The no-action alternative banning all oversnow travel is Alternative 3b. The other four alternatives allow snowmobile and snowcoach use subject to daily entrance limits and with some guided tour requirements. Alternatives 4 and 5 allow for 25% and 20% unguided or noncommercially guided use, respectively, along with snowcoach use. Alternative 6 allows for another winter use of YNP—commercially guided wheeled vehicle use through the West Entrance, which would be plowed

Table 1-1. Yellowstone and Grand Teton National Park Winter Use Plans, November 2006

	Highlights	Road Grooming	Yellowstone Snowmobile Entry Limits	Yellowstone Daily Snowcoach Entry Limits	Grand Teton Snowmobile Entry Limits	Snowmobile Guiding Requirements
Alternative 1: Current Plan (Preferred Alternative)	Allows for nearly historic levels of snowmobile use but requires commercial guides. This alternative mimics the temporary winter use plan currently in place, with three primary changes: 1) snowcoaches must meet BAT standards, 2) daily limit on snowcoaches, and 3) Sylvan Pass would be closed to through travel.	Continue road grooming, except Sylvan Pass would be closed.	720 snowmobiles per day West: 424 South: 256 North: 20 East: 0 Old Faithful: 20 Cave Falls Road: 50 snowmobiles (no BAT or guiding)	78 snowcoaches per day West: 34 South: 13 North: 13 East: 0 Old Faithful/ Parkwide: 18	Grassy Lake Rd: 50 CDST: 50 Jackson Lake: 40	100% commercially guided in YNP GTNP and Parkway: guides allowed but not required
Alternative 2: Snowcoaches Only	Emphasizes snowcoach access; prohibits recreational snowmobiling. Road grooming would continue. Sylvan Pass would be closed to through travel.	Continue road grooming, except Sylvan Pass would be closed.	Snowmobiles prohibited Cave Falls Road closed to snowmobiles	120 snowcoaches per day West: 55 South: 25 North: 17 East: 0 Old Faithful/ Parkwide: 23 All meet snowcoach BAT	Snowmobiles prohibited	N/A
Alternative 3a: Eliminate Most Road Grooming **3b: No Oversnow Vehicles (no action)**	3A: Prohibits road grooming or packing on most road segments in YNP. The road from the South Entrance to Old Faithful would be the only oversnow motorized access route in Yellowstone. 3B: Recreational oversnow vehicle access would cease in all three parks.	3A: Only groom South Entrance to Old Faithful. All other segments ungroomed and closed to all travel. 3B: No roads groomed for recreational access.	3A: South: 250 snowmobiles per day Cave Falls Road closed to snowmobiles 3B: No recreational motorized oversnow access	3A: South: 20 All meet snowcoach BAT 3B: 0	3A: Grassy Lake Road: 50 CDST: Closed Jackson Lake: Closed 3B: No recreational oversnow vehicle access	3A: YNP: 100% commercially guided GTNP and Parkway: guides allowed but not required 3B: No recreational oversnow vehicle access.

(continued)

Table 1-1. Yellowstone and Grand Teton National Park Winter Use Plans, November 2006 (continued)

	Highlights	Road Grooming	Yellowstone Snowmobile Entry Limits	Yellowstone Daily Snowcoach Entry Limits	Grand Teton Snowmobile Entry Limits	Snowmobile Guiding Requirements
Alternative 4: Enhanced Recreational Use	Allows for increased snowmobile use, relative to historic numbers. Commercial guides would be required for most snowmobilers; some could also visit the park after completing guide training course for noncommercially guided trips or unguided trips.	Continue road grooming.	1,025 snowmobiles per day West: 600 South: 250 North: 25 East: 100 Old Faithful: 50 Cave Falls Road: 75 snowmobiles (no BAT or guiding)	115 snowcoaches per day West: 46 South: 15 North: 5 East: 4 Old Faithful/ Parkwide: 35 Private: 10 All meet snowcoach BAT	250 snowmobiles per day Grassy Lake Road: 75 CDST: 75 Jackson Lake: 100	YNP: 75% commercially guided; 25% either unguided or noncommercially guided GTNP and Parkway: CDST: 50 commercially guided; 25 unguided Jackson Lake and Grassy Lake Road: unguided
Alternative 5: Provide for Unguided Access	Balances snowmobile and snowcoach access and accommodates some visitors who wish to have an unguided snowmobile experience. Features a seasonal limit as well as a flexible daily limit.	Continue road grooming.	540 snowmobiles per day West: 290 South: 145 East: 40 North: 40 Old Faithful: 25 Cave Falls Road: 50 snowmobiles (no BAT or guiding) Seasonal entry limit would be put in place.	83 snowcoaches per day West: 34 South: 10 North: 3 East: 2 Old Faithful/ Parkwide: 34 All meet snowcoach BAT Seasonal entry limit	140 snowmobiles per day Grassy Lake Road: 50 CDST: 50 Jackson Lake: 40	YNP: 80% commercially guided 20% unguided, with brief training Unguided snowmobiles would be required to enter YNP prior to 10:30 a.m. GTNP and Parkway: guides allowed but not required

(continued)

Table 1-1. Yellowstone and Grand Teton National Park Winter Use Plans, November 2006 (continued)

	Highlights	Road Grooming	Yellowstone Snowmobile Entry Limits	Yellowstone Daily Snowcoach Entry Limits	Grand Teton Snowmobile Entry Limits	Snowmobile Guiding Requirements
Alternative 6: Mixed Use	Emphasizes plowing Yellowstone's mid-elevation, west-side roads to allow wheeled commercial vehicle access. Continue to allow oversnow vehicle access through the South Entrance and on the east side of the park. Sylvan Pass would be closed to through travel.	Plow Mammoth to the West Entrance to Old Faithful. Groom Old Faithful to South Entrance to Lake to Canyon to Norris. Sylvan Pass would be closed to recreational oversnow access.	350 snowmobiles per day South: 250 Old Faithful/Norris: 100 100 commercial wheeled vehicles Cave Falls Road: 50 snowmobiles (no BAT or guiding)	40 snowcoaches per day South: 10 Old Faithful/Norris: 30 All meet snowcoach BAT 100 wheeled commercial vehicles on west side	Grassy Lake Rd: 50 CDST: Closed Jackson Lake: 40	100% commercially guided for both oversnow and wheeled vehicles GTNP and Parkway: guides allowed but not required
Alternative 7: Revised Preferred Alternative	Combines elements of Alternatives 1, 5, and others to balance snowmobile and snowcoach access. Protects park soundscapes better by reducing snowmobile numbers; protects wildlife better and enhances visitor experience by retaining 100% commercial guiding; and improves employee and visitor health and safety by closing Sylvan Pass to motorized travel.	Continue road grooming, except Sylvan Pass would be closed beginning in 2009. The Madison to Norris road may be closed, depending on the bison-road experiment.	540 snowmobiles per day West: 300 South: 185 North: 35 East: 0 Old Faithful: 20 Cave Falls Road: 50 (no BAT or guiding)	83 snowcoaches per day West: 37 South: 12 North: 15 East: 0 Old Faithful/ Parkwide: 19 All must meet snowcoach BAT	65 snowmobiles per day Grassy Lake Road: 25, non BAT CDST: Converted to trailered route Jackson Lake: 40	YNP: 100% commercially guided GTNP and Parkway: Guides allowed, but not required

from Mammoth to the West Entrance to Old Faithful. Guided snowmobile and snowcoach use would be allowed out of the South Entrance and from Old Faithful and Norris.

In GTNP, Alternatives 1, 3, 5, and 6 allow for all snowmobiles to ride unguided up to varying daily caps. Alternative 4 allows a mixture of guided and unguided snowmobiles, while Alternative 2 bans snowmobiles. Under Alternatives 1, 4, and 5, Grassy Lake Road, the Continental Divide Snowmobile Trail (CDST), and Jackson Lake remain open for snowmobiles. Only Grassy Lake Road is open under Alternative 3a, while Alternative 6 allows snowmobiles on Grassy Lake Road and Jackson Lake.

NPS selected Alternative 7 as the preferred alternative. Alternative 7 combines aspects of several of the other alternatives, especially Alternatives 1 and 5. In YNP, snowmobiles must be on guided tours, as in Alternative 1. The total daily limit for snowmobiles is the same as Alternative 5, although the limit is distributed differently across the entrances and the East Entrance is closed to snowmobiles. In GTNP, the CDST will no longer be maintained, and snowmobiles traveling the trail must be trailered across it. With the closing of the CDST in GTNP, the daily limit on snowmobiles is lower than the other alternatives.

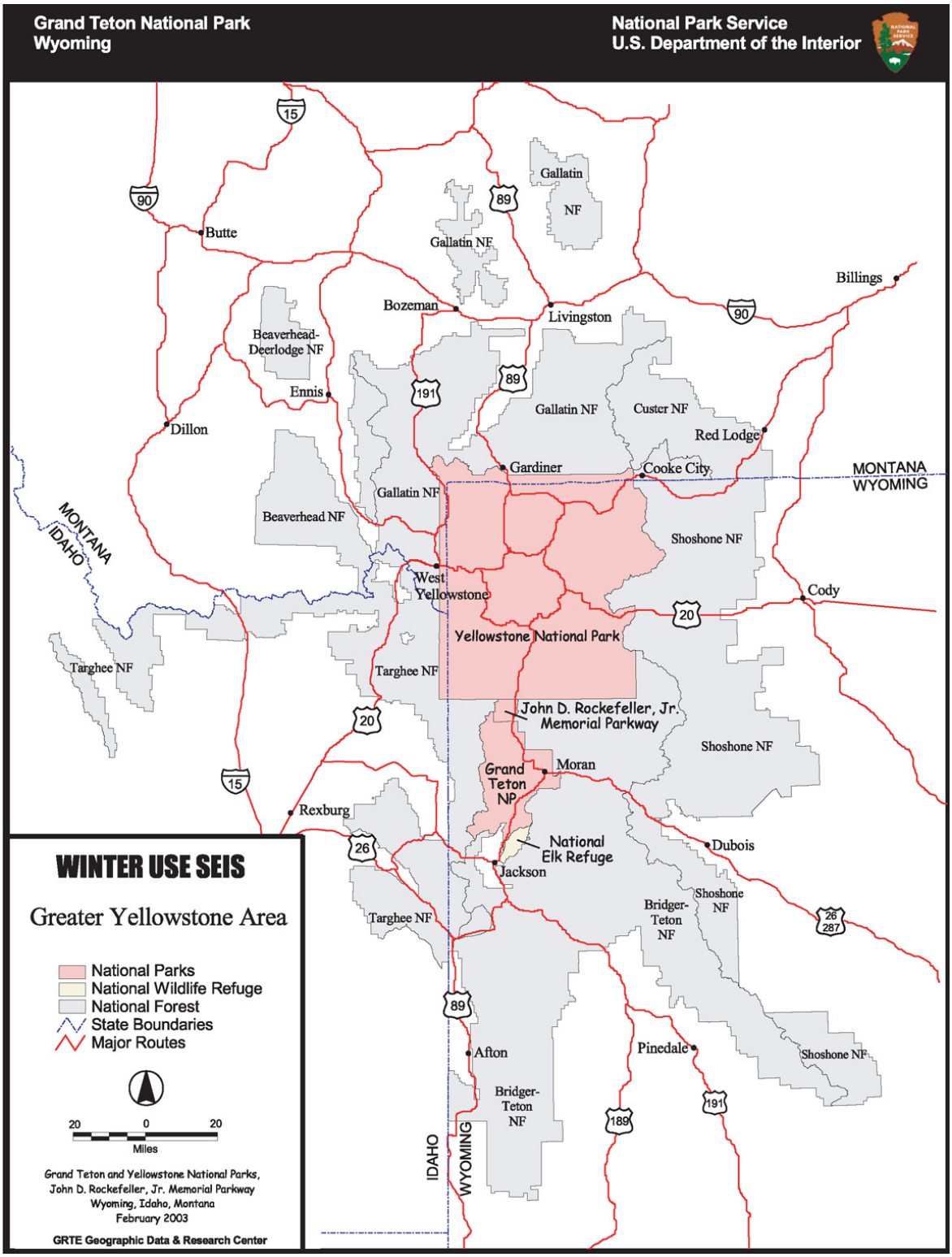
2 Baseline Description of Snowmobile Use in the Greater Yellowstone Area

2.1 THE GREATER YELLOWSTONE AREA

Section 2 describes the baseline conditions against which changes brought about by the proposed alternatives are compared.

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 (Yellowstone has more geysers and hot springs than 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, the highest mountain in the range, 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 193 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 2005–2006 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 193 miles of park roads and plow 58 miles in YNP. About 30 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.

During the 2005–2006 season, park rangers reported 46 percent fewer incidents involving snowmobile citations, 84 percent fewer moving violations, and 53 percent fewer arrests as compared with the 2002–2003 season.

Since the winter of 2003–2004, all snowmobilers have been required to use commercial guides in YNP, and all snowmobiles since the winter of 2004–2005 have had to be BAT machines, which use newer technologies to reduce air and noise emissions. Guided snowmobile service is available from a total of 22 different companies at the various park entrances.

During the 2005–2006 season, park rangers reported 46 percent fewer incidents involving snowmobile citations, 84 percent fewer moving violations, and 53 percent fewer arrests as compared with the 2002–2003 season. These percentages have been adjusted for differences in visitation. The actual number of incidents involving snowmobile citations fell from 383 to 269, the number of moving violations fell from 238 to 26, and the number of arrests dropped from 21 to 1 between the 2005–2006 and 2002–2003 seasons.

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 2005–2006 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.

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 Case Incident Reports (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, 2007).

2.4 VISITATION DATA

An analysis of the social benefits and costs of snowmobile and snowcoach use under the proposed management alternatives relative to the baseline in YNP, GTNP, and the Parkway is presented in Sections 3 and 4. This report presents analysis relative to the Alternative 3b baseline. The baseline prohibits snowmobiles and snowcoaches in the parks. Section 3 contains an analysis of Alternatives 1 through 7 relative to this baseline. To support the development of these analyses, this section presents historical data and projected Alternative 3b 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 and baseline visitation projections based on historical use for the next 10 years.

Winter visitation data from the 2005–2006 winter season are reported; however, these data were not used to create the visitation projections. Visitation during this season was higher than the previous two seasons but lower than historic visitation levels. 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 the 2003–2004 season. Additionally, the seasons of 2003–2004 and 2004–2005 were warmer and drier than normal, making it difficult to open or maintain YNP roads according to schedule.

2.4.1 YNP, GTNP, and the Parkway Total Visitation Data

Total annual recreational visitation in 2004 to YNP was 2,868,317, 2,360,373 in GTNP, and 1,070,301 on the Parkway. Annual visitation for 2005 was lower than in 2004 for YNP, but higher than in 2004 for GTNP and on the Parkway. Table 2-1 provides a month-by-month breakdown of visitation for recreational visits for the 2 years.[1] 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. The majority of winter users in YNP enter through the North and West Entrances (the towns of Gardiner and West Yellowstone, Montana, respectively).

In 2005–2006, winter use was 94,476 in YNP and 174,250 in GTNP. This is comparable to previous years but represents a significant drop in winter use at YNP compared with seasons prior to 2003–2004 (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.

2.4.2 Winter Use Activities Data

In Table 2-3, winter visitation in 1992–1993 through 2005–2006 is broken down by activity for YNP. Snowmobile passengers made up at least 50 percent of winter users in YNP in seasons before 2003–2004. However, in 2005–2006,

[1]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, 2004 and 2005

Month	YNP 2004	YNP 2005	GTNP 2004	GTNP 2005	The Parkway 2004	The Parkway 2005
January	22,817	22,297	51,294	44,727	3,136	3,183
February	30,030	29,018	36,582	43,863	4,345	3,091
March	20,187	17,324	54,733	46,293	3,232	2,922
April	32,434	26,116	52,743	47,223	2,296	2,040
May	216,905	225,811	160,692	151,793	69,837	56,373
June	584,925	560,014	463,445	430,930	198,317	218,685
July	732,682	743,165	588,627	602,298	294,704	321,043
August	657,869	647,288	405,576	544,255	282,694	266,349
September	406,327	393,362	342,945	344,390	159,692	149,313
October	135,605	142,912	117,902	135,657	40,503	46,883
November	13,939	11,505	45,877	31,528	5,613	3,642
December	14,597	16,839	39,957	40,485	5,932	4,122
Total	2,868,317	2,835,651	2,360,373	2,463,442	1,070,301	1,077,646

Source: NPS visitation records.

Table 2-2. Winter Recreational Visitors in YNP and GTNP, 1996–2006

	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
2003–04	47,544	28,880	11,706	4,380	92,510	186,871
2004–05	46,363	24,510	13,875	917	85,665	174,840
2005–06	51,275	28,242	13,900	1,059	94,476	174,250

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	43,036	138	3,071	389	84,473	11,683	142,790
2001–02	47,750	215	417	307	87,206	11,832	147,727
2002–03	41,666	278	796	322	60,406	12,154	115,622
2003–04	42,643	181	1,141	438	30,437	14,823	89,663
2004–05	42,639	138	1,153	468	24,049	17,218	85,665
2005–06	44,136	92	1,288	271	28,833	19,856	94,476

[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 who 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.

Source: NPS visitation records.

snowmobile passengers made up only 30 percent of winter season use. Snowcoach passengers made up approximately 10 percent of winter season use before 2003–2004 but made up 21 percent of use in 2005–2006. 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 1 percent of winter visitors arrived on snowmobiles in 2005–2006, and over 85 percent arrived by car. In contrast, at the other entrances the majority of visitors arrived by snowmobile. As indicated in Table 2-5, 17,362 snowmobile riders entered YNP through the West Entrance in 2005–2006, over 60 percent of the total number of snowmobile passengers entering YNP that year. The East Entrance was the least used of the four winter entrances. As indicated in Table 2-6, only 1,059 people entered from the east in 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	47,750	215	417	5	1,225	2,012	48,387
2002–03	41,666	278	796	4	878	2,003	45,625
2003–04	42,767	181	1,141	3	944	2,508	47,544
2004–05	42,639	138	1,153	3	356	2,074	46,363
2005–06	44,136	92	1,288	1	522	5,236	51,275

[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 who 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.

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	64,063	6,302	70,371
2002–03	69	42,540	7,094	49,703
2003–04	103	20,038	8,749	28,880
2004–05	140	12,917	11,453	24,510
2005–06	121	17,362	10,759	28,242

[a]Numbers of skiers reflect the number of visitors who 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	255	1,006	159	1,420
2001–02	196	2,720	0	2,916
2002–03	236	4,064	0	4,300
2003–04	197	4,183	0	4,380
2004–05	273	498	146	917
2005–06	112	754	193	1,059

[a]Numbers of skiers reflect the number of visitors who 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.

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	20,736	3,861	24,718
2001–02	60	17,854	3,518	21,432
2002–03	53	14,268	3,057	17,378
2003–04	77	8,222	3,407	11,706
2004–05	52	10,278	3,545	13,875
2005–06	37	10,195	3,668	13,900

[a]Numbers of skiers reflect the number of visitors who 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.

Source: NPS visitation records.

winter of 2005–2006, and 71 percent of these visitors (754 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 2005–2006. There were 10,195 people, or 35 percent of the total number of snowmobile riders in YNP, who

entered through the South Entrance. At all the entrances except the South Entrance, there was a large increase in the number of snowmobile visitors in 2005–2006.

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 174,250 visitors who entered GTNP (including the Parkway) in winter 2005–2006 (see Table 2-2), only 21,745 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. Of the 174,250 visitors who entered GTNP (including the Parkway) in winter 2005–2006 (see Table 2-2), only 21,745 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 10,446 visitors in the winter of 2005–2006. Note, however, that these visitors are not mutually exclusive of those counted entering YNP's South Entrance. Of the 10,446 snowmobile visitors in the Parkway, CDST, and GTNP, NPS estimates that the majority 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 10,195 visitors in 2005–2006 would have been double-counted.

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	19,887	1,930	3,643	1,440	1,294	5,962	34,156
1997–98	19,597	1,857	3,951	1,485	1,185	4,151	32,226
1998–99	17,160	1,639	3,436	851	1,149	4,242	28,477
1999–00	23,400	1,329	4,800	1,091	1,581	5,687	37,888
2000–01	31,011	1,307	2,618	1,148	1,987	4,774	42,845
2001–02	26,401	2,006[b]	3,421	1,299	1,842	7,346	40,309
2002–03	23,062	1,752[b]	2,305	0[c]	2,099	7,007	34,473
2003–04	9,217	139	1,939	0	1,389	8,000[d]	12,684
2004–05	7,351	11	149	0	1,775	6,751	16,037
2005–06	10,161	17	268	0	1,456	9,843	21,745

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

[b]Estimate based on previous average percentage of Parkway users.

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

[d]Exact counts are unavailable; this figure represents a best estimate.

Source: NPS visitation records.

2.4.3 Projected Winter Use

The "historical case" refers to conditions that would have occurred in the absence of new winter management policies. The "historical case" is used to estimate visitation under the proposed alternatives, including Alternative 3b.

In Section 3, we derive the net benefits of each proposed alternative relative to the Alternative 3b baseline over the next 10 years (2007–2008 to 2016–2017). To calculate net benefits, we need to forecast visitation over the next 10 years under each alternative. The forecast for each alternative is based on an estimate of how visitation under the alternative is projected to differ from historic visitation (or preregulation visitation). Historical use represents an estimate of what visitation would be today if no new winter management plans had been introduced.

For the YNP forecasts, the winter season of 1997–1998 was selected to represent a typical, preregulation year and the starting point for our 10-year historic use forecasts. The socioeconomic analysis in the DEIS also uses 1997–1998 to represent what visitation would have been today in the absence of new winter management plans. In GTNP, historic snowmobile use is based on 1997–1998 visitation, but historic skier and wheeled vehicle use is based on 2002–2003 visitation. Skier and wheeled vehicle use has increased independently of snowmobile visitation since 1997–1998, so 2002–2003 was deemed more representative of historic visitation.

To project historical YNP winter visitation between 2007–2008 and 2016–2017, NPS used annual growth rates for YNP winter visitation obtained from a YNP transportation report projecting total park visitation through 2010 (BRW, 1997).[2] No such report was available for GTNP, so the growth rates are based on a combination of past trends and input from the park staff.

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 and snowcoach riders versus other winter visitors, primarily autos and skiers/snowshoers, 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 historic winter use projections for YNP using visitation from the 1997–1998 season as the starting point. The growth rate is assumed to be positive each year through 2016–2017, 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.

