March 2013

Economic Analysis of Winter Use Regulations in Yellowstone National Park

Final Report for Final Rulemaking

Prepared for

National Park Service
Environmental Quality Division

Prepared by

RTI International
3040 Cornwallis Road
Research Triangle Park, NC 27709

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RTI International is a trade name of Research Triangle Institute.

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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 series of interim regulations from 2009 to 2013. NPS is now proposing a new rule for 2013–2014 and after. This report describes the results of an economic analysis of the proposed alternatives for regulating winter recreation in YNP.

This report describes the results of an analysis of the economic impacts of four winter use alternatives for regulating snowmobile use in Yellowstone National Park (YNP) starting in the winter of 2013–2014. For a proposed change in regulation, federal statutes, including Executive Order (EO) 12866 and later revisions of the EO, 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.

The report looks at the impacts of the action alternatives relative to two baselines. The guidelines for rulemakings define the official baseline as what would happen if no new rule were passed. If no new rule were passed, Baseline 1 would be defined by conditions under Alternative 1, which bans all oversnow vehicles (snowmobiles and snowcoaches). In addition, NPS defined a second baseline, Baseline 2, as conditions under Alternative 2, the rule in place for the most recent season. The analysis of Baseline 2 provides information on how conditions might change relative to the last four seasons. The quantitative results of the benefit-cost analysis are summarized in Section 3 for Baseline 1 and Section 4 for Baseline 2. Some of the costs and benefits could not be quantified. These benefits and costs are discussed qualitatively. 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 primarily

addresses the economic efficiency of the different alternatives, although it does present some discussion of the distributive equity of the alternatives (i.e., the sectors or groups on which the majority of impacts fall).

The National Park Service (NPS) has been assessing winter use issues within the Greater Yellowstone Area (GYA), and specifically YNP, 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 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

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

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 and hours of operation remained effective for the winter use season of 2002–2003.

The Notice of Availability for the 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.

With no special rule in place for 2008–2009, the Wyoming District Court ordered the reinstatement of the 2004 regulation, which allowed 720 snowmobiles per day into YNP. Another temporary rule was put in place for 2009–2010 and 2010–2011 and extended for 2011–2012 and 2012–2013 with a daily cap on snowmobiles of 318 machines per day and 78 snowcoaches per day.

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. Baseline visitation (under Alternative 1), environmental conditions, and economic activity in and around the park are described in Section 2. Section 3 describes the methodology for assessing the impacts of the alternatives on social welfare and presents a benefit-cost analysis of Alternatives 2, 3, and 4 relative to Baseline 1. Section 4 presents the same analysis, but using Baseline 2 (Alternative 2). Sections 5 and 6 provide an analysis of the impacts of the alternatives on small businesses relative to Baselines 1 and 2, respectively.

During the winter of 2002–2003, a survey of visitors to YNP 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. Although the survey was conducted

almost 10 years ago, it provides the best source of information on how visitor behavior might change for the whole range of alternatives, not just the alternatives that have been in place since 2004, as well as other information useful for the analysis. In addition, the analysis uses actual visitation changes since 2004 to create a range of possible outcomes for each alternative.

1.2 PROBLEM ADDRESSED BY REGULATION

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 when 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 oversnow vehicles use in YNP is based on externalities associated with their use.

The justification for restricting oversnow vehicle use in YNP is based on externalities associated with their use. For instance, the operation of snowmobiles and to a lesser extent snowcoaches 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 and snowcoach 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 and snowcoach use in YNP are far easier to implement and enforce. Some of the potential options include geographic restrictions, time-of-use restrictions, and technology requirements for snowmobiles and snowcoaches.