[2]Initially, NPS estimated regressions using past winter visitation data to project future visitation by winter visitor category. However, the time series available for winter season visitation is relatively short 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 in the absence of regulation, 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.

[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. Some visitors may 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, or wheeled access.

Table 2-9. Projected Historical Winter Use in YNP by Primary Activity, 2007–2008 through 2016–2017

	Cross-Country Skiing or Snowshoeing	Wheeled Access	Snowcoach	Snowmobile	Total Visitors	Visitation Growth Rate
2007–2008	7,000	30,100	10,100	74,100	121,300	1.017
2008–2009	7,100	30,600	10,200	75,200	123,100	1.015
2009–2010	7,200	31,000	10,400	76,200	124,800	1.014
2010–2011	7,300	31,400	10,500	77,200	126,400	1.013
2011–2012	7,400	31,800	10,600	78,200	128,000	1.012
2012–2013	7,500	32,100	10,700	79,000	129,300	1.011
2013–2014	7,600	32,500	10,800	79,800	130,700	1.01
2014–2015	7,600	32,800	10,900	80,500	131,800	1.009
2015–2016	7,700	33,000	11,000	81,100	132,800	1.008
2016–2017	7,800	33,200	11,100	81,700	133,800	1.007

Note: Values rounded to the nearest 100. Total is sum of rounded values.

Similarly, Table 2-10 summarizes projected winter visitation for GTNP (including the Parkway) under historic use conditions. The annual growth rate in winter visitation is expected to be higher for GTNP than YNP over the next 10 years based on information provided by park staff. GTNP staff estimate that growth will be between 3 and 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 4.3 to 3.4 percent annual growth between 2007–2008 and 2016–2017. 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 wheeled vehicle category was calculated by subtracting the number of snowmobilers and cross-country skiers from total visitation.

Table 2-10. Projected Historical Winter Use in GTNP by Primary Activity, 2007–2008 through 2016–2017

	Cross-Country Skiing or Snowshoeing	Wheeled Access	Snowmobile	Total Visitors	Visitation Growth Rate
2007–2008	9,500	184,400	6,100	200,000	1.043
2008–2009	9,900	192,200	6,300	208,400	1.042
2009–2010	10,300	200,100	6,600	217,000	1.041
2010–2011	10,700	208,100	6,900	225,700	1.04
2011–2012	11,100	216,200	7,100	234,400	1.039
2012–2013	11,600	224,400	7,400	243,400	1.038
2013–2014	12,000	232,700	7,600	252,300	1.037
2014–2015	12,400	241,100	7,900	261,400	1.036
2015–2016	12,800	249,500	8,200	270,500	1.035
2016–2017	13,300	258,000	8,500	279,800	1.034

Note: Values rounded to the nearest 100. Total is sum of rounded values.

Under Alternative 3b baseline conditions, all oversnow visitation to the parks would be banned beginning in 2007–2008. To create 10-year visitation forecasts for Alternative 3b, we start with the 10-year historical use projections in Tables 2-9 and 2-10 and adjust visitation for each type of visitor to reflect the anticipated change in visitation patterns as a result of conditions under Alternative 3b. Predicting the percentage change in winter visitation for each visitor type under Alternative 3b relative to historical conditions is subject to a number of sources of uncertainty. Instead of using a point estimate for the percentage change in visitation under Alternative 3b, we characterize the uncertainty in the form of a triangular distribution (parameters: minimum, mean point, and maximum percentage change in visitation) and simulate visitation under Alternative 3b through the median Latin Hypercube Sampling (mLHS) method.

For each type of visitor in YNP and GTNP, we selected the minimum, mean, and maximum percentage change in visitation based on results from the *2002–2003 Winter Visitor Survey* (see Appendix 1), past visitation trends, and professional judgment. In YNP, NPS based the Alternative 3b visitation by

wheeled vehicles on historic visitation by wheeled vehicles at the North Entrance, which will still be open to cars under the no-action alternative. Under historic visitation, the number of skiers in YNP was set equal to 5.8 percent of total visitation in 1998–1999 based on results from the *2002–2003 Winter Visitor Survey*.

The *2002–2003 Winter Visitor Survey* asked about changes in visitation in response to a ban on snowmobiles but not snowcoaches. Survey results indicate that nonsnowmobilers would increase their visitation in the absence of snowmobiles. Wheeled vehicle visitors indicated they would increase their visitation 13.2 percent, while cross-country skiers and snowshoers reported that they would increase visitation by 25.8 percent in YNP. As described above, NPS used a triangular distribution to characterize the range of possible visitation increases under Alterantive 3b relative to historic conditions. The mean of the distribution was set at 13.2 percent for wheeled vehicles, and 25.8 percent for cross-country skiers and snowshoers, which assumes that banning both snowcoaches and snowmobiles is similar to banning just snowmobiles for wheeled visitors and skiers. The distributions also allow for the possibility that visitation could increase or decrease by more than the survey predicted. Some skiers use snowcoaches to reach ski trails in YNP, so banning snowcoaches in addition to snowmobiles might restrict access to the park for these skiers. In YNP, the minimum of the distribution for skier visitation is a 30 percent decrease, allowing for a decrease in skiers, and the maximum is an increase of 40 percent. For wheeled access, we assumed that visitation would not fall below historic levels, so the minimum of the distribution is a 0 percent change. The maximum for the distribution allows for 20 percent growth in wheeled vehicles.

In GTNP cross-country skiers and snowshoers reported that they would increase visitation by 7.9 percent in GTNP. Because the GTNP sample focused on skiers, the YNP percentage of a 13.2 percent increase was assumed for wheeled vehicles. The mean of the distribution was set at 13.2 percent for wheeled vehicles 7.9 percent for cross-country skiers and snowshoers. The minimum point of the GTNP skier distribution, a 4 percent increase in visitation, equals the percentage increase in skiers in GTNP between 2002–2003 and 2003–2004 and the 25 percent increase at the maximum of the distribution equals the

percentage increase in skiers from 2002–2003 to 2005–2006. For wheeled vehicles in GTNP, the minimum value of a 30 percent decline equals the decline in wheeled vehicles in GTNP from 2002–2003 and 2005–2006, while the maximum is set at a 20 percent increase to allow for the possibility of additional growth in visitation consistent with survey responses.

Tables 2-11 and 2-12 summarize the mean of the winter use projections in YNP and GTNP, respectively, under Alternative 3b baseline conditions. Figures 2-2a and 2-2b compare total projected visitation under historic conditions and Alternative 3b.

2.4.4 Sources of Uncertainty in Visitation Projections

NPS estimates of winter visitation for the seasons 2007–2008 through 2016–2017 are based on the best information available from local park staff and 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 went into effect. However, partially because of a lack of snowfall, snowmobile use in YNP was down sharply in 2002–2003. Future trends are difficult to predict, 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.

Table 2-11. Projected Alternative 3b Baseline (No-Action Alternative) Winter Use in YNP by Primary Activity, 2007–2008 through 2016–2017

	Cross-Country Skiing or Snowshoeing	Wheeled Access	Total Visitors
2007–2008	7,900	33,500	41,400
2008–2009	8,000	34,000	42,000
2009–2010	8,100	34,400	42,500
2010–2011	8,200	34,900	43,100
2011–2012	8,300	35,300	43,600
2012–2013	8,400	35,700	44,100
2013–2014	8,500	36,000	44,500
2014–2015	8,600	36,400	45,000
2015–2016	8,600	36,700	45,300
2016–2017	8,700	36,900	45,600

Note: Values rounded to the nearest 100. Total is sum of rounded values.

Table 2-12. Projected Alternative 3b Baseline (No-Action Alternative) Winter Use in GTNP by Primary Activity, 2007–2008 through 2016–2017

	Cross-Country Skiing or Snowshoeing	Wheeled Access	Total Visitors
2007–2008	10,700	186,400	197,100
2008–2009	11,100	194,200	205,300
2009–2010	11,600	202,200	213,800
2010–2011	12,000	210,300	222,300
2011–2012	12,500	218,500	231,000
2012–2013	13,000	226,800	239,800
2013–2014	13,500	235,200	248,700
2014–2015	13,900	243,600	257,500
2015–2016	14,400	252,200	266,600
2016–2017	14,900	260,700	275,600

Note: Values rounded to the nearest 100. Total is sum of rounded values.

Figure 2-2a. Winter Use Projections Comparing the Historic Trend to the No-Action Baseline for Different Visitor Types in YNP

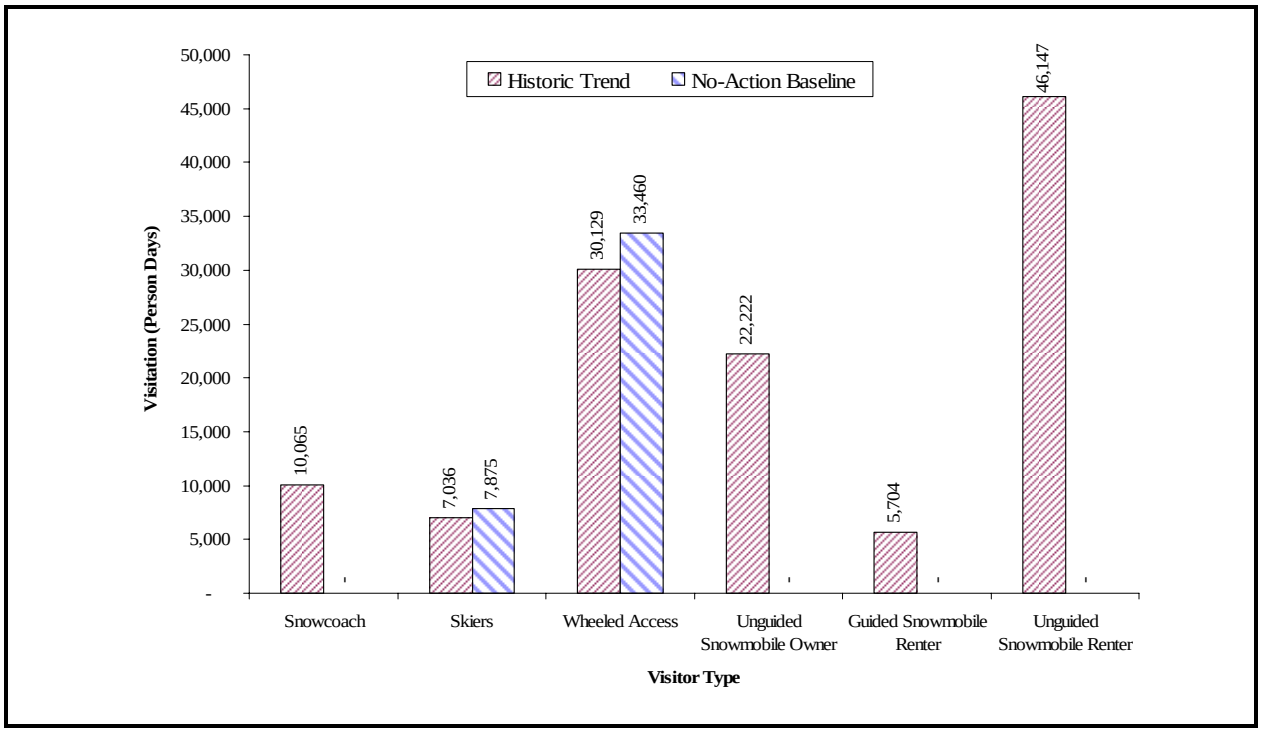
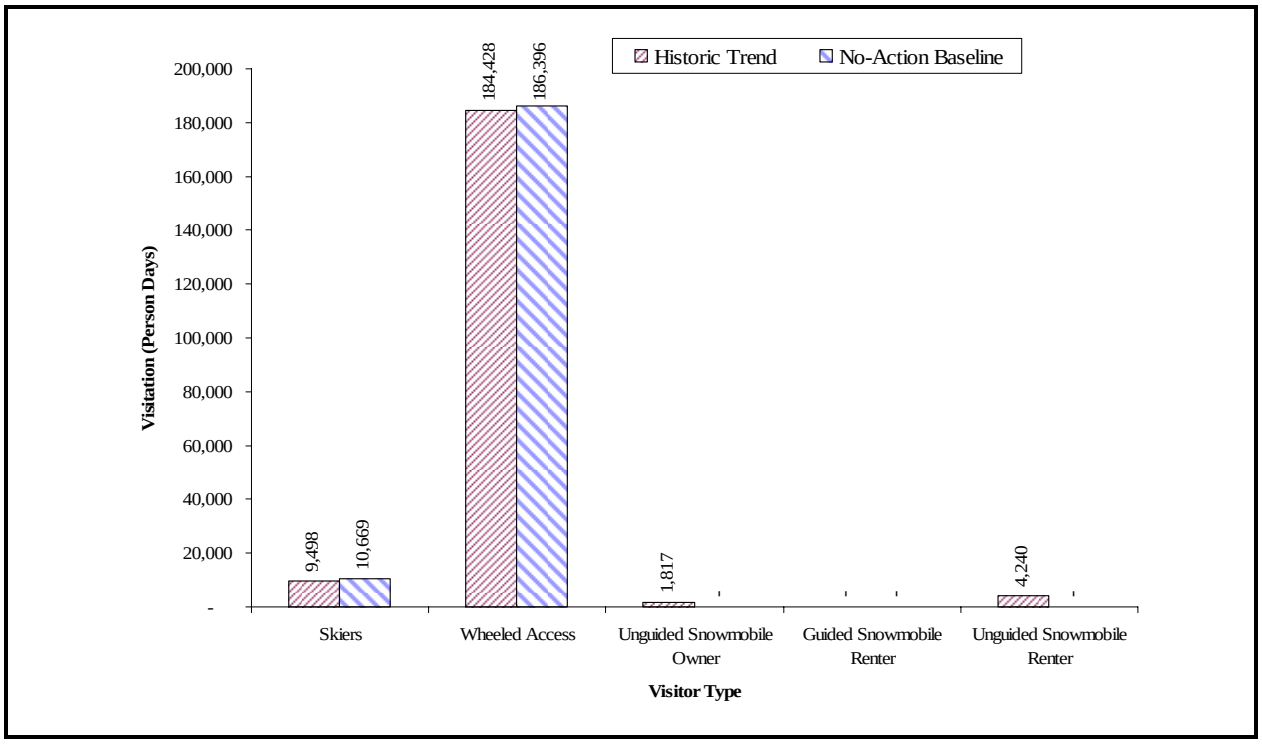


Figure 2-2b. Winter Use Projections Comparing the Historic Trend to the No-Action Baseline for Different Visitor Types in GTNP



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 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 10 years.

2.5 ALTERNATE LOCATIONS FOR SNOWMOBILING NEARBY

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

Wyoming, Montana, and Idaho all have well-established recreational snowmobiling areas. In total, these three states 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, and 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 30 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., particulate matter [PM] and carbon monoxide [CO]).

Contaminants released into the environment as a result of 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 hydrocarbons (HCs), including volatile organic compounds (VOCs) such as benzene, toluene, ethylbenzene, and xylene (collectively referred to as BTEX); polycyclic aromatic HCs (PAHs); nitrogen oxides (NO_x); 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 effect. 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 result from snowmobile emissions depends on the level and duration of exposure.[4] NPS

[4]As discussed in the DEIS, health effects (from CO) may include impairment of visual perception, manual dexterity, learning ability, and performance of complex tasks; headaches and fatigue; or respiratory failure and death. Health effects from PM emissions include reduced lung function, long-term risk of increased cancer rates, and the development or aggravation of respiratory problems.

employees working in areas of high snowmobile use maybe at risk from exposure to these pollutants. However, there is too little data and too much uncertainty to reliably estimate the incidence of these health effects. Studies conducted between 1997 and 2006 at the West Entrance conclude that personal exposure measurements for employees located at entry kiosks were generally below permissible exposure limits and threshold limit values. These studies were limited to employees and did not include visitor exposure measurements.

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 in 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 emissions from the current average levels. No standards for PM were included in the rule "because limits on HC emissions will serve to simultaneously reduce PM" (EPA, 2002). Table 2-13 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 policy. The federal Clean Air Act requires EPA to establish national ambient air quality standards (NAAQS) to protect public health and welfare.

Table 2-13. Comparison of Emissions Requirements and Current Technology

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

[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>.

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 2-14 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.[5]

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

[5]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 2-14. Primary and Secondary Ambient Air Quality Standards

	Time Period	Federal	Wyoming	Montana	Idaho
Particulate matter $(PM)_{10}$	24-hour 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-hour 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>.

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.[6] The following summarizes the results found in the DEIS (NPS, 2007). 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

[6]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).

quality standards. CO concentrations are projected to increase under all alternatives relative to the baseline because of increased daily snowmobile entry limits. 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.

Alternatives 2, 3a, and 5 are expected to have negligible to minor, direct, short-term, and adverse impacts on air quality as a result of CO emissions. Alternatives 1, 6, and 7 are expected to have moderate, direct, short-term, and adverse impacts on air quality, with CO emissions at 6 percent, 3.4 percent, and 4.4 percent of historic CO emissions, respectively. Major, direct, short-term, and adverse impacts on air quality are expected under Alternative 4.

2.7.2 Visibility

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.

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 SO_2 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. For visibility, the secondary PM standard is the relevant standard. Table 2-15 compares typical emissions rates for conventional two-stroke snowmobiles and other vehicles for NO_x and PM.

Table 2-15. 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.

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.

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 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

All alternatives except Alternative 6 are expected to have a negligible impact on visibility. NPS anticipates that Alternative 6 will have moderate, direct, short-term, and adverse impacts on visibility as a result of road sanding operations.

2.7.3 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 2-16, estimates of noise levels from snowmobiles vary widely. The Snowmobile Safety and Certification Committee states that certified snowmobiles emit roughly 73 decibels (dB) of sound when traveling at 15 mph

Table 2-16. Comparative Noise Emissions

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

and no more than 78 dB traveling at full throttle at 50 feet away.[7] 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.[8] To put these noise-level estimates into perspective, Table 2-16 also compares them with those of other familiar sounds.

[7]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 after-market racing exhaust systems can increase the potential noise impacts of snowmobiles.

[8]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).

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 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 DEIS (NPS, 2007). In the DEIS, 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.

All alternatives except Alternative 3a are expected to have moderate, adverse, short-term, and direct impacts on the natural soundscape in YNP. NPS anticipates negligible impacts under Alternative 3a. Alternatives 1, 4, 5, and 7 are expected to have a major, adverse, short-term, and direct impact on the soundscape in GTNP. Alternative 2 is expected to have no impact in GTNP, and Alternative 3a is expected to have a negligible impact on the GTNP soundscape. NPS anticipates moderate effects in GTNP under Alternative 6.

2.7.4 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 (NPS, 2003b) 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.

2.7.5 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.[9]
- 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

[9]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.

susceptibility to predation, and diminished health as a result of increased energy costs. Thus, although animals may appear 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, 2000c).

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 the 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 increase under all alternatives (compared with the baseline) but could be mitigated 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 because of ongoing investigations and analyses on the topic.

The potential impacts to bison and elk range from none or negligible to moderate for Alternatives 1, 2, 5, 6, and 7. Impacts range from negligible to minor for Alternative 3a and minor to moderate for Alternative 4. The impacts under all alternatives are expected to be adverse, short term, and direct. In general, the impacts are due to displacement, vehicle-caused mortality, and behavioral/physiological effects.

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 the ungulate winter range may disturb grizzly bears feeding on winter-killed carcasses. In YNP, the 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, 2000c). 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).

NPS anticipates snowmobile use identified in the alternatives would result in only negligible to minor impacts to the lynx. Impacts to wolves and bald eagles range from negligible to

moderate, due primarily to displacement, behavioral, and phsiological effects.

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). NPS anticipates snowmobile use identified in the alternatives would result in only negligible to moderate impacts on swans and wolverines.

All other species of concern are expected to experience negligible impacts.

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), EA (NPS, 2004), and DEIS (NPS, 2007) 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.[10]

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.

[10]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.

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 GTNP and Flagg Ranch.[11] 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).

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

Table 2-17 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).

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

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 percent 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. 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, NPS identified 15 businesses renting snowmobiles for self-guided tours or offering guided snowmobile tours. In addition, at least five businesses had snowcoaches available, and two provided cross-country ski equipment and guided tours. 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 2006–2007. Both businesses operating out of West Yellowstone offering cross-

Table 2-17. 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 percent
Nonfarm	90,947	96.38 percent
Private	75,814	80.34 percent
Construction	8,149	8.64 percent
Insurance and Real Estate	6,109	6.47 percent
Manufacturing	4,872	5.16 percent
Mining	1,043	1.11 percent
Miscellaneous, Agriculture, and Forestry	1,728	1.83 percent
Retail	19,371	20.53 percent
Services	28,683	30.40 percent
Transport and Utilities	3,235	3.43 percent
Wholesale	2,624	2.78 percent
Government	15,133	16.04 percent

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

country ski equipment were licensed for cross-country ski tours in the park.

To the north and east of the park, in areas including Bozeman and Big Sky, Montana, and Cody, Wyoming, eight additional companies were licensed to offer cross-country ski tours in the park during the 2006–2007 winter use season, and three businesses were identified as providing snowcoach tours. Fifteen snowmobile rental businesses were located in the area, but only two of these businesses were licensed to provide guided tours in the park. One was located in Cody, and the other was headquartered inside the park.

To the south of YNP, approximately 11 businesses were licensed to offer guided snowmobile tours of YNP or GTNP (located in Jackson and Moran, Wyoming) during the winter of 2006–2007. An additional two businesses were identified 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 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. Six snowcoach operators offered tours through the South Gate of YNP, three located in Jackson, one in Moran, one in Dubois, and one inside the park. None of the businesses licensed to provide guided cross-country tours in YNP during the 2006–2007 winter use season were located in Jackson or Moran.

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, 2000c). 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.

The proposed alternatives vary in terms of the numbers of snowmobiles and snowcoaches allowed in the parks. All the alternatives that allow snowmobiles require all or at least 75 percent of snowmobiles to be accompanied by a guide. In the past 5 years, additional businesses have been granted concessions to operate guided snowmobile and snowcoach tours in YNP in anticipation of increased demand. Alternative 6 allows for commercially guided bus tours from the North and West entrances that would also require concessions.

3 Benefit-Cost Analysis of the Alternative Regulations Under the Alternative 3b Baseline

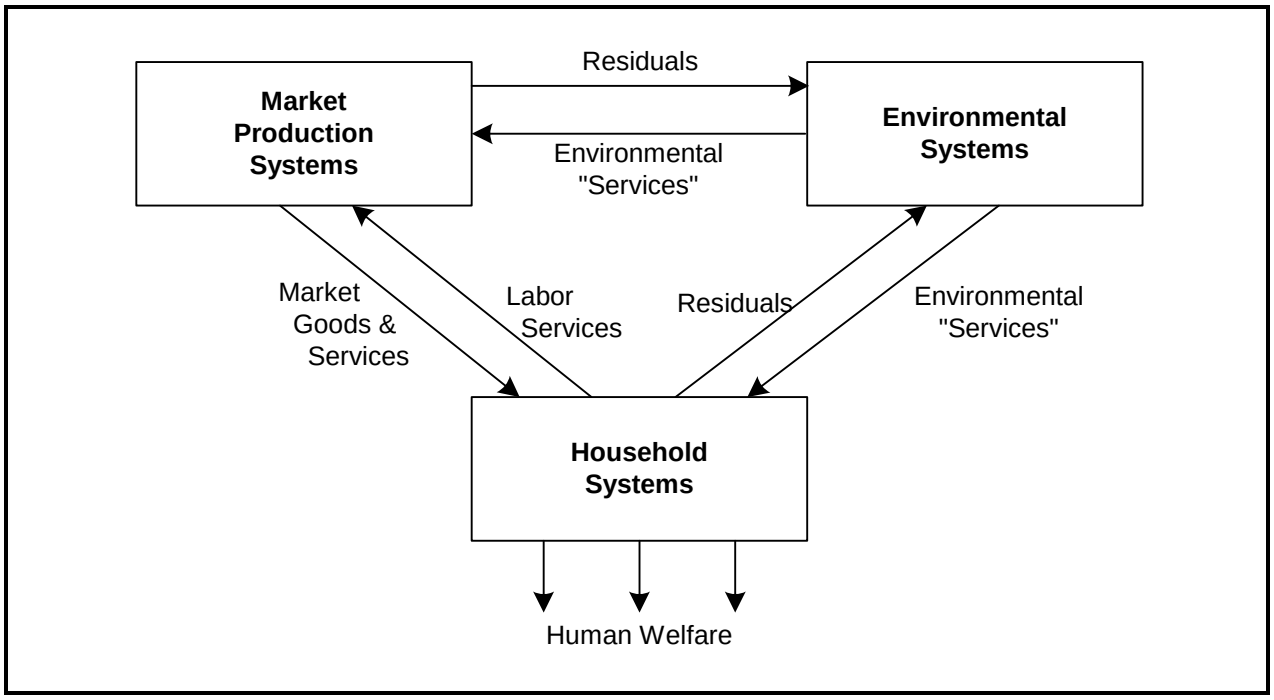
In this section, NPS presents the benefits and costs associated with alternatives considered for managing oversnow vehicle use in the GYA relative to Alternative 3b, the no-action baseline.

The purpose of benefit-cost analysis is to evaluate the social welfare implications of a proposed action—in this case the regulation of winter recreation 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 oversnow vehicle 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 3b baseline.

3.1 CONCEPTUAL BASIS FOR BENEFIT-COST ANALYSIS OF OVERSNOW VEHICLE 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



Under regulations that restrict oversnow vehicle use, the most direct impact will be on visitors who ride oversnow vehicles, whose recreational opportunities will be partially constrained by the restrictions.

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.

The conceptual framework depicted in Figure 3-1, therefore, provides a basis for assessing the benefits and costs of regulating oversnow vehicles in national parks. Under regulations that restrict oversnow vehicle use, the most direct impact will be on visitors who ride oversnow vehicles, whose recreational opportunities will be partially constrained by the restrictions. This will 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 oversnow vehicle-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. Thus, 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, we provide in the remainder of this section and Section 2.7 a more detailed discussion of

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

3.1.1 Social Benefits of Regulations Restricting Oversnow Vehicle Use

The use of oversnow vehicles such as snowmobiles and snowcoaches 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 use, therefore, can be thought of and measured as the reduction in these losses to society. In addition, oversnow vehicles can negatively affect society in ways that are not directly related to the environment; therefore, the benefits of 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. These impacts would also be associated with snowcoaches, but at a much lower level unless snowcoach use increases dramatically. Most of the debate around oversnow vehicle use focuses on snowmobiles. 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.

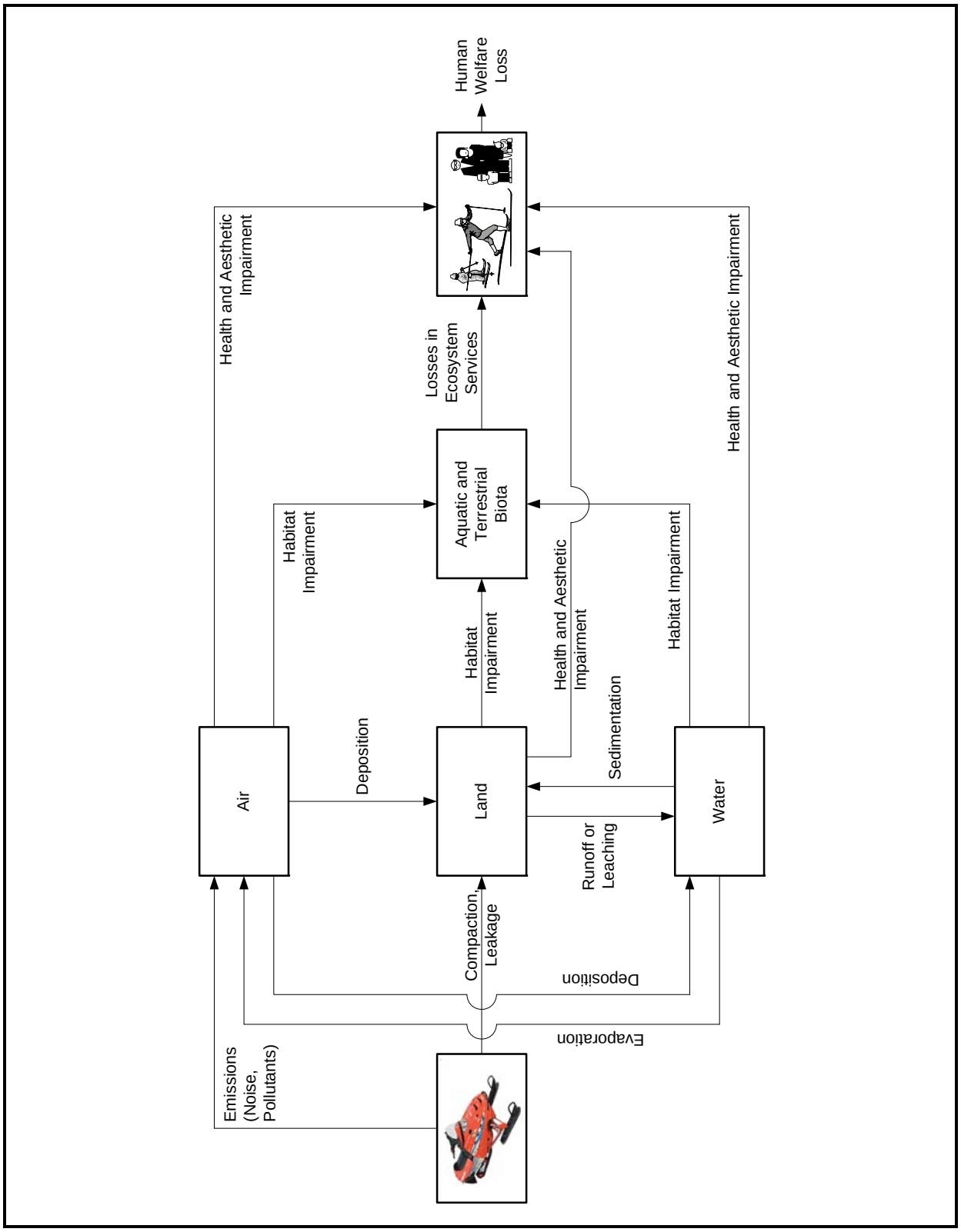
Table 3-1. Classification of Potential Negative Impacts from Snowmobile Use in National Parks

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 Oversnow Vehicle Use

The use of oversnow vehicles 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 oversnow vehicles in national parks can impose welfare losses

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



on society. In this discussion, we focus on snowmobiles, but if snowcoach use increased significantly they would generate many of the same impacts.

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 the 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 oversnow vehicle 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 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,

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.

and ecosystem benefits associated with regulations restricting snowmobile use in national parks is provided in Section 2.7.

Nonenvironmental Benefits

In addition to wide-ranging environmental benefits, regulations restricting oversnow vehicle 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 oversnow vehicle 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.

3.1.2 Social Costs of Regulations Restricting Oversnow Vehicle Use

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

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

The welfare losses to individual consumers are measured by their loss in consumer surplus, while losses to producers are measured by their loss of producer surplus.

3.1.3 Identifying Relevant Benefits and Costs

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.

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 oversnow vehicle 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. 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 oversnow vehicle sales or rentals. Thus, losses or gains to businesses that may be indirectly, but significantly, 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 oversnow vehicle regulations. As described above, oversnow vehicle use may generate negative externalities, such as air pollution and noise that affect other park visitors and park resources. If oversnow vehicles do generate negative externalities, then the private cost of using an oversnow vehicle (the cost to the individual snowmobile rider, for example) will be lower than the social cost of oversnow vehicle use (where the social cost of oversnow vehicle use includes both the cost to the oversnow vehicle user and the costs to others that result from the negative externalities associated with oversnow vehicle use). Because oversnow vehicle users do not have to pay the full social cost of using, for example, a snowmobile and instead only pay the lower, private cost, oversnow vehicle use will be higher than

the socially optimal use level. In addition, measures of net consumer surplus to oversnow vehicle users 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 visitation in past winter seasons and the 2002–2003 survey of winter visitors to YNP and GTNP were used to estimate the Alternative 3b 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 the action alternatives—Alternatives 1, 2, 3a, 4, 5, 6, and 7—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 3b serves as the baseline to which the other alternatives are compared. It should be noted that Alternative 3b eliminates the use of all oversnow vehicles, both snowmobiles and snowcoaches. This no-action baseline places greater restrictions on visitor access to the parks than the baselines in analyses of previous winter use alternatives for YNP, GTNP and the Parkway.

Data from visitation in past winter seasons and the 2002–2003 survey of winter visitors to YNP and GTNP (see Appendix 1) were used to estimate the Alternative 3b baseline visitation numbers presented in Section 2 and the estimates of visitation changes for each action 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 1, 2, 3a, 4, 5, 6, and 7 relative to the Alternative 3b baseline.

3.2.1 Affected Groups

For the purpose of this study, seven 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. Snowcoach riders, whose ability to visit YNP is affected by changes in regulations.
3. Other visitors or potential visitors who may have a different experience at the park depending on oversnow vehicle regulations in YNP, GTNP, or the Parkway.
4. The general public who may care about YNP, GTNP, or the Parkway, even when they do not visit.
5. Producers of snowmobile and snowcoach services in the towns of the five-county area who may experience a change in their welfare.
6. Producers of services to other types of winter visitors (for example, cross-county ski or snowshoe rentals) who may experience a change in their welfare.
7. 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 and snowcoaches 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 Visitation Forecasts

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.

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. The baseline, Alternative 3b, places the greatest restrictions on visitation of all the alternatives in the DEIS (NPS, 2007), banning both snowmobiles and snowcoaches, (see Table 1-1 for a summary of the alternatives). All seven action alternatives permit snowcoaches and all but Alternative 2 permit snowmobiles in the park. Visitation under Alternatives 1, 2, 3a, 4, 5, 6, and 7 relative to the baseline depends on factors such as the number of entrances that are opened, whether guiding is required for snowmobiles, and whether additional roads are plowed.

Predicting changes in winter visitation to the five-county GYA over the ten-year period starting in 2007–2008 as a result of implementing any of the alternatives is subject to a number of sources of uncertainty. We characterize this lack of information or uncertainty in the form of a triangular distribution (parameters: minimum, mean, and maximum percentage

change in visitation) and simulate visitation through our model to characterize some of the uncertainty in our net benefits estimates.

The simulation model runs a large number of iterations. During each iteration of the model, values from each of the triangular distributions are drawn and these values are used to estimate visitation changes and net benefits. Each iteration produces a single estimate of net benefits. We can use the central tendency estimates, standard errors, and percentiles of the distribution to draw conclusions about the uncertainty (or certainty) in the results. To characterize the uncertainty in our model, we simulate using the median Latin Hypercube Sampling (mLHS) method. In mLHS, each uncertain quantity—in this case represented as triangular distributions—is divided into equal-probability intervals equal to sample size or number of iterations. The sampled values are the medians of these intervals. We run 1,000 iterations using mLHS, which can more than adequately represent the values from the entire range of the uncertainty distributions. In addition to characterizing the uncertainty in visitation changes, we consider the uncertainty in profit rates of different establishments while estimating the producer surplus (or benefits to the local businesses).

Table 3-3 presents the minimum, mean, and maximum percentage change in visitation for the triangular distributions used to create the visitation forecasts for each alternative. Below we discuss the assumptions used to develop the distributions and the resulting visitation estimates.

Historic Visitation (pre-2004)

Visitation under each of the action alternatives was estimated by calculating changes in visitation relative to historical visitation levels for each alternative and then subtracting projected visitation under the Alternative 3b baseline from projected visitation under each alternative. Following the socioeconomic analysis in the DEIS (NPS, 2007), we use visitation in 1997–1998 as representative of the “preregulation” era. Incremental visitation was calculated in this way rather than defining changes in visitation relative to Alternative 3b 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 than asking respondents to make

Table 3-3a. Summary of Triangle Distribution Inputs (Minimum, Mean, Maximum) Used to Estimate Visitation Changes Relative to Historical Conditions for YNP in 2007–2008

	Alternative 1	Alternative 2	Alternative 3a	Alternative 4	Alternative 5	Alternative 6	Alternative 7
Percentage of snowmobile owners' visitation that continues as unguided use in the parks	NA	NA	NA	100% (subject to daily cap)	100% (subject to daily cap)	NA	NA
Percentage of snowmobile owners' visitation switched to snowcoaches	(12.5%, 25.7% [a], 50% [b])	(14.3%, 28.6% [a], 50% [b])	(10%, 25.7% [a], 50% [b])	(13.1%, 26.3% [a], 50% [b]) [c]	(13.1%, 26.3% [a], 50% [b]) [c]	(10%, 25.7% [a], 50% [b])	(12.5%, 25.7% [a], 50% [b])
Percentage of guided snowmobile renters' visitation that continues unchanged	(100%, 100%, 550%[b])	NA	(100%, 100%, 550% [b])	(11.5%, 22.9% [a], 50% [b])	(100%, 100%, 550% [b])	(100%, 100%, 550% [b])	(100%, 100%, 550%[b])
Percentage of unguided snowmobile renters' visitation that continues unchanged	NA	NA	NA	100%	100%	NA	NA
Percentage of unguided snowmobile renters' visitation switched to guided snowmobile rentals	(10%, 35.4% [a], 44% [b])	NA	(10%, 35.4% [a], 44% [b])	(10%, 35.4% [a], 44% [b]) [c]	(10%, 35.4% [a], 44% [b]) [c]	(12.5%, 35.4% [a], 44% [b])	(10%, 35.4% [a], 44% [b])
Percentage of snowmobile renters' visitation switched to snowcoaches	(12.5%, 25.1% [a], 50%[b])	(12.5%, 25.1% [a], 50%[b])	(12.5%, 25.1% [a], 50% [b])	(10%, 20.1% [a], 50%[b]) [c]	(12.5%, 25.1% [a], 50% [b]) [c]	(12.5%, 25.1% [a], 50% [b])	(12.5%, 25.1% [a], 50%[b])
Percentage change in snowcoach use by nonsnowmobilers	(101.4%[a], 150%[b], 231% [b])	(101.4% [a], 150% [b], 231% [b])	(100%, 150% [b], 231% [b])	(98% [a], 101.4% [a], 150% [b])	(101.4%, 150% [b], 231% [b])	(100%, 150% [b], 231% [b])	(101.4%[a], 150%[b], 231% [b])
Percentage change in cross-country skiing and snowshoeing in YNP by nonsnowmobilers	(100%, 103.7% [a], 117% [b])	(100%, 125.8% [a], 140%)	(100%, 103.7% [a], 117% [b])	(100%, 101.7% [a], 117% [b])	(100%, 103.7%[a], 117%[b])		(100%, 103.7% [a], 117% [b])
Percentage change in wheeled access visitors	(100%, 101.1% [a], 117% [b])	(100%, 113.2% [a], 117% [b])	(100%, 101.1% [a], 117% [b])	(100%, 104.4% [a], 117% [b])	(100%, 101.1%[a], 117% [b])		(100%, 101.1% [a], 117% [b])

[a]Based on response to *2002–2003 Winter Visitor Survey*.

[b]Based on changes in visitation during the last 10 years.

[c]Percentage of unguided renters who do not continue unguided.

Table 3-3b. Summary of Triangle Distribution Inputs (Minimum, Mean, Maximum) Used to Estimate Visitation Changes Relative to Historical Conditions for GTNP in 2007–2008

	Alternative 1	Alternative 2	Alternative 3a	Alternative 4	Alternative 5	Alternative 6	Alternative 7
Percentage of snowmobile owners' visitation that continues as unguided use in the parks	(7% [b], 10.3% [a], 100%)	NA	(7% [b], 10.3% [a], 100%)	(7% [b], 10.3% [a], 100%)	(7% [b], 10.3% [a], 100%)	(7% [b], 10.3% [a], 100%)	(7% [b], 10.3% [a], 100%)
Percentage of unguided snowmobile renters' visitation that continues unchanged	(7% [b], 14.8% [a], 100%)	NA	(7% [b], 14.8% [a], 100%)	(7% [b], 14.8% [a], 100%)	(7% [b], 14.8% [a], 100%)	(7% [b], 14.8% [a], 100%)	(7% [b], 14.8% [a], 100%)
Percentage of unguided snowmobile renters' visitation switched to guided snowmobile rentals	NA	NA	NA	(0%, 28.3% [a], 100% [c])	NA	NA	NA
Percentage change in cross-country skiing and snowshoeing in GTNP by nonsnowmobilers	(103.5% [a], 104% [b], 125% [b])	(104% [b], 107.9% [a], 125% [b])	(103.5% [a], 104% [b], 125% [b])	(103.5% [a], 104% [b], 125% [b])	(103.5% [a], 104% [b], 125% [b])	(103.5% [a], 104% [b], 125% [b])	(103.5% [a], 104% [b], 125% [b])
Percentage change in wheeled access visitors	(79% [b], 101.1% [a], 113.2% [a])	(79% [b], 113.2% [a], 120%)	(79% [b], 101.1% [a], 113.2% [a])	(79% [b], 101.1% [a], 113.2% [a])	(79% [b], 101.1% [a], 113.2% [a])	(79% [b], 101.1% [a], 113.2% [a])	(79% [b], 101.1% [a], 113.2% [a])

[a] Based on response to *2002–2003 Winter Visitor Survey*.

[b] Based on changes in visitation during the last 10 years.

[c] Percentage of unguided renters who do not continue unguided.

the hypothetical assumption that oversnow vehicles were already banned and asking how much their visitation would increase if the ban were lifted and replaced with a different alternative.

To facilitate a more disaggregate breakdown of visitation, we assumed that under historic visitation conditions 70 percent of snowmobilers in the parks used rented machines and the other 30 percent rode their own machine. Data from YNP on the total number of snowmobile riders and snowmobiles that entered YNP in 2005–2006 indicate that the overall average number of visitors per snowmobile (renters and owners) was approximately 1.31. Finally, based on the 2002–2003 visitor survey results, approximately 11 percent of all rented snowmobiles entering the parks were on guided tours. 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 over the 10-year period at the values presented above.

Section 2.3.2 presents projected visitation under historical, preregulation conditions for 2007–2008 to 2016–2017. The distributions in Table 3-3 define the percentage change in historic visitation levels for different visitor groups[1] that NPS expects under each alternative. The parameters of the distributions are based on visitor survey results (NPS, 2003a, see Appendix 1 for questions), actual changes in visitation since 1997–1998, and factors such as the expected impact of the different alternatives on visitors' experience in the parks.

Alternatives 1, 2, 3a, 4, 5, 6, and 7 Visitation

Table 3-3 presents the minimum, mean and maximum for the triangular distributions used to forecast the change in winter use patterns estimated to occur relative to historic visitation under each alternative. Alternatives 1, 2, 4, and 5 are similar to alternatives considered when the current temporary rule was passed, which were analyzed in the 2004 economic analysis report on the proposed temporary regulations (NPS, 2004b).

Starting with Alternative 2, which allows snowcoach use but not snowmobiles, we describe below the sources for the minimum,

[1]As mentioned elsewhere in this report, many visitors participate in multiple activities during their trips to the GYA. Respondents were categorized based on the activity they indicated was their primary activity in the parks.

mean and maximum values for the triangular distributions in Table 3-3a and b. Survey responses indicated that 25 percent of snowmobile renters and 28 percent of snowmobile owners in the park under historic conditions would continue to visit the park if snowmobiles were banned. Snowmobile riders were assumed to switch to snowcoach use in YNP under Alternative 2. All former snowmobilers who 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. The survey responses represent the mean of the distributions, while the minimum values of 14 percent for owners and 12 percent for renters were set at half of the mean based on professional judgment. The maximum of a 50 percent increase is based on the actual increase in snowcoach use since 2003–2004.

According to the survey results, snowcoach riders (YNP only)[2] and wheeled-access visitors would increase their visitation by 1.4 percent and 13.2 percent, respectively, if snowmobiles were banned.[3] For the snowcoach riders,' the minimum for the triangular distribution is a 1.4 percent increase in visitation based on the survey results. The mean and maximum, a 50 percent increase and a 131 percent increase, reflect the recent increases in snowcoach use. Between 1997–1998 and 2003–2004, when the temporary rule was put in place, snowcoach use increased 50 percent. Since 2003–2004, snowcoach use has increased 15 percent to 16 percent a year. An increase of 15 percent in 2006–2007 would represent a 131 percent increase in snowcoach passengers since 1997–1998. The minimum and maximum percentage change for wheeled vehicle riders in YNP are no change and a 17 percent increase. The assumption of no change as a minimum was based on professional judgment. The 17 percent increase equals the increase in wheeled vehicle visitation between 1997–1998 and 2003–2004. In GTNP, the minimum for the wheeled access

[2]This refers only to visitors who would have used snowcoaches in the parks in the absence of regulation. There will also be an increase in the number of people using snowcoaches in the park due to switching from snowmobiles to snowcoaches.