The extent to which social welfare improves because of oversnow vehicle regulation in YNP 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 oversnow vehicle regulation in YNP depends on the relative benefits and costs associated with such restrictions. Although other visitors may gain from restrictions due to reductions in congestion, pollution, and noise, the oversnow vehicle users 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 and published a rule that would have eliminated recreational snowmobiles by the winter of 2003–2004. However, over the years NPS has identified additional alternatives and reevaluated prior alternatives. Alternatives that allow for continued use of snowmobiles in YNP were developed to address concerns about the negative externalities associated with snowmobile use and to a lesser extent snowcoach use in the parks, while mitigating the welfare losses to oversnow vehicle visitors and the businesses that serve them that would result from implementing a ban on snowmobiles and snowcoaches.

1.3 CURRENT SNOWMOBILE REGULATIONS

Current use of oversnow vehicles in YNP is governed by the interim regulations in place for the winter season of 2009–2010 and extended through the winter season of 2012–2013 that

limited snowmobiles and snowcoaches to 318 and 78 per day, respectively. In the 2013–2014 winter season, all oversnow vehicles would be banned in YNP in the absence of a new rule. Therefore, Baseline 1 (Alternative 1), which bans oversnow vehicles, is the official no-action baseline for this analysis.

1.4 PROPOSED REGULATIONS

In the Supplemental FEIS (NPS, 2013), NPS considered three snowmobile management alternatives for YNP plus the no-action alternative (Alternative 1). Table 1-1, taken from the Supplemental FEIS (NPS, 2013), outlines the four proposed management alternatives. These alternatives were revised from the previous EIS (NPS, 2011) to incorporate a new approach based on "transportation events."

In YNP, the no-action alternative banning all oversnow travel is Alternative 1 (Baseline 1). Alternative 2 (Baseline 2) continues the limits in place under the 2009–2012 interim regulations (318 snowmobiles and 78 snowcoaches per day). Alternative 3 is designed to steer winter oversnow visitation toward snowcoaches, phasing out snowmobiles by the 2020–2021 winter season. Alternative 4 allows for a certain number of "transportation events." Transportation events are defined as either one snowcoach or a commercially guided snowmobile tour with up to 10 snowmobiles (with an average of 7 snowmobiles per tour for the season). This alternative also allows up to 4 noncommercially guided snowmobile tours of up to 5 snowmobiles each day (1 from each entrance).

Table 1-1a, also taken from the Supplemental FEIS (NPS 2013), presents information about potential visitation under each alternative. The visitation forecasts used in the analysis for this report differ from the information on potential visitation, including maximum possible visitation, presented in Table 1-1a. The methods for calculating visitation for this report are described in Sections 2 and 3.

Table 1-1. Summary of Alternative Elements

	Alternative 1: No Action—No Snowmobile/Snowcoach Use	Alternative 2: Continue Snowmobile/Snowcoach Use at 2011–2012 Winter Season Interim Regulation Limits	Alternative 3: Transition to Snowcoaches that Meet Best Available Technology (BAT) Requirements Only	Alternative 4: Manage Oversnow Vehicle Use by Transportation Events
General description	Once the 2009 interim regulation expires (after the 2010–2011 season), there would be no regulation in its place and oversnow vehicle use would no longer be permitted. Administrative oversnow vehicle use would continue as needed. Visitors could ski or snowshoe into the park.	Oversnow vehicle use would continue at levels described under the 2009–2013 interim regulations: up to 318 snowmobiles and up to 78 snowcoaches per day.	Oversnow vehicle access into the park would transition to BAT-compliant snowcoaches beginning in the 2017–2018 winter season when all snowcoaches must meet BAT requirements. Snowcoaches would replace snowmobiles within a 3-year period (by the 2020–2021 winter season).	Alternative 4 would allow for increases in visitation while reducing transportation-generated noise and air impacts. Oversnow vehicle access to the park would be managed by transportation events. A total of 110 transportation events would be allowed each day. Operators would have the flexibility to allocate their transportation events between snowmobiles and snowcoaches, but no more than daily 50 snowmobile events would be permitted. If oversnow vehicle s meet E-BAT standards, there is the potential for increasing the average group size. Noncommercial guiding would be included under this alternative.
Elements Related to Snowmobile Use				
Daily snowmobile limits (with allocations by entrance)	N/A	Up to 318 snowmobiles per day (actual current average is about 191 per day). Entrance allocations (by number of snowmobiles): • West—160 • South—114 • East—20 • North—12 • Old Faithful—12	Up to 318 snowmobiles per day through the 2017–2018 winter season. Entrance allocations (by number of snowmobiles): • West—160 • South—114 • East—20 • North—12 • Old Faithful—12 No commercial snowmobiles would be permitted after the 2020–2021 winter season.	110 transportation events would be allowed each day, with no more than 50 transportation events from snowmobiles. A transportation event would allow one snowcoach or one group of snowmobiles, with an average group size of 7 snowmobiles. (each group of snowmobiles may have up to 10 vehicles, but must average a group size of 7 snowmobiles over the course of a winter season.) For the first three seasons (2014–2015, 2015–2016, 2016–1017) before new BAT standards are in effect, use would be averaged daily. However, if new air and sound emission requirements are met, they would be averaged seasonally, providing additional flexibility.