[3]This reflects the change in visitation by people who visit in the absence of regulation. It does not include people who would not visit in the absence of restrictions on snowmobilers but would visit under Alternative 3b baseline conditions because there is insufficient information to estimate their responsiveness to restrictions on oversnow vehicle use.

distribution is a 21 percent decrease in visitation relative to historic conditions, which is the percentage decrease in wheeled vehicle use of the park between 2002–2003 and 2005–2006. The maximum value for the distribution, a 20 percent increase, is based on professional judgment. Finally, the mean value of the triangular distribution for cross-country skiers and snowshoers is set at an increase of 25.8 percent in YNP and 7.9 percent in GTNP in the absence of snowmobiles based on survey results. In YNP, the minimum is no change in visitation (100 percent of historic visitation continues) and a 40 percent increase at the maximum, both based on professional judgment. In GTNP, the minimum is a 4 percent increase and the maximum is a 25 percent increase. Between 2002–2003 and 2004–2005, the number of skiers increased 4 percent and between 2002–2003 and 2005–2006 skiers increased 25 percent.

Alternatives 1, 3a, 4, 5, 6, and 7 provide for snowmobile access to the park subject to varying daily caps, guiding requirements, and entrance restrictions. Alternatives 1, 3a, 6, and 7 require 100 percent guiding for snowmobiles in YNP, while Alternatives 4 and 5 allow 25 percent and 20 percent of snowmobiles to be unguided, respectively. Based on survey responses, unguided snowmobile renters displayed more willingness than snowmobile owners to participate in guided snowmobile tours, with 35.4 percent saying they would switch if unguided snowmobile use was not allowed. 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.

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 distributions for all six alternatives that allow snowmobiles make the same assumption about the percentage of unguided renters who would switch to guided tours. The mean is 35.4 percent and the maximum is 44 percent based on the observed increase in guided snowmobile rentals in the first year of the temporary rule and the number of guided and unguided snowmobilers in the park the previous year. The minimum was assumed to be a conservative 10 percent.

The survey results indicate that under alternatives that allow only guided snowmobiles, 25 percent of unguided snowmobile

owners and renters would switch to snowcoach use. Based on this, the mean of the distribution for the percentage of unguided owners and renters who switch to snowcoaches was set at 25 percent under all alternatives. In Alternatives 4 and 5, which allow unguided snowmobiles, the distribution applies to those snowmobile riders who cannot ride unguided because of the daily cap. The maximum was set at 50 percent of unguided snowmobilers based on the increase in snowcoach use since 2003–2004, while the minimum was set to approximately half the mean value.

Visitation by guided snowmobile renters follows a distribution assuming current visitation levels as a minimum and a 450 percent increase at the maximum. The number of guided snowmobile riders increased 454 percent between 2002–2003 and 2003–2004, from approximately 6,600 guided renters in 2002–2003 (assuming 11 percent of snowmobiles were guided) to approximately 30,000 guided snowmobiles in 2003–2004.

Finally, the distribution for the percentage change in snowcoach visitors in Alternatives 1, 3a, 5, 6, and 7 are similar to Alternative 2. In Alternative 4, the distribution is lower with a minimum 98 percent (a 2 percent decrease), a mean of 1.4 percent increase and a 50 percent increase at the maximum. The 2 percent decrease comes from survey results.

Wheeled-access visitors and cross-county ski and snowshoe visitors are expected to increase in numbers relative to historic trends under all six alternatives that allow snowmobiles in the park. The means of the distributions, about a 1 percent increase to a 3 percent increase, are based on responses to the visitor survey. Visitation equal to that of historic trends is assumed as the minimum, while the maximum is a 17 percent increase based on the increase in wheeled vehicle traffic since 1997–1998 and the assumption that many cross-county skiers drive to trail heads inside the park.

Forecasting the number of commercial wheeled-vehicle passengers under Alternative 6 is subject to even greater uncertainty than the other estimates. The maximum of the triangular distribution was set at the maximum number of visitors allowed under the daily cap of 100 vehicles assuming 21 passengers per vehicle (Duffield and Neher, 2006), the minimum was set at 5 buses per day (approximately 100 people, corresponding to the 100 snowmobiles available to rent

at Old Faithful under this alternative), and the mean was set at 44 buses per day, which is approximately the number of buses needed to carry the 77,892 passengers as used in the socioeconomic analysis for the DEIS (Duffield and Neher, 2006).

In GTNP, all the alternatives except Alternative 2 allow for unguided snowmobile use subject to varying daily limits. Alternative 4 has a lower cap on unguided use and specifically requires guided trips for other snowmobiles, and Alternative 2 bans snowmobiles. Except for Alternative 2, visitation under the other six alternatives was assumed to vary according to similar distributions. The mean percentage change for unguided owners and renters is based on visitor survey results (10 percent and almost 15 percent, respectively). The minimum of 7 percent reflects the actual decline in snowmobile use between 2002–2003 and 2005–2006. Under Alternative 4, the mean percentage of unguided renters who might switch to guided rentals if the unguided option is unavailable is 28 percent based on survey results. The minimum of 0 percent and maximum of 100 percent reflect the uncertainty over guided snowmobile use in GTNP.

As in YNP, cross-county skiing in GTNP is assumed to increase under all the alternatives with a minimum increase of about 3.5 percent based on survey results and mean and maximum increases of 4 percent and 25 percent based on the observed increase in skiers between 2002–2003 and 2003–2004 and between 2002–2003 and 2005–2006, respectively. Wheeled access shows a different trend over the last few years. The minimum of the distribution is a decrease of about 20 percent based on the change in wheeled vehicles between 2002–2003 and 2005–2006, while the mean of a 1 percent increase and a maximum of a 13 percent increase are based on the survey results. For Alternative 2, the increases in skiers and wheeled-access visitors are somewhat larger, reflecting survey responses.

As discussed above, the percentage changes in visitation are applied to the historic visitation trends presented in Tables 2-9 and 2-10 to forecast visitation under each of the six action alternatives. Then visitation under each action alternative is subtracted from the forecasted visitation under the Alternative 3b baseline, from Tables 2-11 and 2-12, to calculate the

incremental change in visitation from each proposed alternative relative to the baseline.

Table 3-4 compares mean winter use under each of the alternatives for 2007–2008. This table shows the allocation of visitors based on the assumptions described above. Tables 3-5 and 3-6 provide the incremental impacts on winter use patterns resulting from implementing Alternative 1, 2, 3a, 4, 5, 6, or 7 relative to the Alternative 3b baseline for YNP and GTNP.

Table 3-4a. Comparison of Mean Winter Visitation in 2007–2008 Under Snowmobile Management Alternatives in YNP (Number of Visitors)[a]

	Cross-Country Skiing or Snowshoeing	Wheeled Access	Snowcoach	Snowmobile	Bus	Total Visitors
Alternative 1	7,500	32,000	36,200	28,000	0	103,700
Alternative 2	8,600	33,200	38,300	0	0	80,100
Alternative 3a	7,500	32,000	14,100	13,100	0	66,700
Alternative 4	7,600	32,300	30,300	55,500	0	125,700
Alternative 5	7,500	32,000	36,300	38,800	0	114,600
Alternative 6	7,500	31,500	26,000	20,900	90,200	176,100
Alternative 7	7,500	32,000	36,200	28,000	0	103,700

[a]All values in this table are absolute visitation levels (i.e., they are not incremental values relative to the baseline) rounded to the nearest 100. The values were calculated using the median Latin Hypercube Sampling method and triangular distributions with the parameters from Table 3-3a.

Table 3-4b. Comparison of Mean Winter Visitation in 2007–2008 Under Snowmobile Management Alternatives in GTNP (Number of Visitors)[a]

	Cross-Country Skiing or Snowshoeing	Wheeled Access	Snowmobile	Total Visitors
Alternative 1	10,500	180,300	2,400	193,200
Alternative 2	10,700	191,900	0	202,600
Alternative 3a	10,500	180,300	2,400	193,200
Alternative 4	10,500	180,300	4,000	194,800
Alternative 5	10,500	180,300	2,400	193,200
Alternative 6	10,500	180,300	2,400	193,200
Alternative 7	10,500	180,300	2,400	193,200

[a]All values in this table are absolute visitation levels (i.e., they are not incremental values relative to the baseline). The values were calculated using the median Latin Hypercube Sampling method and triangular distributions with the parameters from Table 3-3b.

Table 3-5. Incremental Change in Mean Winter Visitation Relative to the Alternative 3b Baseline in YNP for 2007–2008 (Number of Visitors)

	Cross-Country Skiing or Snowshoeing	Wheeled Access	Snowcoach	Snowmobile	Bus	Total Visitors
Alternative 1	–400	–1,500	36,200	28,000	0	62,300
Alternative 2	700	–300	38,300	0	0	38,700
Alternative 3a	–400	–1,500	14,100	13,100	0	25,300
Alternative 4	–300	–1,200	30,300	55,500	0	84,300
Alternative 5	–400	–1,500	36,300	38,800	0	73,200
Alternative 6	–400	–2,000	26,000	20,900	90,200	134,700
Alternative 7	–400	–1,500	36,200	28,000	0	62,300

Note: Incremental impacts are calculated as the difference between visitation under each action alternative and Alternative 3b, the no action alternative. All values have been rounded to the nearest 100.

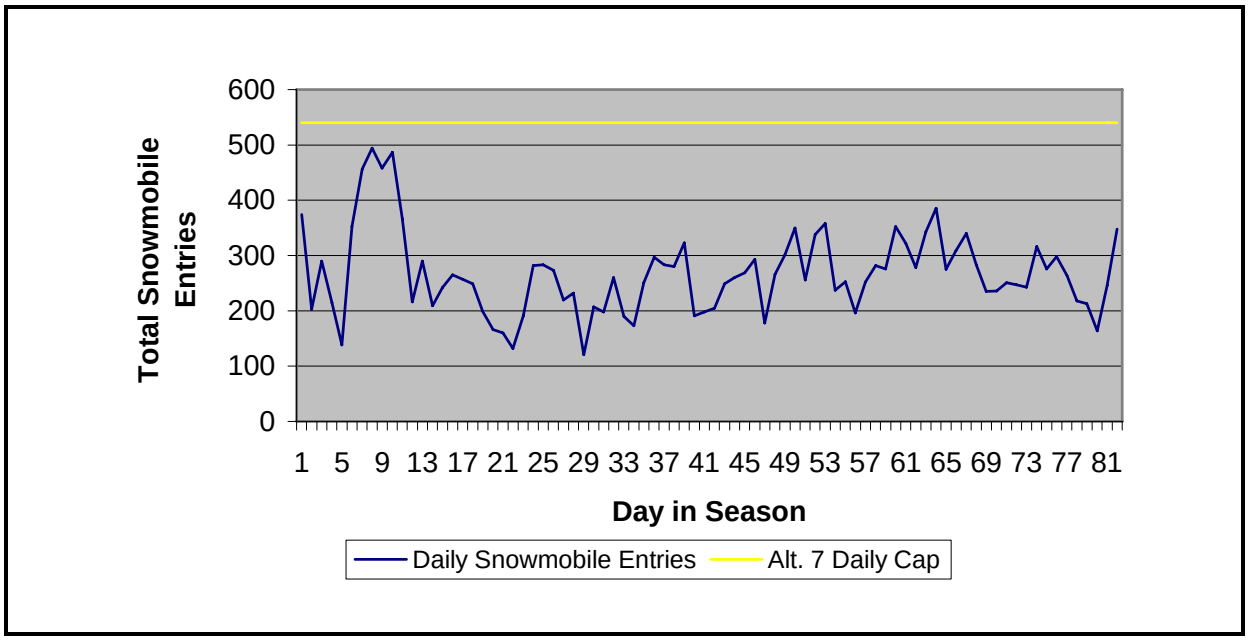
Table 3-6. Incremental Change in Mean Winter Visitation Relative to the Alternative 3b Baseline in GTNP for 2007–2008 (Number of Visitors)[a]

	Cross-Country Skiing or Snowshoeing	Wheeled Access	Snowmobile	Total Visitors
Alternative 1	–100	–6,100	2,400	–3,900
Alternative 2	0	5,500	0	5,500
Alternative 3a	–100	–6,100	2,400	–3,900
Alternative 4	–100	–6,100	4,000	–2,300
Alternative 5	–100	–6,100	2,400	–3,900
Alternative 6	–100	–6,100	2,400	–3,900
Alternative 7	–100	–6,100	2,400	–3,900

Note: Incremental impacts are calculated as the difference between visitation under each action alternative and Alternative 3b, the no action alternative. All values have been rounded to the nearest 100.

The results for snowmobilers generally follow the expected pattern between alternatives. Although Alternative 4 provides for double the number of snowmobiles compared to Alternatives 5 and 7, recent visitation under the temporary rule with the 100 percent guiding requirement indicates that even the cap specified for Alternatives 5 and 7 is unlikely to be met in the near future. Figure 3-3 displays daily snowmobile

Figure 3-3. Daily Snowmobile Entries for 2005–2006 and Alternative 7 Daily Cap



numbers for each day[4] of the 2005–2006 winter season compared to the daily cap of 540 for Alternatives 5 and 7. Alternative 4 allows for more unguided or noncommercial guiding than Alternative 5, resulting in somewhat greater numbers of unguided snowmobiles. Predicted visitation is the same under Alternatives 1 and 7. Alternative 1 has a higher daily cap on snowmobiles than Alternative 5, and the Alternative 5 cap is not predicted to be binding based on visitation in 2005–2006.

The visitation estimates in future years are assumed to be distributed across the more detailed subcategories in the same proportions as in Table 3-5. The distribution of visitation under Alternative 6 in YNP varies over the widest range, reflecting the uncertainty over the number of visitors who would take a commercial bus tour if the roads from the North and West entrances were plowed. The distributions are similar across the alternatives in GTNP. Conditions are not expected to differ radically across the alternatives in GTNP, and the visitation forecasts reflect this prediction. Even under Alternative 2, which

[4] The days are numbered sequentially. The 2005-2006 season lasted 82 days, starting on December 21, 2005 and ending on March 12, 2006.

bans snowmobiles, the low projected snowmobile use and large number of wheeled vehicles dominates the forecast.

3.2.3 Benefits

Benefits to Snowmobilers and Snowcoach Riders

The Alternative 3b baseline requires a complete ban on snowmobiles and snowcoaches starting in the 2007–2008 winter season. As discussed above in Section 3.2.2, Alternatives 1, 2, 3a, 4, 5, 6, and 7 will benefit snowmobilers (except Alternative 2) and snowcoach riders and providers of services to these visitors by allowing access to the parks. If implemented, the benefits of these management alternatives will begin accruing to oversnow visitors in the 2007–2008 winter season. This section describes the consumer surplus benefits to snowmobilers and snowcoach riders that will result from implementing the less-restrictive management options compared with baseline conditions.

If snowmobile and snowcoach use in the three parks is allowed, riders who visit the parks will be better off; they experience an increase in consumer surplus. Under historic conditions, snowmobile riders could either take a guided tour or ride unguided in YNP and GTNP. Depending on how the snowmobile and snowcoach riders feel about alternative activities, their consumer surplus gains associated with a particular alternative may be larger or smaller. The more acceptable substitutes an individual has for riding a snowmobile unguided in the parks or riding a snowcoach, the lower his or her gain in consumer surplus if they have access to the park, all else equal. Other alternatives in the GYA include the following:

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.

- Riding a snowmobile in the nearby national forests. 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. 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.

- Taking a snowcoach tour of YNP. 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 they were not allowed to ride a snowmobile. 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* (NPS, 2003b) confirm that the majority of snowmobilers would not visit the park if snowmobiles were banned.
- Taking a guided snowmobile tour of YNP or GTNP. 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, support, and planning assistance 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.
- Cross-county skiing, snowshoeing, or auto tours from the North Entrance are available; however, discussions with park staff and survey results indicate that most snowmobilers and snowcoach riders would not visit the park for these activities.
- Taking a commercially guided tour on a bus over plowed roads. Bus tours over plowed roads have not been offered in the winter in YNP, so it is difficult to predict how many snowmobilers and snowcoach riders would switch to bus tours.

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.

Conditions in the park also affect the size of the consumer surplus gain experienced by an individual. With fewer snowmobiles in the park, all visitors in the park, including snowmobile riders, may experience a larger increase in consumer surplus because the park will be less crowded and the potential problems of noise, air emissions, and safety considerations associated with snowmobiles will be lessened.

To calculate the consumer surplus benefits to snowmobilers and snowcoach riders of moving from the Alternative 3b baseline (a ban on oversnow vehicles) to the different alternatives, WTP estimates derived from the *2002–2003 Winter Visitor Survey* (NPS,2003b) were used. Estimates were based on the stated choice conjoint experiment, Model 2 (mixed logit) from Table 6-7 of Appendix 1.[5] The survey and regression models used to calculate WTP in this report are described in Appendix 1. To calculate WTP values from the survey results, conditions under each alternative need to be described in terms of the trip characteristics and conditions in the park included as attributes in the conjoint model (see Appendix 1 for more details on attribute levels). The attributes were coded as follows for the alternatives for snowmobile and snowcoach riders:

- Alternative 3b, snowmobile and snowcoach riders not in the park (opt-out level of utility)
- Alternative 1, guided trip, on a mixture of low crowding days (low crowding at entrance and destination, smooth road surface, low noise and emissions) and low/ moderate crowding days (low crowding at entrance and moderate crowding at destination, rough and bumpy road surface, moderate noise and emissions)
- Alternative 2, for snowcoaches guided trip on all low crowding days (low crowding at entrance and destination, smooth road surface, low noise and emissions)
- Alternative 3a, guided trip from the South Entrance on all low crowding days (low crowding at entrance and destination, smooth road surface, low noise and emissions)

[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.

- Alternative 4, mixture of guided and unguided snowmobile trips, guided snowcoach trips, on a mixture of high and moderate crowding days (moderate crowding at entrance and moderate or high crowding at destination, rough and bumpy road surface, moderate noise and emissions)
- Alternative 5, mixture of guided and unguided snowmobile trips, guided snowcoach trips, on a mixture of moderate and low crowding days (low crowding at entrance and moderate crowding at destination, rough and bumpy road surface, moderate noise and emissions)
- Alternative 6, guided trip from South Entrance on low and moderate crowding days (low crowding at entrance and low or moderate crowding at destination, smooth road surface, low noise and emissions)
- Alternative 7, guided trip, on a mixture of low crowding days (low crowding at entrance and destination, smooth road surface, low noise and emissions) and low/ moderate crowding days (low crowding at entrance and moderate crowding at destination, rough and bumpy road surface, moderate noise and emissions)

The change in welfare, or WTP, for each type of visitor for each action alternative is the difference between utility under the action alternative and utility under the baseline.

The change in welfare, or WTP, for each type of visitor for each action alternative is the difference between utility under the action alternative and utility under the baseline. For skiers and wheeled-vehicle users who visit the park under Alternative 3b, conditions become noisier and more crowded leading to a loss of utility. Snowmobilers and snowcoach riders, as well as bus riders in Alternative 6, do not visit the park under baseline conditions. In this case, utility increases when they are allowed into the park under the action alternatives.

Table 3-7 contains the WTP point estimates for snowmobile and snowcoach riders for each alternative. It must be emphasized that the WTP values reported in Table 3-7 represent mean estimates (within a range of uncertainty) based on the modeling approaches discussed in Appendix 1. For each action alternative, the expected number of low, moderate, and high crowding days was calculated based on 2005–2006 visitation and forecast visitation for the alternative. Using the predicted percentage of low, moderate, and high crowding under each action alternative, a weighted WTP was created. Table 3-8 presents the percentage of low, moderate, and high crowding expected under each alternative, based on the definitions of moderate and low crowding used in the *2002–2003 Winter*

Table 3-7. Mid-Value of Per-Day WTP for Guided and Unguided Snowmobile and Snowcoach Riders to Change from the Alternative 3b Baseline to Alternatives 1, 2, 3a, 4, 5, 6, and 7[a]

	Guided Snowmobile	Unguided Snowmobile	Snowcoach	Bus
Alternative 1 weighted average	$184	NA	$169	NA
Alternative 2 weighted average	NA	NA	$350	NA
Alternative 3a weighted average	$305	NA	$264	NA
Alternative 4 weighted average	$36	$296	$49	NA
Alternative 5 weighted average	$111	$371	$106	NA
Alternative 6 weighted average	$280	NA	$244	$145
Alternative 7 weighted average	$184	NA	$169	NA
GTNP low crowding	$278	$538	NA	NA

[a]Change in utility based on regression results for Model 2 for visiting under conditions when snowmobiles banned, see Table 6-7 of Appendix 1. WTP values are a weighted average based on percentage of high, moderate and low crowding days during the season predicted under each alternative. 2003 dollars.

Table 3-8. Percentage of High, Moderate, and Low Crowding Days at the Entrance and Destination for Snowmobiles Expected During the Season in YNP[a]

	High	Moderate	Low
Alternative 1	0%	Destination: 60%	Entrance: 100% Destination: 40%
Alternative 3a	0%	0%	Entrance: 100% Destination: 100%
Alternative 4	Destination: 16%	Entrance: 100% Destination: 84%	0%
Alternative 5	0%	Destination: 100%	Entrance: 100%
Alternative 6	0%	Destination: 13%	Entrance: 100% Destination: 87%
Alternative 7	0%	Destination: 60%	Entrance: 100% Destination: 40%

[a]High, 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 2005–2006 winter season, visitation was adjusted for changes in visitation forecast under each alternative. Snowmobiles are banned under Alternative 2.

Visitor Survey (250 or fewer snowmobiles is a low crowding day, up to 650 is a moderate crowding day, and over 650 is a high crowding day) and the expected visitation levels under each alternative. For GTNP, WTP is based on the assumption that all days are low crowding and the trip originates from

GTNP. In the Monte Carlo model WTP varied according to a triangular distribution from 10 percent below the mean point estimate to 10 percent above the point estimate.

WTP for commercial wheeled vehicle trips under Alternative 6 cannot be estimated from existing survey data. Wheeled commercial trips into the heart of YNP were not offered as a choice in the 2002–2003 visitor survey, and Duffield and Neher (2000) did not ask about commercial trips, only trips in private vehicles. In the model, we estimate WTP for a bus trip using a triangular distribution with a minimum of $45 (the cost of a bus trip assumed in the expenditure portion of the model) and a maximum of $244, the average of the snowcoach and snowmobile WTP.

The survey did not include an attribute describing whether all the other snowmobiles in the park 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 gains in Alternatives 1, 3a, and 6 may be larger than in Alternatives 4 and 5.

Consumer Surplus Gains of Alternatives 1, 2, 3a, 4, 5, 6, and 7. Using the WTP values from Table 3-7, the total consumer surplus benefits for snowmobilers and snowcoach riders under Alternatives 1, 2, 3a, 4, 5, 6, and 7 relative to the Alternative 3b baseline were calculated. Table 3-9 presents the mean estimates of total consumer surplus gains for 2007–2008 based on the incremental changes in visitation and WTP values for each alternative. Again, it must be emphasized that these estimates are based on mean WTP estimates (within a range of uncertainty).

Alternatives 1, 3a, 6, and 7 require 100 percent of snowmobiles in YNP to be commercially guided. This requirement results in lower estimated consumer surplus gains compared with Alternatives 4 and 5 where some of the trips were unguided. Both the survey results and visitation under the historic trend, when a majority of snowmobilers were unguided, suggest a preference for unguided trips over guided trips. In addition, some visitors may find the cost of a guided tour to be prohibitive, while for others the added cost of a guided tour will limit the choice set of recreational options for the rest of the trip. The Model 2 results in Appendix 1 support the contention

Table 3-9a. Mean Estimated Consumer Surplus Gains for Snowmobile, Snowcoach, and Bus Riders in YNP Relative to Alternative 3b, 2007–2008

	Snowcoach	Snowmobile	Bus	Total
Alternative 1	$7,141,800	$6,009,500	$0	$13,151,300
Alternative 2	$15,641,100	$0	$0	$15,641,100
Alternative 3a	$4,328,400	$4,667,000	$0	$8,995,400
Alternative 4	$1,736,100	$10,986,200	$0	$12,722,300
Alternative 5	$4,485,400	$8,684,000	$0	$13,169,400
Alternative 6	$7,389,900	$6,817,000	$13,041,200	$27,248,100
Alternative 7	$7,140,100	$6,006,900	$0	$13,147,000

Note: All values have been rounded to the nearest 100. 2003 dollars.

Table 3-9b. Mean Estimated Consumer Surplus Gains for Snowmobile Riders in GTNP Relative to Alternative 3b, 2007–2008

	Snowmobile
Alternative 1	$1,520,400
Alternative 2	$0
Alternative 3a	$1,523,100
Alternative 4	$2,026,400
Alternative 5	$1,515,000
Alternative 6	$1,532,200
Alternative 7	$1,525,400

Note: All values have been rounded to the nearest 100. 2003 dollars.

that, on average, snowmobilers prefer unguided to guided snowmobile trips, although this is not true for all snowmobilers. In GTNP, similar visitation projections and WTP values result in very similar estimates of consumer surplus gains for snowmobile riders.

Alternatives 4 allows for 25 percent of snowmobiles to be unguided or noncommercially guided. Alternative 5 stipulates that 20 percent of snowmobilers in YNP may be unguided. Noncommercially guided trips 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. Unguided and noncommercially guided trips should also lower

the cost of the tour compared with traveling with a commercial guide.

The snowmobile technology requirements imposed by Alternatives 1, 2, 3a, 4, 5, 6 and 7 are a potential limiting factor in the consumer surplus gains that are not reflected in the WTP estimates. For almost all snowmobiles under all the alternatives, BAT snowmobile technology is required.

Alternative 2, which emphasizes snowcoach access, results in the largest consumer surplus gains for snowcoach riders. Alternatives 1 and 6 provide the second and third highest gains, mostly due to higher snowcoach visitation, but also higher WTP values than Alternatives 4 and 5.

The snowmobile technology requirements imposed by Alternatives 1, 2, 3a, 4, 5, 6, and 7 are a potential limiting factor in the consumer surplus gains that are not reflected in the WTP estimates. For almost all snowmobiles under all the alternatives, BAT snowmobile technology is required. Local snowmobilers who own traditional two-stroke models may experience lower consumer surplus gains because they would be unable to use their machines in the GYA parks. However, renters and individuals who already own the permitted models should experience welfare gains. Those who 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 snowmobile-related health effects than GYA snowmobilers in past seasons.

Benefits to Businesses

Compared with the Alternative 3b baseline, Alternatives 1, 2, 3a, 4, 5, 6, and 7 will result in increased numbers of visitors in YNP, GTNP, and the Parkway. The increase will positively affect the suppliers of oversnow vehicle and other tourism-related services in the GYA.

Compared with the Alternative 3b baseline, Alternatives 1, 2, 3a, 4, 5, 6, and 7 will result in increased numbers of visitors in YNP, GTNP, and the Parkway. The increase will positively affect the suppliers of oversnow vehicle and other tourism-related services in the GYA.

To calculate gains in producer surplus to businesses, first changes in business revenue relative to the Alternative 3b baseline were calculated. For each alternative, revenue changes are reported for eight spending/business categories. To estimate these values, the alternative-specific estimates of the change in the number of visitors were multiplied by the average (per visitor) spending in each category, where per visitor spending is based on responses to the 2002–2003 visitor survey (NPS, 2003a). Under Alternative 6, bus trips were assumed to cost $45 per person based on the cost of summer bus tours in the park.

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).[6]

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 3-10a and 3-10b 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

Table 3-10a. Mean Estimated Producer Surplus Gains Relative to Alternative 3b in YNP, 2007–2008 to 2016–2017

	Alternative 1	Alternative 2	Alternative 3a	Alternative 4	Alternative 5	Alternative 6	Alternative 7
2007–2008	$555,500	$225,900	$236,600	$820,600	$671,300	$1,283,500	$555,000
2008–2009	$563,400	$229,000	$238,300	$828,200	$675,900	$1,295,100	$563,300
2009–2010	$571,500	$232,200	$239,200	$836,200	$677,600	$1,305,400	$571,400
2010–2011	$578,800	$235,300	$240,400	$842,700	$679,300	$1,316,600	$578,800
2011–2012	$585,700	$238,100	$241,600	$849,100	$681,000	$1,325,600	$586,200
2012–2013	$591,600	$240,900	$242,300	$854,800	$682,500	$1,333,300	$591,900
2013–2014	$598,000	$243,300	$243,200	$860,300	$684,100	$1,340,300	$598,100
2014–2015	$603,500	$245,400	$244,500	$865,500	$685,500	$1,347,100	$604,100
2015–2016	$608,300	$247,500	$245,100	$869,900	$686,400	$1,354,300	$608,300
2016–2017	$612,000	$249,200	$245,700	$873,700	$687,700	$1,356,800	$612,400
Total	$5,868,300	$2,386,800	$2,416,900	$8,501,000	$6,811,300	$13,258,000	$5,869,500

Note: All values have been rounded to the nearest 100. 2003 dollars.

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

Table 3-10b. Mean Estimated Producer Surplus Gains Relative to Alternative 3b in GTNP, 2007–2008 to 2016–2017

	Alternative 1	Alternative 2	Alternative 3a	Alternative 4	Alternative 5	Alternative 6	Alternative 7
2007–2008	$4,400	$31,400	$4,800	$23,700	$2,500	–$400	$3,300
2008–2009	$3,900	$34,100	$3,800	$25,800	$3,300	–$200	$3,800
2009–2010	$4,500	$33,200	$5,900	$26,500	$4,300	–$900	$3,400
2010–2011	$5,100	$35,500	$5,400	$25,900	$4,900	–$1,200	$4,400
2011–2012	$5,400	$36,400	$4,500	$27,600	$4,600	–$200	$4,600
2012–2013	$4,800	$37,800	$4,300	$28,300	$5,000	–$700	$5,900
2013–2014	$5,200	$39,900	$5,000	$29,400	$5,600	–$500	$4,400
2014–2015	$5,200	$41,200	$5,700	$30,600	$6,000	–$1,500	$6,100
2015–2016	$5,900	$42,800	–$7,100	$32,000	$3,700	–$2,600	$4,700
2016–2017	$6,000	$44,700	–$7,600	$31,900	$5,300	–$200	$5,400

Note: All values have been rounded to the nearest 100. 2003 dollars.

Alternative 3b baseline for YNP and GTNP. The calculations presented in Table 3-10 assume that each snowmobile or snowcoach visitor represents a new visitor to the area and thus additional spending relative to Alternative 3b.

Impacts through National Park Expenditures in YNP, GTNP, or the Parkway of Alternative 1 2, 3a, 4, 5, 6, or 7

In 2006–2007, snowmobilers paid $20 for a 7-day pass to enter the parks, and snowcoaches also pay an entrance fee based on the number of passengers. Revenue from entrance fees will decline under the Alternative 3b baseline relative to current and historic visitation (if snowmobile and snowcoach visitation is not offset by increases in visitation by wheeled vehicles or skiers).[7] Under Alternative 1, 2, 3a, 4, 5, 6, or 7, if visitation is higher than it would have been under the Alternative 3b 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 spend more money in the surrounding communities.

[7]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.

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 1 2, 3a, 4, 5, 6, or 7

West Yellowstone, Montana, applies a 3 percent resort tax to lodging, dining, bars, snowmobile rentals, and souvenir sales (Duffield and Neher, 2006). An increase in visitors to West Yellowstone as a result of Alternative 1, 2, 3a, 4, 5, 6, or 7 relative to the Alternative 3b 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 system and other public services.

3.2.4 Costs

As described in Sections 2.7 and 3.1 snowmobile use and to a lesser extent snowcoach use in national parks can be linked to a variety of negative externalities for other visitors. Under Alternatives 1, 3a, 4, 5, 6, and 7, snowmobile use would be allowed and all the action alternatives allow snowcoaches. 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. Many of the costs are difficult to quantify, so a monetary value is not estimated.

Through the 2006–2007 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 snowmobilers continued access to the parks.

Nonsnowmobiling winter recreators (including snowcoach riders) 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 (and to a lesser extent visitors can also be affected by snowcoach traffic). Among the more popular activities and means of experiencing the parks during the winter season other than snowmobiling and riding a snowcoach are cross-country skiing, snowshoeing, winter hiking, and automobile touring. As shown in Table 2-3, in 2005–2006 the number of winter recreation visits to the park was 94,476 to YNP, and nonsnowmobile visitors accounted for almost 70 percent of these visits. In 2002–2003 nonsnowmobile visitors accounted for just over 46 percent of these visits.

Negative externalities associated with snowmobiles and snowcoaches may reduce the value of trips to YNP, GTNP, and the Parkway, causing a loss of consumer surplus for other visitors. 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. The loss in consumer surplus to snowcoach riders is factored into the WTP values presented above, so the WTP values represent net benefits. An added stress is put on cross-country skiers recreating in the vicinity of snowmobile routes when they are forced to breathe snowmobile emissions. All the alternatives potentially result in consumer surplus losses for visitors not traveling in oversnow vehicles relative to the Alternative 3b baseline. To the extent that the presence of snowcoaches in YNP generates negative externalities for skiers using the same areas of the park, Alternative 2 will also result in consumer surplus losses for skiers. Wheeled vehicles in the northern part of YNP have very limited contact with snowcoaches because they do not share the same roads.

Consumer Surplus Losses

Primarily due to impacts from snowmobile sound and air emissions and to a lesser extent snowcoach emissions, skiers and wheeled-vehicle passengers are expected to experience consumer surplus losses when moving from the Alternative 3b baseline to Alternatives 1 through 7. To quantify these welfare losses, NPS used WTP estimates derived from the *2002–2003 Winter Visitor Survey* (NPS, 2003a). The same survey and regression models used to calculate WTP for snowmobile and snowcoach visitors are used for skiers and wheeled-vehicle passengers. Table 3-11 presents the point estimate for mean WTP 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, moderate, or high crowding days was calculated. WTP is negative because skiers and wheeled-vehicle passengers are generally worse off under Alternative 1, 2, 3a, 4, 5, 6, or 7 than under Alternative 3b. A negative value implies that these visitors would need to be compensated to reach the same level of welfare they experienced under the baseline. It is possible that some skiers may be worse off under Alternative 3b if they used snowcoaches or snowmobiles to access trails inside YNP or they skied on roads that were groomed for snowmobiles and snowcoaches. To the extent that this is true, the WTP measures overstate the losses associated with the action alternatives for skiers (but the distribution used to forecast visitation helps account for this possibility).

Using the predicted percentage of low, moderate and high crowding days under each alternative, a weighted WTP was created (see Table 3-8 for the percentage of low, moderate and high crowding days selected under each alternative). For skiers and wheeled vehicle passengers the Alternative 3b baseline utility is based on conditions in the park under a ban on snowmobiles and snowcoaches. WTP is calculated for moving from this baseline to Alternatives 1, 2, 3a, 4, 5 6 and 7. As with the WTP values for motorized recreation, the WTP value was drawn from a triangular distribution that varied between 10 percent above and 10 percent below the mean WTP.

Table 3-11 presents the WTP estimates. 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

Table 3-11. Midpoint of Per-Day WTP for Nonoversnow Visitors to Change from the Alternative 3b Baseline to Alternatives 1, 2, 3a, 4, 5, 6 or 7[a]

	Cross-Country Ski or Snowshoe	Wheeled Access
Alternative 1 weighted average WTP	–$156	–$156
Alternative 2 weighted average WTP	$0	$0
Alternative 3a weighted average WTP	–$85	–$85
Alternative 4 weighted average WTP	–$261	–$264
Alternative 5 weighted average WTP	–$204	–$204
Alternative 6 weighted average WTP	–$101	–$101
Alternative 7 weighted average WTP	–$156	–$156
GTNP	–$97	–$97

[a]Change in utility based on regression results for Model 2 for visiting under conditions when snowmobiles banned, see Table 6-7 of Appendix 1. Weighted average WTP based on percentage of high, moderate and low crowding days during the season. 2003 dollars.

not include an attribute describing whether all the other snowmobiles in the park 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 in Alternatives 4 and 5 may be larger than in the other alternatives.

Using the WTP values from Table 3-11, NPS calculated the total consumer surplus losses for nonoversnow visitors under Alternatives 1, 2, 3a, 4, 5, 6, and 7 compared to the Alternative 3b baseline. Table 3-12 summarizes the estimated consumer surplus losses in 2007–2008.

In addition to these quantified impacts of the action alternatives on visitors in the park under Alternative 3b and on nonsnowmobiling visitors for all the action alternatives except Alternative 2, 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 snowmobiles are banned, but will not visit under Alternatives 1, 2, 3a, 4, 5, 6,

Table 3-12a. Mean Estimated Consumer Surplus Losses for Cross-Country Skiers or Snowshoers and Wheeled Access Visitors Relative to Alternative 3b in YNP, 2007–2008

	Cross-Country Skiing or Snowshoeing	Wheeled Access	Total
Alternative 1	–$1,489,700	–$6,126,700	–$7,616,400
Alternative 2	$0	$0	$0
Alternative 3a	–$813,400	–$3,342,700	–$4,156,100
Alternative 4	–$2,502,700	–$8,024,600	–$10,527,300
Alternative 5	–$1,947,200	–$8,011,800	–$9,959,000
Alternative 6	–$965,600	$0	–$965,600
Alternative 7	–$1,490,900	–$6,126,000	–$7,616,900

Note: All values have been rounded to the nearest 100. 2003 dollars.

Table 3-12b. Mean Estimated Consumer Surplus Losses for Cross-Country Skiers or Snowshoers and Wheeled Access Visitors Relative to Alternative 3b in GTNP, 2007–2008

	Cross-Country Skiing or Snowshoeing	Wheeled Access	Total
Alternative 1	–$16,600	–$698,100	–$714,700
Alternative 2	$0	$0	$0
Alternative 3a	–$14,400	–$642,800	–$657,200
Alternative 4	–$16,600	–$688,700	–$705,300
Alternative 5	–$16,100	–$657,400	–$673,500
Alternative 6	–$16,200	–$709,100	–$725,300
Alternative 7	–$16,600	–$676,800	–$693,400

Note: All values have been rounded to the nearest 100. 2003 dollars.

and 7 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). 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 1, 2, 3a, 4, 5, 6, and 7, 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.[8]

Costs to Park Operations in YNP, GTNP, or the Parkway of Alternative 1 2, 3a, 4, 5, 6, or 7

Alternative 3b will reduce operating costs for the parks during the winter, in particular for YNP. The resources devoted to grooming roads, avalanche control at the East entrance and winter staffing under the action alternatives might be better spent on other activities within the park. To the extent that these other activities improve conditions in the park, the management costs incurred under the action alternatives will result in a loss to park staff and visitors.

Other Costs

Other potential costs from allowing continued snowmobile and snowcoach activity in the park include those associated with the risks of snowmobile and snowcoach-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, oversnow vehicle 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 safety risks that they face on the park roads, restrictions on snowmobile use would benefit these individuals by protecting their safety.[9] 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

[8]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.

[9]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.

operations, which would allow these resources to be redirected to other park management activities. Alternatives 1, 2, 3a, 4, 5, 6, and 7 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 and to a lesser extent snowcoach activity in the park would allow NPS to redirect resources that are currently devoted to snowmobile-related activities to other park management activities. Park rangers provide a range of services to oversnow vehicle passengers, 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 conditions would eliminate these demands on park resources as they relate to snowmobile and snowcoach use (although grooming would be required for snowcoach travelers under Alternative 2). Consequently, Alternatives 1, 2, 3a, 4, 5, 6, and 7 impose costs on the park by requiring it to continue to devote resources towards managing snowmobiles and to a lesser extent snowcoaches in the park that could be diverted to other uses under the Alternative 3b baseline.

3.2.5 Uncertainty

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.

A number of factors will affect the estimated costs and benefits associated with the winter management alternatives being analyzed. Distributions were developed for Alternatives 1, 2, 3a, 4, 5, 6, and 7 to show the range of impacts from 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:

- 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 1, 2, 3a, 4, 5, 6, and 7. 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 1, 2, 3a, 4, 5, 6, and 7 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.

- 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 4 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, losses to nonsnowmobilers under Alternatives 1, 2, 3a, 4, 5, 6, and 7 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 park natural resources are protected. Including nonuse value could increase the consumer surplus losses associated with Alternatives 1, 2, 3a, 4, 5, 6, and 7.
- 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.

3.3 SUMMARY

Six winter use management alternatives are analyzed relative to the Alternative 3b baseline to examine the effect of allowing the use of snowmobiles and snowcoaches in YNP, GTNP, and the Parkway. Under the Alternative 3b baseline, snowmobile and snowcoach use would be prohibited. Alternatives 1, 2, 3a, 4, 5, 6, and 7 allow for continued recreational snowmobile use (except Alternative 2) and snowcoach use subject to daily limits on the number of snowmobiles and snowcoaches that can enter the parks, BAT restrictions, and requirements that most or all of the snowmobiles be on guided tours. Alternative 6 adds commercially guided bus tours from the West Entrance to provide a broader range of recreational options for winter visitors.

The primary beneficiaries of Alternatives 1, 2, 3a, 4, 5, 6, and 7 relative to the Alternative 3b baseline are the park visitors who ride snowmobiles or snowcoaches in the park and passengers on the proposed commercial bus tours 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 6 is estimated to provide the greatest consumer surplus benefits due to the commercial bus access. The daily caps on snowmobile use vary across the seven alternatives, with Alternative 4 allowing the most snowmobiles per day into the parks. Alternatives 1, 3a, 6, and 7 require snowmobilers to be part of a guided tour in YNP, 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 4 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.

Estimates of the total present value of quantified net benefits expected from Alternatives 1, 2, 3a, 4, 5, 6, and 7 are calculated over a 10-year horizon from the 2007–2008 winter season through the 2016–2017 winter season. A range of net benefits is calculated to acknowledge uncertainty in the benefit and cost estimates resulting from uncertainty in the visitation changes associated with the action alternatives. Tables 3-13a and 3-13b present the total present value of quantified net benefits for both YNP and GTNP, respectively.

Table 3-13a. Total Present Value of Net Benefits for YNP Relative to the Alternative 3b Baseline, 2007–2008 through 2016–2017

		Total Present Value of Net Benefits
Alternative 1	Discounted at 3%[a]	$54,806,400
	Discounted at 7%[b]	$44,971,900
Alternative 2	Discounted at 3%[a]	$142,655,200
	Discounted at 7%[b]	$117,056,700
Alternative 3a	Discounted at 3%[a]	$43,176,100
	Discounted at 7%[b]	$35,554,800
Alternative 4	Discounted at 3%[a]	$22,416,800
	Discounted at 7%[b]	$18,638,400
Alternative 5	Discounted at 3%[a]	$30,476,600
	Discounted at 7%[b]	$25,244,500
Alternative 6	Discounted at 3%[a]	$240,417,300
	Discounted at 7%[b]	$197,677,800
Alternative 7	Discounted at 3%[a]	$54,807,000
	Discounted at 7%[b]	$44,969,100

Note: All values have been rounded to the nearest 100. 2003 dollars.

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

[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.

Table 3-13b. Total Present Value of Net Benefits for GTNP Relative to the Alternative 3b Baseline, 2007–2008 through 2016–2017

		Total Present Value of Net Benefits
Alternative 1	Discounted at 3%[a]	$8,589,200
	Discounted at 7%[b]	$6,864,200
Alternative 2	Discounted at 3%[a]	$339,200
	Discounted at 7%[b]	$271,000
Alternative 3a	Discounted at 3%[a]	$8,925,300
	Discounted at 7%[b]	$7,149,700
Alternative 4	Discounted at 3%[a]	$14,239,600
	Discounted at 7%[b]	$11,377,900
Alternative 5	Discounted at 3%[a]	$8,867,600
	Discounted at 7%[b]	$7,084,600
Alternative 6	Discounted at 3%[a]	$8,416,600
	Discounted at 7%[b]	$6,727,300
Alternative 7	Discounted at 3%[a]	$8,579,600
	Discounted at 7%[b]	$6,853,800

Note: All values have been rounded to the nearest 100. 2003 dollars.

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

[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.

Table 3-14 presents the total present value of net benefits for both YNP and GTNP summed together. The amortized net benefits per year over the 10-year time frame of the analysis for this valuation case are presented in Table 3-15. The means of net benefits for the valuation case represented by Tables 3-14 and 3-15 are entirely positive for Alternatives 1, 2, 3a, 4, 5, 6, and 7.