(continued)

Table 1-1. Summary of Alternative Elements (continued)

	Alternative 1: No Action—No Snowmobile/Snowcoach Use	Alternative 2: Continue Snowmobile/Snowcoach Use at 2011–2012 Winter Season Interim Regulation Limits	Alternative 3: Transition to Snowcoaches that Meet BAT Requirements Only	Alternative 4: Manage Oversnow Vehicle Use by Transportation Events
Daily snowmobile limits (with allocations by entrance) (cont.)				If snowmobiles meet E-BAT, the alternative allows for a potential increase in the number of vehicles per transportation event—from a seasonal average of 7 to an average of 8 snowmobiles per group. Maximum allowed snowmobile transportation event entrance allocations (by gate): • West—23 • South—16 • East—3 • North—2 • Old Faithful—2 In addition, four noncommercially guided events, with up to 5 snowmobiles per group, would be permitted each day, one from each entrance.
Variable snowmobile numbers	N/A	Daily snowmobile levels would be fixed for the season. No variation would occur.		Snowmobile numbers could vary daily, depending on how operators use their transportation events. Up to 50 daily transportation events could be allocated to snowmobiles.
Variable entrance allocations	N/A	Entrance allocations would be fixed (may not be shared between entrances).		The total number of transportation events at each gate would be fixed, but transportation events could be traded between operators. This would not apply to noncommercially guided snowmobile groups.

(continued)

Table 1-1. Summary of Alternative Elements (continued)

	Alternative 1: No Action—No Snowmobile/Snowcoach Use	Alternative 2: Continue Snowmobile/Snowcoach Use at 2011–2012 Winter Season Interim Regulation Limits	Alternative 3: Transition to Snowcoaches that Meet BAT Requirements Only	Alternative 4: Manage Oversnow Vehicle Use by Transportation Events
Snowmobile guide requirements, including maximum group size (if applicable)	N/A	100% commercially guided. Group size (including guide's snowmobile): 10		100% guided: commercial and noncommercial guiding allowed. Group size for commercial operations (including guide): 10 maximum, average of 7 over a season. Four transportation events (one per gate) of up to 5 snowmobiles each would be reserved for noncommercially guided access. Each noncommercial guide would be allowed to lead up to 2 groups per season, and permits for this opportunity would be allocated via an online lottery system.
BAT requirements for snowmobiles	N/A	BAT required for snowmobiles. Starting in the 2017–2018 season, the BAT sound standards for snowmobiles would be reduced from 73 dBA to 71 dBA.	No changes to BAT for sound standards because snowmobiles would be phased out.	BAT would be required for commercially and noncommercially guided snowmobiles. Initially, the BAT sound standard for all snowmobiles would be 73 dBA, and the carbon monoxide standard would be 120 g/kW-hr. Starting in the 2017–2018 season, the BAT sound standard would be reduced to 67 dBA, and the carbon monoxide standard would be reduced to 90 g/kW-hr.
Cost of snowmobile use	N/A	Park entrance fee. Cost of snowmobile guide and rental.	Park entrance fee. Cost of snowmobile guide and rental.	Park entrance fee (for commercially and noncommercially guided groups). Cost of snowmobile guide and rental. BAT snowmobile rental fees. Lottery fees for noncommercially guided groups.

(continued)

Table 1-1. Summary of Alternative Elements (continued)

	Alternative 1: No Action—No Snowmobile/Snowcoach Use	Alternative 2: Continue Snowmobile/Snowcoach Use at 2011–2012 Winter Season Interim Regulation Limits	Alternative 3: Transition to Snowcoaches that Meet BAT Requirements Only	Alternative 4: Manage Oversnow Vehicle Use by Transportation Events
Elements Related to Snowcoach Use				
Daily snowcoach limits (with allocations by entrance)	N/A	Up to 78 snowcoaches per day. Entrance allocations (by number of snowcoaches): • West—34 • South—13 • East—2 • North—13 • Old Faithful—16	Up to 78 snowcoaches per day initially, allocated by entrance, the same as in Alternative 2. Once all snowcoaches meet BAT, increase to up to 120 BAT snowcoaches per day (with a corresponding decrease in snowmobiles over a 3-year period as snowcoach numbers increase). Entrance allocations after transition (by number of snowcoaches): • West—62 • South—10 • East—0 • North—19 • Old Faithful—29	A transportation event would initially equal 1 snowcoach or one group of snowmobiles (average of 7 snowmobiles in one group, not to exceed 10, averaged over the season). The number of snowcoaches per event could increase from 1 to 2 over time if each snowcoach meets E-BAT (each snowcoach emits less than 71 dBA of sound). Snowcoach entrance allocations (by transportation events) if all 50 snowmobile events are used: • West—26 • South—10 • East—2 • North—10 • Old Faithful—12
Daily snowcoach limits (with allocations by entrance) (cont.)				Snowcoach entrance allocations (by transportation events) if none of the commercial snowmobile events are used (106 events, with 4 events reserved for noncommerically guided snowmobile use): • West—47 • South—17 • East—2 • North—17 • Old Faithful—23

(continued)

Table 1-1. Summary of Alternative Elements (continued)

	Alternative 1: No Action—No Snowmobile/Snowcoach Use	Alternative 2: Continue Snowmobile/Snowcoach Use at 2011–2012 Winter Season Interim Regulation Limits	Alternative 3: Transition to Snowcoaches that Meet BAT Requirements Only	Alternative 4: Manage Oversnow Vehicle Use by Transportation Events
Variable snowcoach numbers	N/A	Daily snowcoach levels would be fixed for the season. No variation would occur.		Snowcoach numbers could vary daily, depending on which vehicles the operators allocate their transportation events to. Up to 50 transportation events may be allocated to groups of snowmobiles daily. If all 50 snowmobile allocations are used, 60 allocations would be available for snowcoach use. If no snowmobile allocations are used, 106 snowcoach transportation events would be available to operators.
Variable entrance allocations	N/A	Entrance allocations would be fixed (may not be shared between entrances).		Entrance allocation would be flexible, based on the demand at the three snowcoach entry locations (i.e., sharing among operators at a single entrance).
Snowcoach guide requirements	N/A	Common to all action alternatives: snowcoach entry by commercial guide only.		
Snowcoach BAT requirements	N/A	BAT would be developed and implemented for snowcoaches by the 2017–2018 season. BAT for snowcoaches would require sound emissions to be less than 75 dBA.		BAT would be developed and implemented for snowcoaches by the 2017–2018 season. BAT for snowcoaches would require sound emissions to be less than 75 dBA. With E-BAT, two snowcoaches would be allowed in a group if both snowcoaches have sound emission of 71 dBA or less.
Wheeled-vehicle access—Common to all alternatives: Wheeled-vehicle access would continue along the road between Mammoth Hot Springs and Cooke City. No other roads would be plowed for wheeled vehicle use.				