Table 3-16 summarizes the changes in per-day consumer surplus that result from moving from alternatives with higher net benefits to alternatives with lower net benefits in YNP according to the results displayed in Table 3-14. The WTP values in the table are for a visitor who visits the park under the alternative. It does not factor in visitors who can not access the park because of the daily caps or who choose not to visit based on the activities choices. The changes in WTP from one alternative to another primarily reflect the change in crowding, noise, emissions and road conditions.

Table 3-14. Total Present Value of Quantified Net Benefits for the Winter Use Alternatives in the Greater Yellowstone Area Relative to the Alternative 3b Baseline, 2007–2008 through 2016–2017

		Total Present Value of Quantified Net Benefits[a]
Alternative 1	Discounted at 3%	$63,395,600
	Discounted at 7%	$51,836,100
Alternative 2	Discounted at 3%	$142,994,400
	Discounted at 7%	$117,327,700
Alternative 3a	Discounted at 3%	$52,101,400
	Discounted at 7%	$42,704,500
Alternative 4	Discounted at 3%	$36,656,400
	Discounted at 7%	$30,016,300
Alternative 5	Discounted at 3%	$39,344,200
	Discounted at 7%	$32,329,100
Alternative 6	Discounted at 3%	$248,833,900
	Discounted at 7%	$204,405,100
Alternative 7	Discounted at 3%	$63,386,600
	Discounted at 7%	$51,822,900

Note: All values have been rounded to the nearest 100. 2003 dollars.

[a]Office of Management and Budget Circular A-4 recommends a 7% discount rate in general, and a 3% discount rate when analyzing impacts to private consumption. All values in 2003 dollars.

Table 3-15. Quantified Net Benefits per Year for the Winter Use Alternatives in the Greater Yellowstone Area Relative to the Alternative 3b Baseline, 2007–2008 through 2016–2017

		Quantified Net Benefits per Year[a,b]
Alternative 1	Discounted at 3%	$7,431,898
	Discounted at 7%	$7,380,294
Alternative 2	Discounted at 3%	$16,763,306
	Discounted at 7%	$16,704,825
Alternative 3a	Discounted at 3%	$6,107,874
	Discounted at 7%	$6,080,160
Alternative 4	Discounted at 3%	$4,297,248
	Discounted at 7%	$4,273,646
Alternative 5	Discounted at 3%	$4,612,340
	Discounted at 7%	$4,602,937
Alternative 6	Discounted at 3%	$29,170,924
	Discounted at 7%	$29,102,688
Alternative 7	Discounted at 3%	$7,430,843
	Discounted at 7%	$7,378,415

Note: All values have been rounded to the nearest 100. 2003 dollars.

[a]Office of Management and Budget Circular A-4 recommends a 7% discount rate in general, and a 3% discount rate when analyzing impacts to private consumption. All values in 2003 dollars.

[b]This is the total present value of quantified net benefits reported in Table 17 amortized over the ten-year analysis timeframe at the indicated discount rate.

Table 3-16. Incremental Per-Day Consumer Surplus Between Alternatives as Net Benefits Increase in YNP

	Cross-Country Skiers and Snowshoers	Wheeled Vehicle Passengers	Snowmobile Riders	Snowcoach Passengers	Bus Passengers
Baseline to Alternative 6	–$101	–$101	$280	$244	$145
Alternative 6 to Alternative 2	$101	$101	–$280	$106	–$145
Alternative 2 to Alternatives 1 & 7	–$156	–$156	$184	–$181	$0
Alternatives 1 & 7 to Alternative 3a	$71	$71	$121	$95	$0
Alternative 3a to Alternative 5	–$119	–$119	Guided: –$191 Unguided: $371	–$158	$0
Alternative 5 to Alternative 4	–$57	–$57	Guided: –$75 Unguided: –$75	–$57	$0

Notes: WTP calculated using weighted average WTP (weighted by proportion of low, moderate and high crowding days).

The primary consumer group that would incur costs under Alternatives 1, 2, 3a, 4, 5, 6, and 7 would be the park visitors who do not ride oversnow vehicles. Alternative 2 results in the smallest losses for these visitors. Out of the set of alternatives that allow for continued snowmobile access to the parks, Alternative 6 is expected to impose the lowest costs on nonsnowmobile users because of the lower daily limits, guided tour requirements and restriction of oversnow vehicles to the South entrance.

For businesses, the producer surplus gains relative to the Alternative 3b baseline are expected to be ordered similar to the way consumer surplus gains are for snowmobilers and snowcoach riders because they are driven largely by the number of visitors. Alternative 6 is expected to have the greatest positive impact on local businesses because the bus access is expected to result in the largest increase in visitation.

Alternative 4, which allows the most snowmobiles and the most unguided snowmobiles, offers the second highest benefit to producers.

Tables 3-17a and 3-17b summarize the present value of the total quantified incremental benefits and costs for different types of visitors of each alternative relative to the Alternative 3b baseline for 2007–2008 through 2016–2017. Table 3-17a reflects the same pattern of benefits and costs in YNP as the values for 2007–2008 presented in Tables 3-9a, 3-10a, and 3-12a. The present value projections for GTNP in Table 3-14b are driven almost entirely by changes in visitation, since WTP does not vary across the alternatives for the different visitors.

Tables 3-18a and 3-18b show the incremental costs and benefits associated with moving from baseline to Alternative 6, Alternative 6 to Alternative 2, Alternative 2 to Alternative 1, Alternative 1 to Alternative 7, Alternative 7 to Alternative 5 and finally from Alternative 5 to Alternative 4 (in order from highest to lowest net benefits between Alternatives 1, 2, 3a, 4, 5, 6, and 7 from Table 3-14.).

Based on the results of this analysis, the gains to oversnow passengers and local businesses generally outweigh the losses to other visitors. However, as noted earlier in this section, there are a number of uncertainties that may be influencing this result. One important factor is the fact that the total costs and benefits provided in Table 3-17 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. 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. Against this, snowmobiles are unguided in GTNP, which will increase WTP for snowmobile trips in GTNP relative to YNP for alternatives that require guided snowmobile trips.

In addition, it is possible that both snowmobilers and nonsnowmobilers are providing responses to the visitor survey 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

Table 3-17a. Present Value of Projected Mean Incremental Benefits and Costs Relative to the Alternative 3b Baseline by Visitor Type in YNP, 2007–2008 through 2016–2017[a]

		Ski	Wheeled Access	Snowcoach	Snowmobile	Bus
Alternative 1	Discounted at 3%[b]	–$13,416,000	–$55,198,200	$66,152,400	$57,268,200	$0
	Discounted at 7%[c]	–$11,008,500	–$45,292,400	$54,282,000	$46,990,800	$0
Alternative 2	Discounted at 3%[b]	$37,000	–$15,500	$142,633,700	$0	$0
	Discounted at 7%[c]	$30,300	–$12,700	$117,039,000	$0	$0
Alternative 3a	Discounted at 3%[b]	–$7,334,900	–$30,149,900	$38,845,800	$41,815,000	$0
	Discounted at 7%[c]	–$6,018,600	–$24,739,300	$31,917,600	$34,395,100	$0
Alternative 4	Discounted at 3%[b]	–$22,524,500	–$72,232,100	$17,210,700	$99,962,700	$0
	Discounted at 7%[c]	–$18,482,400	–$59,270,100	$14,121,700	$82,269,300	$0
Alternative 5	Discounted at 3%[b]	–$17,538,800	–$72,144,600	$42,251,900	$77,908,000	$0
	Discounted at 7%[c]	–$14,391,400	–$59,198,100	$34,669,600	$64,164,500	$0
Alternative 6	Discounted at 3%[b]	–$8,704,700	–$131,900	$64,654,800	$59,499,700	$125,099,500
	Discounted at 7%[c]	–$7,142,600	–$106,600	$53,225,700	$49,046,800	$10,2654,500
Alternative 7	Discounted at 3%[b]	–$13,423,600	–$55,182,100	$66,130,800	$57,281,900	$0
	Discounted at 7%[c]	–$11,014,900	–$45,279,600	$54,263,300	$47,000,200	$0

[a]All dollar values in 2003 dollars and rounded to the nearest $100.

[b]The economics literature supports a 3% discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3% 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% 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.

Table 3-17b. Present Value of Projected Mean Incremental Benefits and Costs Relative to the Alternative 3b Baseline by Visitor Type in GTNP, 2007–2008 through 2016–2017

		Ski	Wheeled Access	Snowmobile
Alternative 1	Discounted at 3%[a]	–$182,400	–$7,915,900	$16,687,500
	Discounted at 7%[b]	–$145,800	–$6,323,000	$13,333,000
Alternative 2	Discounted at 3%[a]	$200	$339,000	$0
	Discounted at 7%[b]	$100	$270,900	$0
Alternative 3a	Discounted at 3%[a]	–$171,000	–$7,504,500	$16,600,800
	Discounted at 7%[b]	–$136,300	–$5,989,000	$13,275,000
Alternative 4	Discounted at 3%[a]	–$182,900	–$7,940,400	$22,362,900
	Discounted at 7%[b]	–$146,100	–$6,344,000	$17,868,000
Alternative 5	Discounted at 3%[a]	–$184,600	–$7,622,400	$16,674,600
	Discounted at 7%[b]	–$147,400	–$6,086,000	$13,318,000
Alternative 6	Discounted at 3%[a]	–$180,300	–$8,117,400	$16,714,300
	Discounted at 7%[b]	–$143,700	–$6,484,000	$13,355,000
Alternative 7	Discounted at 3%[a]	–$188,300	–$7,915,100	$16,683,000
	Discounted at 7%[b]	–$150,200	–$6,323,000	$13,327,000

Note: All values have been rounded to the nearest 100. 2003 dollars.

[a]The economics literature supports a 3% discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3% 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% 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.

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 results from the visitor survey used in the 2004 benefit-cost analysis (NPS, 2004a) to predict visitation under the current temporary rule actually understated the decline in snowmobile visitation, which is the opposite of what would be expected if snowmobile respondents behaved strategically.

The quantified net benefits are based in part on data from the 2002–2003 winter visitor survey of current winter visitors. The survey does not represent the values of individuals who do not currently visit, but who might start visiting if snowmobiles were restricted or prohibited. No attempt is made in the analysis to

Table 3-18a. Present Value of Projected Incremental Benefits and Costs from Highest Net Benefit Alternative to Lowest by Visitor Type in YNP, 2007–2008 through 2016–2017[a]

		Ski	Wheeled Access	Snowcoach	Snowmobile	Bus
Baseline to Alternative 6	Discounted at 3%[a]	–$8,704,700	–$131,900	$64,654,800	$59,499,700	$125,099,500
	Discounted at 7%[b]	–$7,142,600	–$106,600	$53,225,700	$152,611,500	$102,654,500
Alternative 6 to Alternative 2	Discounted at 3%[a]	$8,741,700	$116,400	$77,978,900	–$59,499,700	–$125,099,500
	Discounted at 7%[b]	$7,172,900	$93,900	$63,813,300	–$49,046,800	–$102,654,500
Alternative 2 to Alternative 1	Discounted at 3%[a]	–$13,453,000	–$5,5182,700	–$76,481,300	$57,268,200	$0
	Discounted at 7%[b]	–$11,038,800	–$4,5279,700	–$62,757,000	$46,990,800	$0
Alternative 1 to Alternative 7	Discounted at 3%[a]	–$7,600	$16,100	–$21,600	$13,700	$0
	Discounted at 7%[b]	–$6,400	$12,800	–$18,700	$9,400	$0
Alternative 7 to Alternative 3a	Discounted at 3%[a]	$6,088,700	$2,5032,200	–$27,285,000	–$15,466,900	$0
	Discounted at 7%[b]	$4,996,300	$2,0540,300	–$22,345,700	–$12,605,100	$0
Alternative 3a to Alternative 5	Discounted at 3%[a]	–$10,203,900	–$4,1994,700	$3,406,100	$36,093,000	$0
	Discounted at 7%[b]	–$8,372,800	–$3,4458,800	$2,752,000	$29,769,400	$0
Alternative 5 to Alternative 4	Discounted at 3%[a]	–$4,985,700	–$87,500	–$25,041,200	$22,054,700	$0
	Discounted at 7%[b]	–$4,091,000	–$72,000	–$20,547,900	$18,104,800	$0

Note: All values have been rounded to the nearest 100. 2003 dollars.

[a]The economics literature supports a 3% discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3% 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% 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.

estimate the number of people who do not currently visit, but might start except for bus riders in Alternative 6. Thus, the benefits of restricting or prohibiting snowmobiles may be understated.

Table 3-18b. Present Value of Projected Incremental Benefits and Costs from Highest Net Benefit Alternative to Lowest by Visitor Type in GTNP, 2007–2008 through 2016–2017

		Ski	Wheeled Access	Snowmobile
Baseline to Alternative 6	Discounted at 3%[a]	–$180,300	–$8,117,400	$16,714,300
	Discounted at 7%[b]	–$143,700	–$6,484,000	$13,355,000
Alternative 6 to Alternative 2	Discounted at 3%[a]	$180,500	$8,456,400	–$16,714,300
	Discounted at 7%[b]	$143,800	$6,754,900	–$13,355,000
Alternative 2 to Alternative 1	Discounted at 3%[a]	–$182,600	–$8,254,900	$16,687,500
	Discounted at 7%[b]	–$145,900	–$6,593,900	$13,333,000
Alternative 1 to Alternative 7	Discounted at 3%[a]	–$5,900	$800	–$4,500
	Discounted at 7%[b]	–$4,400	$0	–$6,000
Alternative 7 to Alternative 3a	Discounted at 3%[a]	$17,300	$410,600	–$82,200
	Discounted at 7%[b]	$13,900	$334,000	–$52,000
Alternative 3a to Alternative 5	Discounted at 3%[a]	–$13,600	–$117,900	$73,800
	Discounted at 7%[b]	–$11,100	–$97,000	$43,000
Alternative 5 to Alternative 4	Discounted at 3%[a]	$1,700	–$318,000	$5,688,300
	Discounted at 7%[b]	$1,300	–$258,000	$4,550,000

Note: All values have been rounded to the nearest 100. 2003 dollars.

[a]The economics literature supports a 3% discount rate in the valuation of public goods (e.g., Freeman, 1993). Federal rule-makings also support a 3% 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% 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.

3.4 ALTERNATIVE 7: THE PREFERRED ALTERNATIVE

NPS selected Alternative 7 as the preferred alternative; however, Alternatives 2 and 6 each have higher levels of quantified net benefits. Alternative 1 generates essentially the same level of quantified net benefits. Additional factors that are relevant in the selection of the preferred alternative include costs that could not be quantified and distributive equity concerns. With respect to costs that could not be quantified, Alternative 6 involves road plowing operations and moderate, adverse visibility impacts due to road sanding operations, neither of which were quantified in terms of monetized costs. This operation would reduce the quantified net benefits of

Alternative 6 relative to those of Alternative 7. With respect to distributive equity concerns, Alternative 7 better balances the visitor experiences of all visitor groups compared to all other action alternatives. The costs and benefits accruing to the different visitor groups are more evenly distributed in

Alternative 7 than in Alternative 2 and Alternative 6. The benefits of Alternative 2 are disproportionately associated with snowcoach riders. The benefits to snowmobile riders in Alternative 6 will be concentrated on riders who have access to the South entrance. Finally, the lack of any historical precedent for plowing roads and allowing commercial bus tours during the winter leads to large uncertainties as to the magnitude of the benefits associated with Alternative 6. For these reasons, NPS selected Alternative 7 as the preferred alternative.

4 Small Entity Impact Analysis

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

Changes to the management of oversnow vehicle 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 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. 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, and provides a final regulatory flexibility analysis.

Throughout this report, the impacts of the alternatives have been measured relative to one baseline, the no-action alternative, Alternative 3b. This baseline does not authorize oversnow motorized access to the park. Snowmobiles and snowcoaches would be prohibited, and the park would not groom any interior roads. All alternatives lead to increased revenue for small businesses compared with the baseline.

Section 1 presents Alternative 7 as the preferred alternative and discusses the reasons for this decision. From the point of view of small businesses, Alternative 4 might be marginally better depending on the popularity of guided snowmobile tours, because it may result in higher visitation than Alternative 7. 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 with the other alternatives that require 100 percent guided tours for snowmobiles in YNP—Alternatives 2, 3a, and 6—Alternative 7 may be better for small businesses in YNP because of the higher daily entrance limits, thus potentially increasing revenue generated by higher snowmobile visitation to the parks. The daily snowmobile limits under Alternative 6 in GTNP are higher, but Alternative 7 leaves the CDST open.

4.1 IDENTIFYING SMALL ENTITIES

Because businesses that offer winter recreational services are likely to be most affected, the focus of the analysis is on those firms.

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. Because businesses that offer winter recreational services are likely to be most affected, the focus of the analysis is on those firms.

For analysis of the small business impacts of these alternatives, NPS identified numerous companies providing recreational services in the area surrounding the parks. There were 43 different businesses identified that offered snowmobile rentals (including 21 concessionaires that offer guided tours), 13 companies offering snowcoach tours, and 14 companies offering guided cross-country skiing tours (including 10 companies offering tours through the park), although there may be others. The total number of unique businesses identified was only 54 because many of these businesses offer more than one recreational activity.

There were 43 snowmobile rental businesses (including 21 concessionaires that offer guided tours), 13 companies offering snowcoach tours, and 10 companies offering guided cross-country skiing tours in the park identified in the area, although there may be others.

A number of these businesses have multiple establishments in the area. A total of 84 establishments have been identified as being owned by these 54 firms. A large number of the snowmobile and snowcoach companies are located in West Yellowstone. Fifteen businesses offer snowmobile rentals, and five provide snowcoach rentals in West Yellowstone (three of these firms provide both snowmobile and snowcoach rentals). Overall, 33 establishments owned by companies providing winter recreational services were identified in West Yellowstone. Jackson, Wyoming, was second to West Yellowstone in number of snowmobile rental companies, with 13 companies identified. The city with the most companies providing cross-country

skiing tours is Bozeman, Montana, with two businesses. The rest of the companies are spread among numerous communities in the GYA.

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] When available, revenue estimates were obtained for the rest of the firms from *Info*USA (2004).

Among the businesses offering snowmobile, snowcoach, and/or cross-country skiing rentals and tours with available data, 15 have sales less than $500,000, 10 have sales between $500,000 and $1 million, 13 have sales between $1 and $3 million, 2 have sales between $3 and $5 million, 5 have sales between $5 and $10 million, and 3 firms have estimated sales between $10 and $25 million. Cross-country skiing companies are not directly affected by this regulation, but they may experience impacts on their business following changes in oversnow vehicle management. No information on annual revenue could be located for the remaining six companies identified.

Using the SBA criterion above and available sales estimates, 40 out of 48 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, 40 out of 48 businesses offering unguided snowmobile rentals or guided tours (either snowmobile, snowcoach, or skiing) with available revenue estimates were classified as small businesses.[3] For the purposes of this analysis, the remaining six companies for which no revenue estimates could be located were assumed to be small businesses. Thus, 46 out of 54

[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. When this occurs and information is available, revenue estimates are for the parent company. Some businesses have insufficient information on company structure, so these were treated individually.

companies offering recreational services in the area were classified as 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, revenue estimates for businesses in other tourism-related sectors were not collected. Instead, it was assumed that they are all small businesses.

4.2 IMPACT 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 seven alternatives considered in this report relative to the baseline.

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 seven alternatives considered in this report relative to the baseline. Expected changes in revenue and producer surplus across all firms are presented in Section 3. Section 3 estimates these impacts relative to the Alternative 3b 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.

4.2.1 Alternative 3b Baseline (Ban on Oversnow Vehicle Use)

Compared with the Alternative 3b 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 all other alternatives. It is possible, although unlikely, that small businesses that provide goods and services primarily to skiers or other visitors who do not ride a snowmobile or snowcoach may experience reductions in revenue. Alternative 3b 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, these businesses should be able to afford compliance with the regulatory alternatives. A relatively small number of firms that cater primarily to visitors other than snowmobile and snowcoach riders could potentially suffer negative impacts, but these impacts are typically not expected to be significant.

The projected reduction in visitation by visitors other than snowmobile and snowcoach riders as a result of implementing any of the action alternatives is less than 4,000 visitors in the scenarios with the largest estimated changes in visitation. However, projected increases in visitation by snowmobilers and snowcoach riders 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 or riding snowcoaches often provide goods and services used by these visitors as well and could potentially benefit from the increase in overall visitation. After considering the economic impacts of the oversnow vehicle management alternatives under consideration on small entities, NPS concludes that the preferred alternative (Alternative 1) would mitigate the impacts on most small businesses relative to the impacts under the Alternative 3b baseline (as would all other alternatives). Alternative 3b would have no incremental impacts on small businesses because it maintains baseline conditions. In cases where Alternatives 1, 2, 3a, 4, 5, 6, and 7 cause reduced revenues for a few specific firms compared with the Alternative 3b baseline, NPS expects that the declines would be very small.

After considering the economic impacts of the oversnow vehicle management alternatives under consideration on small entities, NPS concludes that the preferred alternative (Alternative 1) would mitigate the impacts on most small businesses relative to the impacts under the Alternative 3b baseline (as would all other alternatives).

Not all entrances will be affected equally by the alternatives. Compared with the baseline, Alternative 4 would have the greatest positive effect on snowmobile-related businesses at the West Entrance because the greatest number of snowmobiles are allowed through the West Entrance under that alternative. Alternative 1 would have a slightly smaller positive impact, followed by Alternatives 7, 5, and 6. There would be no change under Alternatives 2 and 3a.

The East Entrance is only open to recreational snowmobilers and snowcoaches under Alternatives 4 and 5. These are the only two alternatives that would affect businesses at the East Entrance relative to the Alternative 3b baseline. Establishments catering to snowmobilers would see a larger increase in business under Alternative 4.

Alternative 1 allows for slightly more recreational snowmobilers to enter through the South Entrance than Alternatives 3a, 4, 6, and 7. These five alternatives would result in the largest increase in business for snowmobiling-related companies at the South Entrance compared with the baseline.

The North Entrance is open to recreational snowmobiling and snowcoaches under Alternatives 1, 4, 5, and 7. The number of snowmobiles allowed through this entrance is only a small percentage of total snowmobiles allowed to enter the park. These alternatives would have a small positive influence on snowmobiling-related companies located at the North Entrance.

Disproportionality Analysis

NPS does not expect small entities to be substantially disadvantaged relative to large entities. First of all, although the entities identified vary substantially in size, 85% of operators identified are small businesses. Second, most small entities are expected to be positively affected under alternatives other than Alternative 3b. To the extent that small firms rely on revenue from visitors who do not ride snowmobiles or snowcoaches for a greater share of their total revenue, it is possible that they would be relatively disadvantaged if visitation by these visitors decreases. However, based on estimates of the proportion of business revenue attributable to snowmobilers and snowcoach riders, it appears that small businesses identified in the area actually tend to derive a smaller share of total revenue from visitors who do not ride snowmobiles or snowcoaches than large businesses.

Business Closure Analysis

As noted above, small businesses are generally expected to have increased revenue under Alternatives 1, 2, 3a, 4, 5, 6, and 7, while Alternative 3b has no incremental impact. There may be some negative impacts on revenue for businesses that primarily provide goods and services to visitors who do not ride

snowmobiles or snowcoaches. However, these impacts are expected to be relatively small, and no business closures are expected because of any of the regulatory alternatives considered.

4.3 FINAL REGULATORY FLEXIBILITY ANALYSIS

The threshold analysis was used to determine the expected impacts of the alternatives. The above discussion demonstrates that all the alternatives result in positive impacts. This is the basis for the final 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, record keeping, 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 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, published on March 29, 2002, 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).

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. A temporary rule was passed to cover the winter seasons of 2004–2005 to 2006–2007.

The new management alternatives are being considered for the winter season 2007–2008.

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 Rule. The final rule would implement 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 all snowmobilers to be on guided tours, and a requirement that snowmobiles used in the parks must meet BAT standards for emissions and noise. These requirements would 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, Executive Orders, and NPS management policies and regulations. The three parks subject to these regulations currently have park-specific regulations that designate areas and routes open to snowmobile and snowplane use. Although the temporary winter use plan allows temporary restricted access to oversnow vehicles, the regulations expire

after the 2006–2007 season. Absent implementation of a new winter use plan, no recreational oversnow access would be permitted. The new alternatives now under consideration would allow recreational oversnow access while protecting park resources and values.

The Kind and Number of Small Entities to Which the Rule Will Apply. The final rule would affect numerous small entities that supply snowmobile rentals, lodging, restaurants, gas, and other retail, each having $5 million or less in annual sales, in addition to other small businesses in local communities. There were 54 businesses offering snowmobile rentals, snowcoach rentals, and/or cross-country ski rentals identified in the region (owning 84 establishments). Based on revenue data from *Info*USA for these companies, NPS estimates that 46 are small businesses. NPS expects the final rule to have no negative impacts on all identified small entities as well as additional small entities that could not be identified.

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

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

Alternatives that May Reduce the Impacts on Small Businesses. Alternative 4 has the highest daily snowmobile limits and allows for 25% of snowmobilers to be on noncommercially guided or unguided tours; it would most likely result in the largest number of snowmobilers visiting the park. Thus, Alternative 4 would likely be the most beneficial to small businesses overall. However, Alternative 6, which allows guided commercial wheeled access to parts of the park through the North and West Entrances, is forecast to have the highest visitation. Visitation under Alternative 6 is the most uncertain because of the commercial wheeled access provision.

Small businesses near the East Entrance and the town of Cody, Wyoming, would benefit more from Alternatives 4 and 5, which allow snowmobile traffic through the East Entrance. The East Entrance will be closed to snowmobile traffic under both the no-action alternative and Alternative 7.

Nevertheless, Alternative 7 was selected as the preferred alternative for reasons discussed in the DEIS (NPS, 2006).

4.4 ASSESSMENT

Based on the screening analyses above and after considering the economic impacts of the snowmobile management alternatives under consideration on small entities, NPS concludes that management Alternatives 1, 2, 3a, 4, 5, 6, and 7 will have positive impacts and will not have significant negative impacts on small businesses relative to the Alternative 3b baseline.

References

Aune, K.E. 1981. "Impacts of Winter Recreationists on Wildlife in a Portion of Yellowstone National Park, Wyoming." M.S. thesis, Montana State University, Bozeman.

Boardman, A.E., D.H. Greenberg, A.R. Vining, and D.L. Weimer. 1996. *Cost-Benefit Analysis: Concepts and Practice*. Toronto: Prentice-Hall.

Borrie, W.T., W.A. Freimund, M.A. Davenport, R.E. Manning, W.A. Valliere, and B. Wong. 1999. *Winter Visit and Visitor Characteristics of Yellowstone National Park: Final Report 1999*. Missoula, MT: University of Montana School of Forestry and Montpeilier, VT: University of Vermont.

Boyle, Stephen A., and Fred B. Samson. 1985. "Effects of Nonconsumptive Recreation on Wildlife: A Review." *Wildlife Society Bulletin* 13:110-116.

BRW, Inc. 1997. *Final Draft Transportation Study: Dunraven Road, July 1997*. Prepared in association with Lee Engineering, Inc. for the National park Service, Denver Service Center.

Bullock, Michelle, RTI, January 2001. Personal communication.

Dorrance, M.J., P.J. Savage, and D.E. Huff. 1975. "Effects of Snowmobiles on White-Tailed Deer." *Journal of Wildlife Management* 39(3):563-569.

Duffield, J.W., and C.J. Neher. 2000. *Final Report: Winter 1998-99 Visitor Survey, Yellowstone National Park, Grand Teton National Park, and the Greater Yellowstone Area*. Prepared for the National Park Service, Denver, CO. Missoula, MT: Bioeconomics, Inc.

Duffield, J.W. and C.J. Neher, 2006. Final Technical Report: Regional Economic Impact Analysis for Yellowstone and Grand Teton National Parks and the John D. Rockefeller, Jr. Memorial Parkway Winter Use Draft Environmental Impact Statement. Prepared for the National Park Service, Denver, CO. Missoula, MT: Bioeconomics, Inc.

Dun & Bradstreet (D&B). 2001. *Industry Norms & Key Business Ratios. Desk-Top Edition*. Murray Hill, NJ: D&B.

Eckstein, R.G., T.F. O'Brien, O.J. Rongstad, and J.G. Bollinger. 1979. "Snowmobile Effects on Movements of White-Tailed Deer: A Case-Study." *Environmental Conservation* 6(1):45-51.

Freddy, D.J., W.M. Bronaugh, and M.C. Fowler. 1986. "Responses of Mule Deer to Disturbance by Persons Afoot and Snowmobiles." *Wildlife Society Bulletin* 14:63-68.

Freeman, A. Myrick III. 1993. *The Measurement of Environmental and Resource Values: Theory and Methods.* Washington, DC: Resources for the Future.

*Info*USA 2004. <http://www.infousa.com>.

ISMA. Manufacturers Technology Improvements. <http://www.snowmobile.org/t_techimp.htm.>. As obtained on October 13, 2000.

Kado, N.Y., R.A. Okamoto, J. Karim, and P.A. Kuzmicky. 2000. Airborne Particle Emissions from 2- and 4-Stroke Outboard Marine Engines: Polycyclic Aromatic Hydrocarbon and Bioassay Analyses." *Environmental Science & Technology* 34:2714-2720.

League for the Hard of Hearing. Noise Center of the League: Recreational Noise Fact Sheet. <http://www.lhh.org/noise/facts/recreation.htm>. As obtained in October 2000.

Malm, William C. 1999. *Introduction to Visibility*. Prepared under Cooperative Agreement CA2350-97-001: T097-04, T098-06. Fort Collins, CO: Cooperative Institute for Research in the Atmosphere, NPS Visibility Program.

Moen, A.N., S. Whittemore, and B. Buxton. 1982. "Effects of Disturbance by Snowmobiles on Heart Rate of Captive White-tailed Deer." *New York Fish and Game Journal* 29(2):176-183.

National Park Service (NPS). 1990. *Winter Use Plan Environmental Assessment, Yellowstone and Grand Teton National Parks and John D. Rockefeller, Jr., Memorial Parkway, Wyoming, Idaho, and Montana*. Denver, CO: National Park Service.

National Park Service (NPS). 1999. *Statistical Abstract 1999*. Denver, CO: National Park Service.

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

National Park Service (NPS). "Effects of Visual Air Quality on Visitor Experience." <http://www2.nature.nps.gov/ard/vis/visitexp.htm>. As obtained on October 25, 2000b.

National Park Service (NPS). 2000c. *Winter Use Plans: Final Environmental Impact Statement for the Yellowstone and Grand Teton National Parks and John D. Rockefeller, Jr., Memorial Parkway*. <http://www.nps.gov/planning/yell/winterfinal/frmain.htm>.

National Park Service (NPS). 2002. *Winter Use Plans. Draft. Supplemental Environmental Impact Statement*.

National Park Service (NPS). 2003a. *2002–2003 Winter Visitor Survey: Yellowstone and Grand Teton National Parks*. Prepared for the National Park Service. Research Triangle Park, NC: RTI.

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 Service (NPS). August 2004a. *Temporary Winter Use Plans Environmental Assessment.* Washington, DC: National Park Service.

National Park Service (NPS). August 2004b. *Economic Analysis of Temporary Regulations on Snowmobile Use in the Greater Yellowstone Area, Final Report.* Washington, DC: National Park Service

National Park Service (NPS). 2007. *Winter Use Plans: Draft Environmental Impact Statement for the Yellowstone and Grand Teton National Parks and John D. Rockefeller, Jr., Memorial Parkway, January 2007.* Washington, DC: National Park Service.

Nelson, M.E., and L.D. Mech. 1984. "Home Range Formation and Dispersal of Deer in Northeastern Minnesota." *J. Mammal*. 65(4):567-575.

Neumann, P.W., and H.G. Merriam. 1972. "Ecological Effects of Snowmobiles." *The Can. Field Nat.* 86:207-212.

Office of Management and Budget (OMB). 2000. Guidelines to Standardize Measures of Costs and Benefits and the Format of Accounting Statements. Memorandum M-00-08. March 22, 2000.

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.

Overseas Marketing Group (OMGSIC). Hearing Problems and Diseases. <http://www.omgsic.com/2.4v.htm.>. As obtained on October 9, 2000.

Paquet, P.C., J. Wierczhowski, and C. Callaghan. 1996. *Summary Report of the Effects of Human Activity on Gray Wolves in the Bow River Valley, Banff National Park, Alberta*. Prepared for Parks Canada, Banff, Alberta.

Pearce, D., and D. Moran. 1994. *The Economic Value of Biodiversity*. London: Earthscan Publication.

Pruitt, W.O. Jr. 1971. Paper presented at Conference on Snowmobiles and All-Terrain Vehicles at University of Ontario, Canada.

Rasker, R., N. Tirrel, and D. Kloepfer. 1992. "The Wealth of Nature: Rural Economies of the Greater Yellowstone." In *Symposium Proceedings, the Economic Value of Wilderness*. May 9-11, 1991. Jackson, WY. Athens, GA: USDA Forest Service Southeast Experiment Station.

Richens, V.B., and G.R. Lavigne. 1978. "Response of White-Tailed Deer to Snowmobiles and Snowmobile Trails in Maine." *Can. Field Nat.* 92(4):334-344.

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.

Schmid, W.D. 1971. "Modifications of the Subnivean Microclimate by Snowmobiles." Proceedings of the Snow and Ice Symposium, Co-operative Wildlife Research Unit, Iowa State University, Ames. pp. 251-257.

U.S. Bureau of Labor Statistics. Consumer Price Index. Series CUUR000SAR. <http://146.142.24/cgi-bin/surveymost>. As obtained on October 26, 2000.

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

U.S. Department of the Interior and U.S. Geological Survey (USDOI/USGS). 1998. *Effects of Snowmobile Use on Snowpack Chemistry in Yellowstone National Park, 1998*. Water Resources Investigations Report 99-1448.

U.S. Environmental Protection Agency (EPA). 1993. EPA Fact Sheet: Automobiles and Ozone. <http://www.epa.gov/otaq/04-ozone.htm>.

U.S. Environmental Protection Agency (EPA). August 1994. "Automobile Emissions: An Overview." EPA 400-F-92-007. Fact Sheet OMS-5. Available at <http://epa.gov/otaq/05-autos.htm> <http://epa.gov/otaq/05-autos.htm>.

U.S. Environmental Protection Agency (EPA). Final Rule for Cleaner Large Industrial Spark-Ignition Engines, Recreational Marine Diesel Engines, and Recreational Vehicles. <http://www.epa.gov/otaq/regs/nonroad/2002/cleanrec-final.htm#chapter>. As obtained in November 2002.

VanMouwerik, M., and M. Hagemann. 1999. "Water Quality Concerns Related to Personal Watercraft Usage." Technical paper. Water Resources Division, Fort Collins, CO.

Appendix 1

July 2005

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

Revised Final Report

Prepared for

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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 $110 and $360 per day for both snowmobile riders and nonsnowmobile visitors.

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 $110 and $360 per day for both snowmobile riders and nonsnowmobile visitors. However, policies that require snowmobiles to be on guided tours result in welfare losses from a baseline of moderate crowding. Banning snowmobiles in the parks resulted in a per day welfare loss of $191 for snowmobile riders in one model, while nonsnowmobile riders had welfare gains of $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)

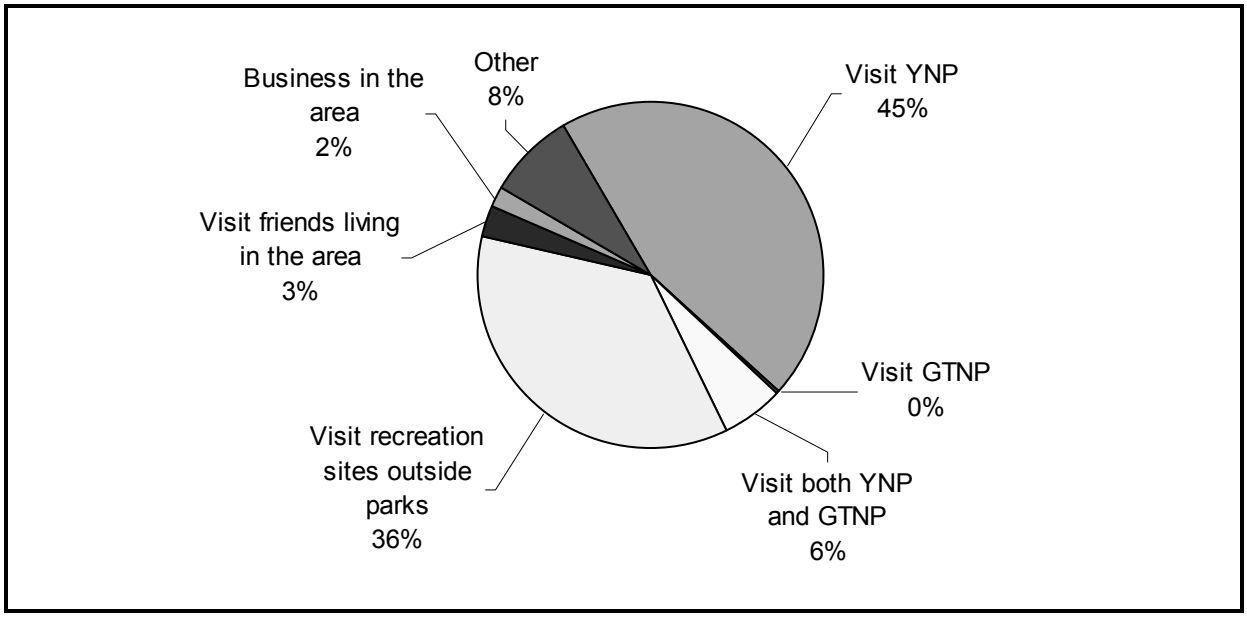
	Total	Snowmobilers	Nonsnowmobilers
Number of days in YNP so far this season and anticipated[b]			
Mean	1.57 (0.04)	1.54 (0.04)	1.66 (0.11)
Median	0.73	0.74	0.69
Number of days in GTNP so far this season and anticipated[b]			
Mean	0.57 (0.07)	0.59 (0.08)	0.48 (0.08)
What one thing about your trip would 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%		

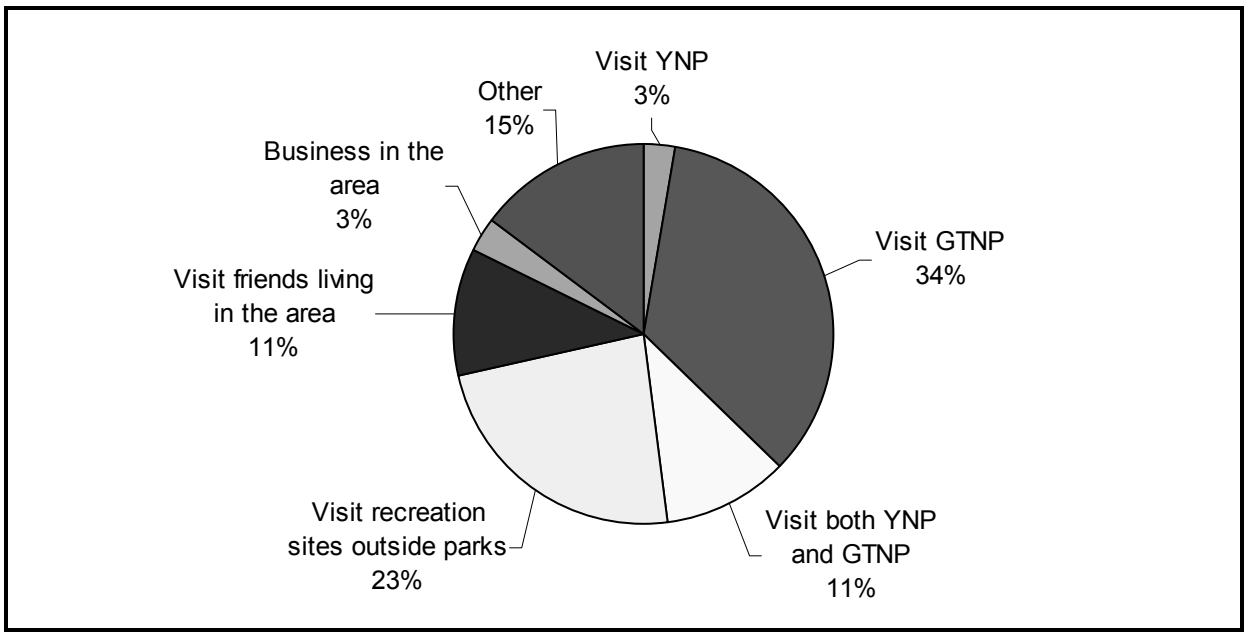
[a]n is the number of people who answered each question; the total sample size is 220, except where noted.

[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

$$\begin{aligned} pr(u_j \geq u_k) &= pr(v_j + \varepsilon_j \geq v_k + \varepsilon_k) \\ &= pr(\varepsilon_k - \varepsilon_j \leq v_j - v_k) \end{aligned} . \qquad (6.2)$$

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

$$pr(u_j \geq u_k) = \frac{\exp(v_j)}{\sum_{k=1}^{J} \exp(v_k)} . \qquad (6.3)$$

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

$$cs = \frac{1}{\hat{\beta}} \left(\ln \left[\sum_{j=1}^{J} \exp(\hat{v}_j) \right] - \ln \left[\sum_{j=2}^{J} \exp(\hat{v}_j) \right] \right), \qquad (6.4)$$

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_{jt}^{i} 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_{jt}^{i} is a disturbance term.

The linear specification of utility for the three alternatives is

$$\begin{aligned} U_{jt}^{i} &= V_{jt}^{i} + e_{jt}^{i} = \gamma_{0}^{i} + e_{jt}^{i} \quad j = 0 \\ U_{jt}^{i} &= V_{jt}^{i} + e_{jt}^{i} = X_{jt}\beta^{i} + p_{jt}\delta^{i} + e_{jt}^{i} \quad j = 1, 2 \end{aligned} \tag{6.7}$$

where U_{jt}^{i}, j = 0, 1, 2 is the utility of each of the three trip alternatives. U_{0t}^{i} 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_{1t}^{i} and the utility of Trip B is U_{2t}^{i}.

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:

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[6]Mathematically, individual i will choose alternative j from among the set of alternatives K,

if $U_{jt}^{i} > U_{kt}^{i}$ for all j in K, $j \neq k$

substituting for U_{jt}^{i} from Eq. (6.6), and rearranging terms we have

$V_{jt}^{i} - V_{kt}^{i} > e_{kt}^{i} - e_{jt}^{i}$.

$$Prob[C_t^i = j] = \frac{\exp\left(V_{jt}^i\right)}{\sum_{k=0}^{2}\exp\left(V_{kt}^i\right)} \quad (6.8)$$

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

$$Prob[C^i = (C^i_{j1}, C^i_{j2}, ..., C^i_{j6})] = \prod_{t=1}^{6}\left[\frac{\exp[V^i_{jt}(\beta^*)]}{\sum_{k=0}^{2}\exp[V^i_{kt}(\beta^*)]}\right] \tag{6.10}$$

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 than the other options.