(continued)

Table 1-1. Summary of Alternative Elements (continued)

	Alternative 1: No Action—No Snowmobile/Snowcoach Use	Alternative 2: Continue Snowmobile/Snowcoach Use at 2011–2012 Winter Season Interim Regulation Limits	Alternative 3: Transition to Snowcoaches that Meet BAT Requirements Only	Alternative 4: Manage Oversnow Vehicle Use by Transportation Events
Other/General Elements				
Road grooming	Allow for the minimal road grooming needed to maintain administrative access. Sylvan Pass would not be maintained.	Continue road grooming. Manage Sylvan Pass in accordance with the Sylvan Pass Working Group agreement.	Continued road grooming would be needed to maintain snowcoach and administrative access. Sylvan Pass would be closed to vehicle traffic and would not be maintained.	Continue road grooming. Manage Sylvan Pass in accordance with the Sylvan Pass Working Group agreement.
Zoning—temporal and spatial	N/A	Continue temporal and spatial zoning of some side roads (e.g., snowcoaches only in the morning, snowmobiles and snowcoaches in the afternoon).	The east side of the park would only be available for nonmotorized use once transition to snowcoaches is complete. Oversnow vehicle use would not be permitted from the east entrance to the Fishing Bridge Developed Area.	Continued temporal and spatial zoning of some side roads (e.g., snowcoaches only in the morning, snowmobiles and snowcoaches in the afternoons).
Opportunities for nonmotorized recreation use	Park would be open for skiing and snowshoe access. Most of the park would be considered "backcountry" for this type of use.	Continue to groom 35 miles of secondary park roads for cross-country skiers and snowshoers. Use will be permitted subject to Winter Severity Index.		
Dates/length of winter season	The season would start when accumulation of snow allows for nonmotorized use. It would continue into March, depending on snow levels and any closures for wildlife management and spring road plowing.	Common to all action alternatives: No change in current dates for motorized and nonmotorized winter use in the park.		

(continued)

Table 1-1. Summary of Alternative Elements (continued)

	Alternative 1: No Action—No Snowmobile/Snowcoach Use	Alternative 2: Continue Snowmobile/Snowcoach Use at 2011–2012 Winter Season Interim Regulation Limits	Alternative 3: Transition to Snowcoaches that Meet BAT Requirements Only	Alternative 4: Manage Oversnow Vehicle Use by Transportation Events
Estimated number of daily vehicle passengers (excludes Mammoth to Cooke City) Maximum numbers assume 2 people per snowmobile and 12.3 per snowcoach. Average numbers assume 1.4 people per snowmobile and 8 per snowcoach.	Zero oversnow vehicles	Maximum • Snowmobile = 636 • Snowcoach = 959 • Total = 1,595 Average • Snowmobile = 445 • Snowcoach = 624 • Total = 1,069	Maximum • Snowmobile passengers = 636 (0 after phaseout) • Snowcoach passengers = 959 (1,476 after phaseout) • Total = 1,519 (1,476 after phaseout) Average • Snowmobile passengers = 445 (0 after phaseout) • Snowcoach passengers = 624 (960 after phaseout) • Total = 1,069 (960 after phaseout)	See "Table 1a: Estimated Visitation under Each Alternative."
Transition period (when limits under a new regulation, that are different from current limits, would take effect)	The 2009 to 2013 interim regulations expired. No transition period.	The 2009 to 2013 interim regulations would continue. No transition period.	The 2009 to 2013 interim regulations would continue until the 2017–2018 season, after which time a 3-year phaseout of snowmobiles would occur.	There would be a two-season transition period to prepare for implementation of the new winter use plan. Provisions of the 2009 to 2013 interim regulations would continue during this transition.
Adaptive management program	No adaptive management program would be implemented.	Adaptive management would be implemented as outlined in Appendix D of the Supplemental FEIS (NPS 2013).		

N/A = not applicable.