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 much larger than 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	0.190**	0.211	0.064	0.010
	0.079	0.135	0.086	0.145
Standard deviation		*0.236*		*0.386**
		0.309		*0.211*
North	–0.033	–0.201**	0.004	0.020
	0.056	0.101	0.069	0.114
Standard deviation		*0.439***		*0.754****
		0.181		*0.139*
South	–0.099	0.088	–0.091	–0.002
	0.076	0.136	0.103	0.163
Standard deviation		*0.296*		*0.252*
		0.193		*0.156*
Grand Teton[c]	–0.057	–0.098	0.024	–0.029
	0.103	0.172	0.122	0.205
Activity[b]				
Snowmobiling	1.054***	2.188***	–0.457***	–0.696***
	0.078	0.166	0.097	0.165
Standard deviation		*1.654****		*1.277****
		0.132		*0.142*
Snowcoach tour	–0.088	0.090	–0.127	–0.057
	0.097	0.169	0.103	0.173
Standard deviation		*0.956****		*0.652****
		0.173		*0.216*
Skiing/hiking	–0.440***	–0.482***	0.177**	0.309**
	0.074	0.122	0.077	0.127
Standard deviation		*0.045*		*0.015*
		0.192		*0.194*
Auto tour[c]	–0.526***	–1.797***	0.408***	0.444*
	0.146	0.273	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	–0.422***	–0.891***	0.069	0.138
	0.044	0.093	0.068	0.114
Standard deviation		*1.193***		*0.952***
		0.091		*0.102*
Unguided tour[c]	0.422***	0.891***	–0.069	–0.138
	0.044	0.093	0.068	0.114
Crowding at Entrance[b]				
Low traffic	0.208***	0.372***	0.329***	0.445***
	0.070	0.118	0.085	0.128
Standard deviation		*0.039*		*0.513****
		0.168		*0.125*
Moderate traffic	–0.024	–0.057	–0.042	0.011
	0.070	0.123	0.083	0.132
Standard deviation		*0.036*		*0.070*
		0.194		*0.191*
High traffic[c]	–0.184***	–0.316***	–0.288***	–0.455***
	0.061	0.100	0.086	0.138
Crowding at Destination[b]				
Low traffic	0.237**	0.252	0.434***	0.707***
	0.095	0.157	0.099	0.164
Standard deviation		*0.007*		*0.202*
		0.163		*0.148*
Moderate traffic	0.081	0.046	–0.021	–0.104
	0.065	0.109	0.083	0.129
Standard deviation		*0.285***		*0.151*
		0.140		*0.143*
High traffic[c]	–0.319***	–0.297**	–0.413***	–0.603***
	0.094	0.155	0.127	0.201
Road Condition[b]				
Smooth	0.147***	0.359***	0.070	0.224***
	0.040	0.074	0.044	0.069
Standard deviation		*0.323****		*0.130*
		0.111		*0.097*
Bumpy and rough[c]	–0.147***	–0.359***	–0.070*	–0.224***
	0.040	0.074	0.044	0.069
Noise Level[b]				
Low	–0.007	0.157	0.159*	0.211
	0.073	0.124	0.087	0.138
Standard deviation		*0.727****		*0.738****
		0.113		*0.143*

(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	–0.174**	–0.250**	–0.121*	–0.058
	0.069	0.116	0.064	0.100
Standard deviation		*0.596***		*0.067*
		0.101		*0.127*
High[c]	0.181**	0.093	–0.038	–0.153
	0.091	0.149	0.109	0.173
Emissions Level[b]				
Not noticeable	–0.060	0.124	0.059	0.401**
	0.098	0.165	0.117	0.195
Standard deviation		*0.131*		*0.776****
		0.160		*0.169*
Noticeable	0.187***	0.211*	0.105	0.142
	0.068	0.118	0.084	0.139
Standard deviation		*0.348****		*0.027*
		0.128		*0.092*
Very noticeable[c]	–0.126**	–0.335***	–0.164**	–0.543***
	0.075	0.127	0.099	0.166
No Crowding at Entrance/Destination Dummy	0.189	–0.212	1.268***	2.111***
	0.153	0.277	0.180	0.301
Standard deviation		*1.239****		*0.824****
		0.237		*0.164*
Opt–Out Dummy	1.123***	1.377***	0.621***	0.430
	0.140	0.257	0.177	0.296
Standard deviation		*3.014****		*2.535****
		0.161		*0.142*
Number of choices	5,127	5,127	3,815	3,815
Log likelihood	–4,400.7802	–0.6965[d]	–3,418.7774	–0.7660[d]
LR $\chi^2(19)$	2,463.61		1,544.86	
Probability > χ^2	0.0000		0.0000	
Pseudo R^2	0.2187		0.1843	

[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. 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. However, the standard deviation is large and significant. For some snowmobile visitors, no snowmobiles in the park increased utility. 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. In the mixed logit results, 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 (although the difference is not significant), 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 on average, while cross-country skiing and auto tours have positive and significant coefficients. The large and significant standard deviation on snowmobile suggests that preferences for snowmobiles vary within the group, having a negative impact on some visitors and a positive impact for others. 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 relative to most of the other coefficients in the model. 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 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,

$$WTP^i\left(X^* - X^0\right) = p_j^* - p_j^0 = \frac{\left(X^* - X^0\right)\beta^i}{-\delta^i} \quad (6.12)$$

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 $110 and $360.

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 $110 and $360. 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 $191. 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

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	$117	$155
Baseline high to cap only low	$362	$352
Baseline high to ban		$437
Baseline high to opt out	–$191	
Baseline high to cap and guided tours low	$102	$352
Baseline moderate to cap and guided tours low	–$16	$197

[a]These sample WTP estimates are point estimates calculated using parameter means.

the park may understate welfare losses by focusing on the losses for a given day.

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 is significantly smaller than 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 the results are intuitive and the consistency tests reported in Section 6.6.3 are favorable, the responses to the survey could differ from actual behavior.

References

Dey, Aloke. 1985. *Orthogonal Fractional Factorial Designs*. New York: Halstead Press.

Huber, Joel, and Klaus Zwerina. 1996. "The Importance of Utility Balance in Efficient Choice Designs." *Journal of Marketing Research* 33:307-317.

Krinksky, I., and A. Robb. 1986. "On Approximating the Statistical Properties of Elasticities." *Review of Economics and Statistics* 68:715-719.

Kuhfeld, Warren F., Randall D. Tobias, and Mark Garratt. 1994. "Efficient Experimental Design with Marketing Research Applications." *Journal of Marketing Research* 31:545-557.

Larson, D. 1993. "Separability and the Shadow Value of Time." *American Journal of Agricultural Economics* 75:572-577.

McFadden, D. 1981. "Econometric Models of Probabilistic Choice." In *Structural Analysis of Discrete Data*, C. Manski and D. McFadden, eds., pp.198-272. Cambridge, MA: The MIT Press.

McFadden, Daniel, and Kenneth Train. 2000. "Mixed MNL Models for Discrete Response." *Journal of Applied Econometrics* 15(5):447-470.

National Park Service (NPS). 1990. *Winter Use Plan Environmental Assessment, YNP and GTNP and John D. Rockefeller, Jr., Memorial Parkway, Wyoming, Idaho, and Montana*. Denver, CO: National Park Service.

National Park Service (NPS). 2003. *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>.

Revelt, D., and K. Train. 1998. "Mixed Logit with Repeated Choice: Households' Choices of Appliance Efficiency Level." *The Review of Economics and Statistics* 80:647-657.

Swait, J. 1984. "Incorporating Constraints in Discrete Choice Models of Transportation Demand." PhD dissertation, Department of Civil Engineering, Massachusetts Institute of Technology, Cambridge, MA.

Zwerina, K., J. Huber, and W.F. Kuhfeld. 1996. "A General Method for Constructing Efficient Choice Designs." SAS Working Paper. Available at <http://citeseer.nj.nec.com/rd/89088587.376089.1.0.25. Download/http:qSqqSqftp.sas.comqSqtechsupqSqdownloadqSqtechnoteqSqts629.pdf>.

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:

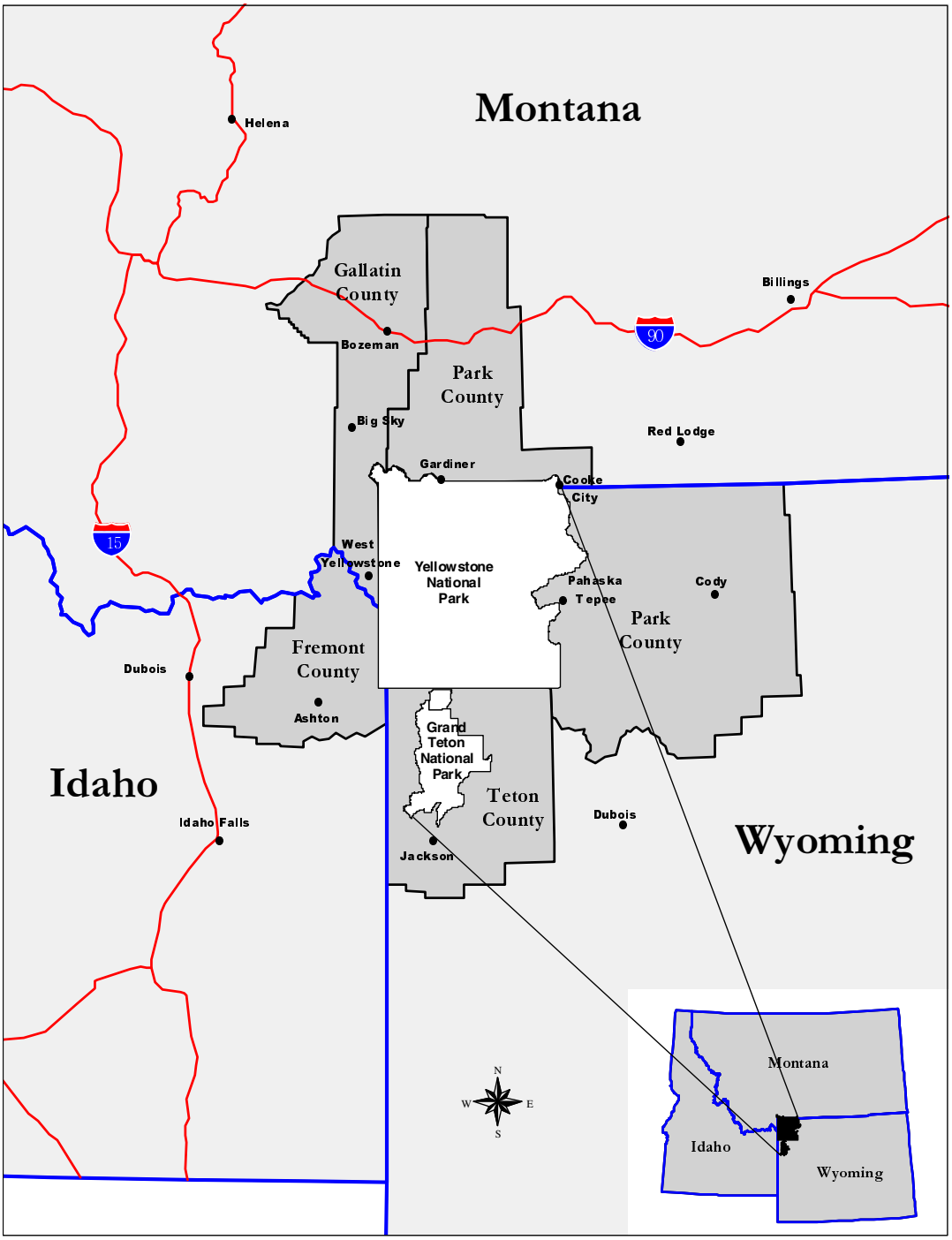
- The version for local visitors on day trips contains the same questions, except in a different order.[1]
- Question 19 was different for nonsnowmobile riders or for first-time snowmobile riders. Section B.2 contains the text of the alternative question asking about winter recreation trips.
- Questions 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

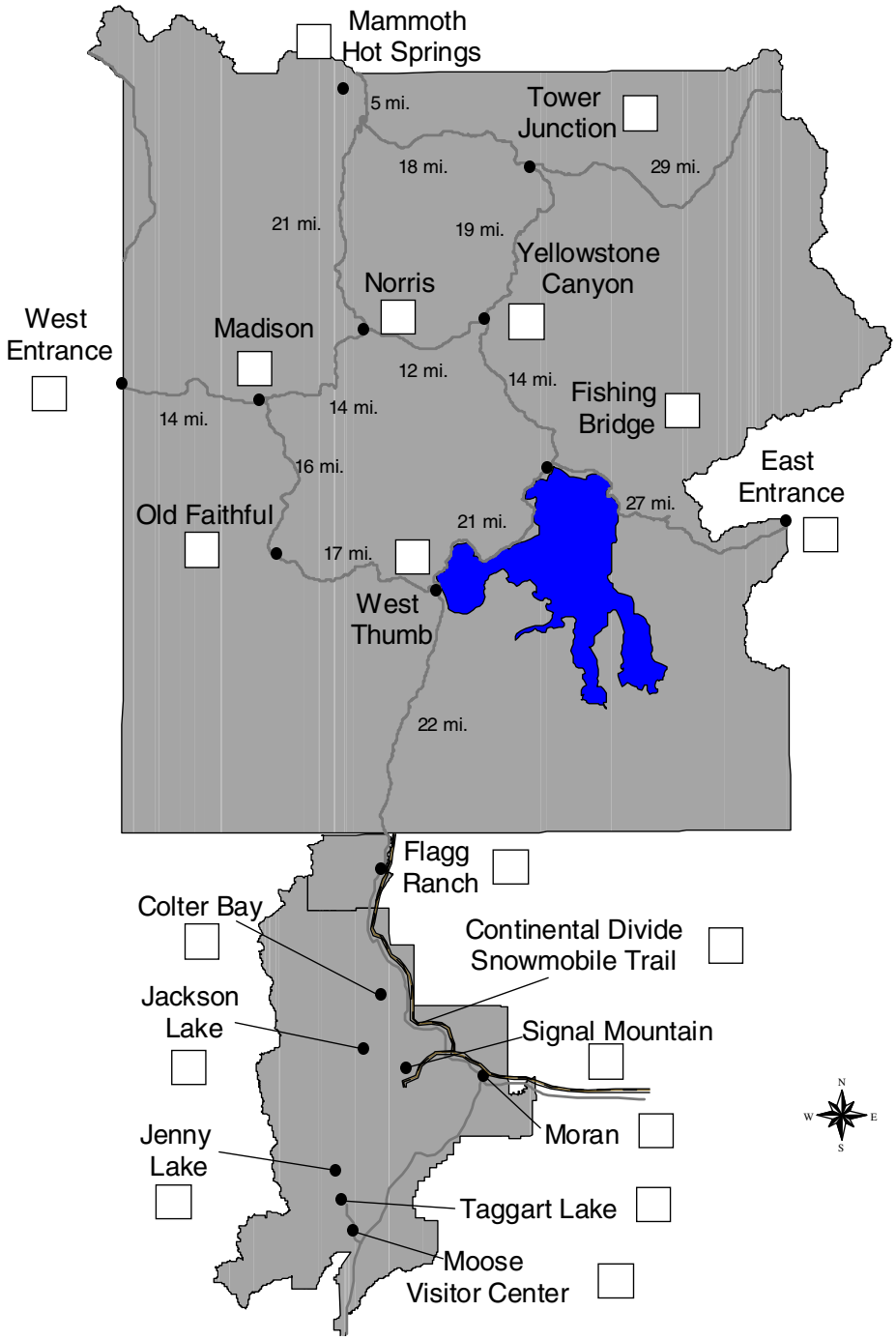
☐ Other (please describe) _____

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**

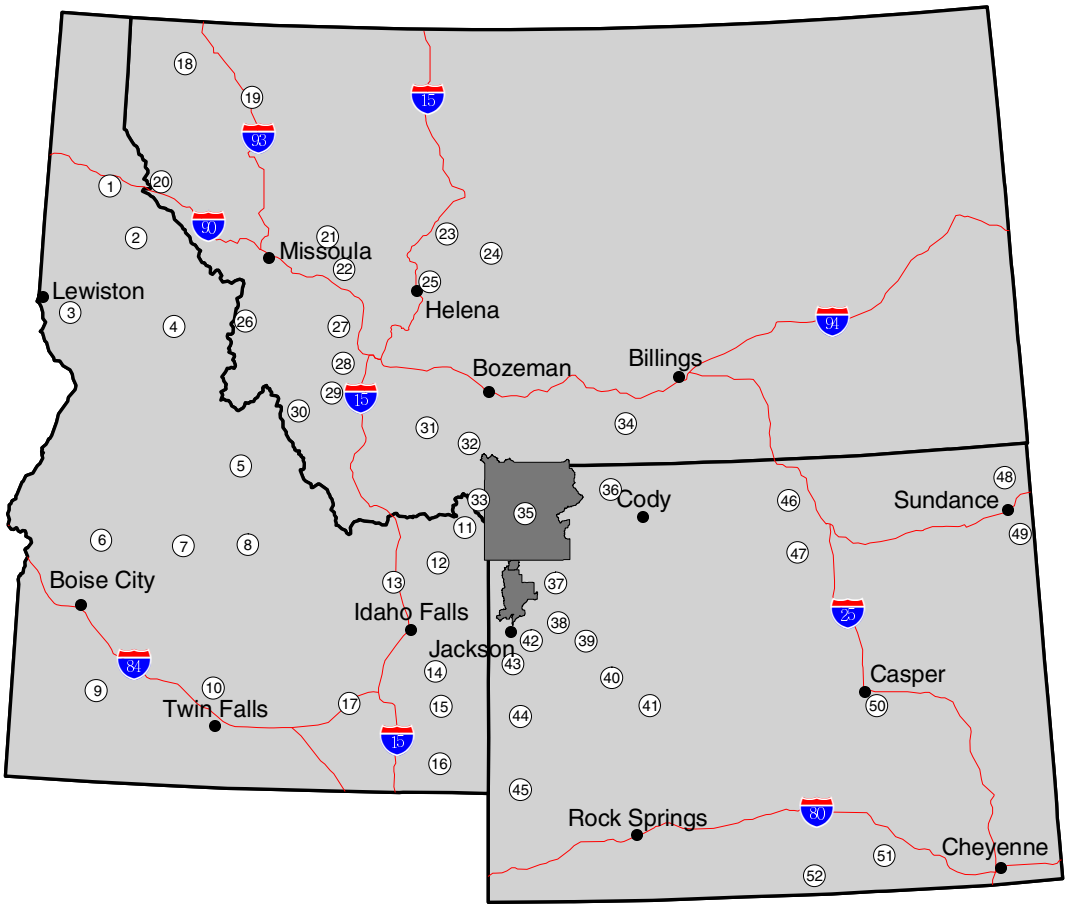
18a. How many of these days do you **plan** to spend inside **Yellowstone National Park**?

_____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.

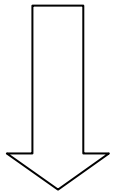
We know that these are not the only choices of activities to do in Yellowstone and Grand Teton National Parks, however as you answer each question please assume that the two trips describe your only two choices, in addition to the option of not entering the parks.

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?

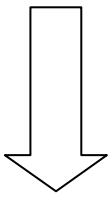
- ☐ Stay at home; I would not travel to the Greater Yellowstone Area
- ☐ Travel to the Greater Yellowstone Area to snowmobile outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to cross-country ski outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to downhill ski at Big Sky or 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?

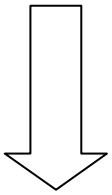
- ☐ Stay at home; I would not travel to the Greater Yellowstone Area
- ☐ Travel to the Greater Yellowstone Area to snowmobile outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to cross-country ski outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to downhill ski at Big Sky or 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?

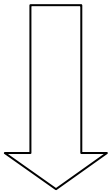
- ☐ Stay at home; I would not travel to the Greater Yellowstone Area
- ☐ Travel to the Greater Yellowstone Area to snowmobile outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to cross-country ski outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to downhill ski at Big Sky or 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?

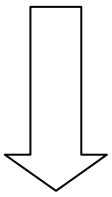
- ☐ Stay at home; I would not travel to the Greater Yellowstone Area
- ☐ Travel to the Greater Yellowstone Area to snowmobile outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to cross-country ski outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to downhill ski at Big Sky or 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.

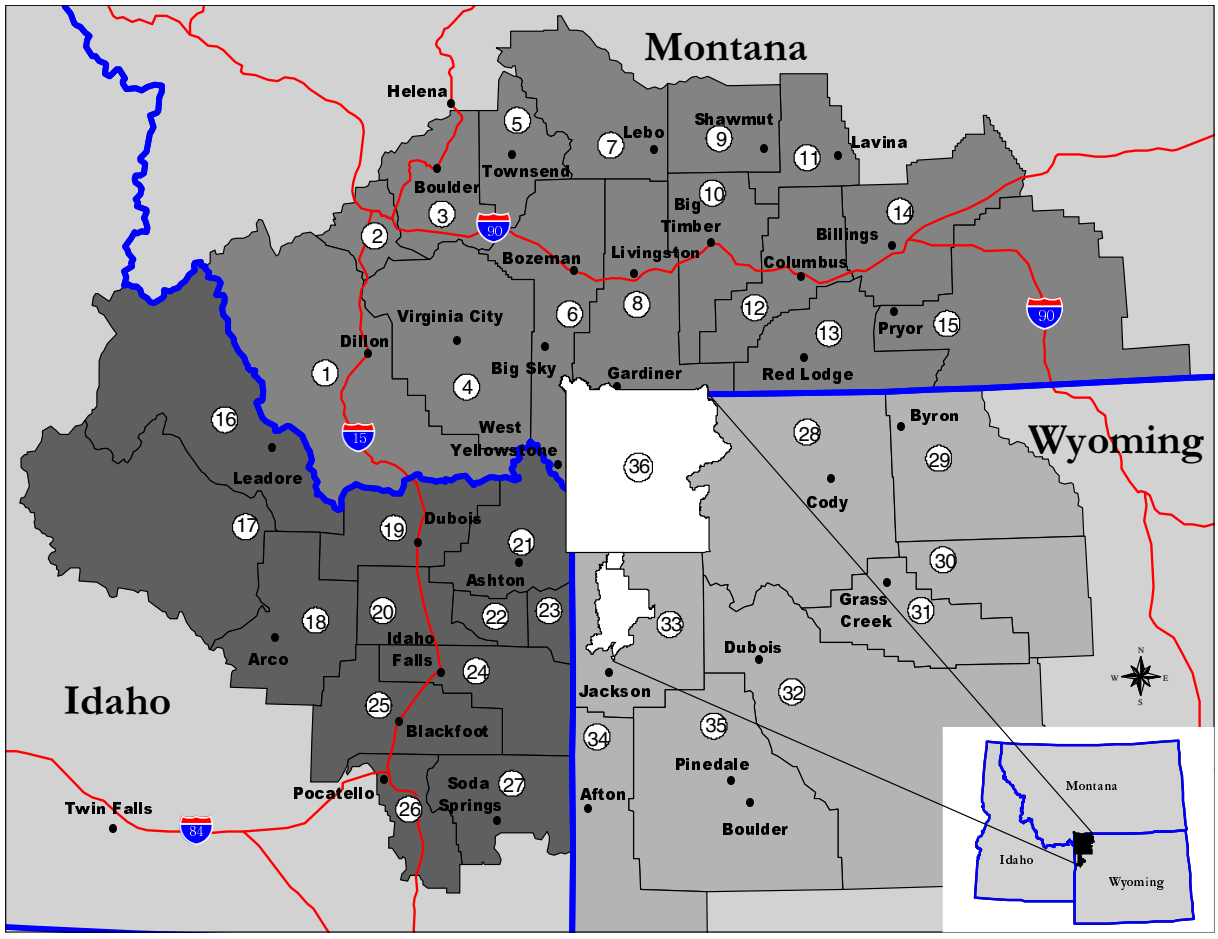
12. Looking at the map on the next page, did you make any trips in the counties in or around Yellowstone and Grand Teton National Parks during the previous winter season (December 2001–March 2002)?

- ☐ 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

$$W_{7A}(i,j|r,s,t) = W_{5A}(i,j|r,s,t)\, W_{6A}(r,s,t)$$