Source: Table 9 (NPS 2013)

Table 1-1a. Estimated Visitation under Each Alternative

Alternative	Event Types	Max.[a] Number of Events	Min. Number of Events	Max. Number of BAT OSVs (daily)	Average[b] Number of BAT OSVs (daily)	Max. Number of E-BAT OSVs (daily)	Average Number of E-BAT OSVs (daily)	Max. Number of People Daily[c] (peak day)	Max. Average Daily Number of People (avg day)	Max. Number of People per Season
Alternative 2: Continue Snowmobile/Snow coach Use at 2012–2013 Winter Season Interim Regulation Limits	Commercial snowcoaches	78	78	78	78	N/A	N/A	1,069	1,069	96,174
	Commercial snowmobiles	159	31.8	318	318	N/A	N/A	636	636	57,240
	Noncommercial snowmobiles			0	0	N/A	N/A	0	0	0
	SUM	237	110	396	396			1,705	1,705	153,414
Alternative 3: Transition to BAT Snowcoaches (after phaseout, before phaseout visitation is the same as Alternative 2)	Commercial snowcoaches	120	120	120	120	N/A	N/A	1,644	1,644	147,960
	Commercial snowmobiles			0	0	N/A	N/A	0	0	0
	Noncommercial snowmobiles			0	0	N/A	N/A	0	0	0
	SUM	120	120	120	120			1,644	1,644	14,7960
Alternative 4: Manage Oversnow Vehicle Use by Transportation Events (pre E-BAT, maximum number of snowmobiles)	Commercial snowcoaches	60		60	60	N/A	N/A	822	822	73,980
	Commercial snowmobiles	46		460	322	N/A	N/A	920	644	57,960
	Noncommercial snowmobiles	4		20	20	N/A	N/A	40	40	3,600
	SUM	110		540	402			1,782	1,506	135,540
Alternative 4: Manage Oversnow Vehicle Use by Transportation Events (pre E-BAT, maximum number of snowcoaches)	Commercial snowcoaches	106		106	106	N/A	N/A	1,452	1,452	130,698
	Commercial snowmobiles	0		0	0	N/A	N/A	0	0	0
	Noncommercial snowmobiles	4		20	20	N/A	N/A	40	40	3,600
	SUM	110		126	126			1,492	1,492	134,298

(continued)

Table 1-1a. Estimated Visitation under Each Alternative (continued)

Alternative	Event Types	Max.[a] Number of Events	Min. Number of Events	Max. Number of BAT OSVs (daily)	Average[b] Number of BAT OSVs (daily)	Max. Number of E-BAT OSVs (daily)	Average Number of E-BAT OSVs (daily)	Max. Number of People Daily[c] (peak day)	Max. Average Daily Number of People (avg day)	Max. Number of People per Season
Alternative 4: Manage Oversnow Vehicle Use by Transportation Events (with E-BAT, maximum number of snowmobiles)	Commercial snowcoaches	60				120	120	1,644	1,644	147,960
	Commercial snowmobiles	46				460	368	920	736	66,240
	Noncommercial snowmobiles	4				20	20	40	40	3,600
	SUM	110				600	508	2,604	2,420	217,800
Alternative 4: Manage Oversnow Vehicle Use by Transportation Events (with E-BAT, maximum number of snowcoaches)	Commercial snowcoaches	106				212	212	2,904	2,904	261,396
	Commercial snowmobiles	0				0	0	0	0	0
	Noncommercial snowmobiles	4				20	20	40	40	3600
	SUM	110				232	232	2,944	2,944	264,996

[a] Where there is no variation in the number of oversnow vehicles allowed, maximum and minimum event numbers are the same.
[b] Average refers to the number of oversnow vehicles allowed seasonally. The possible daily maximum and average differ for Alternative 4 but are the same for all other alternatives.
[c] The maximum number of people per snowmobile was assumed to be 2.0; the maximum number of people per snowcoach was assumed to be 13.7.

N/A = not applicable.

Source: Table 1, NPS (2013)

2 Baseline Description of Snowmobile Use in the Greater Yellowstone Area

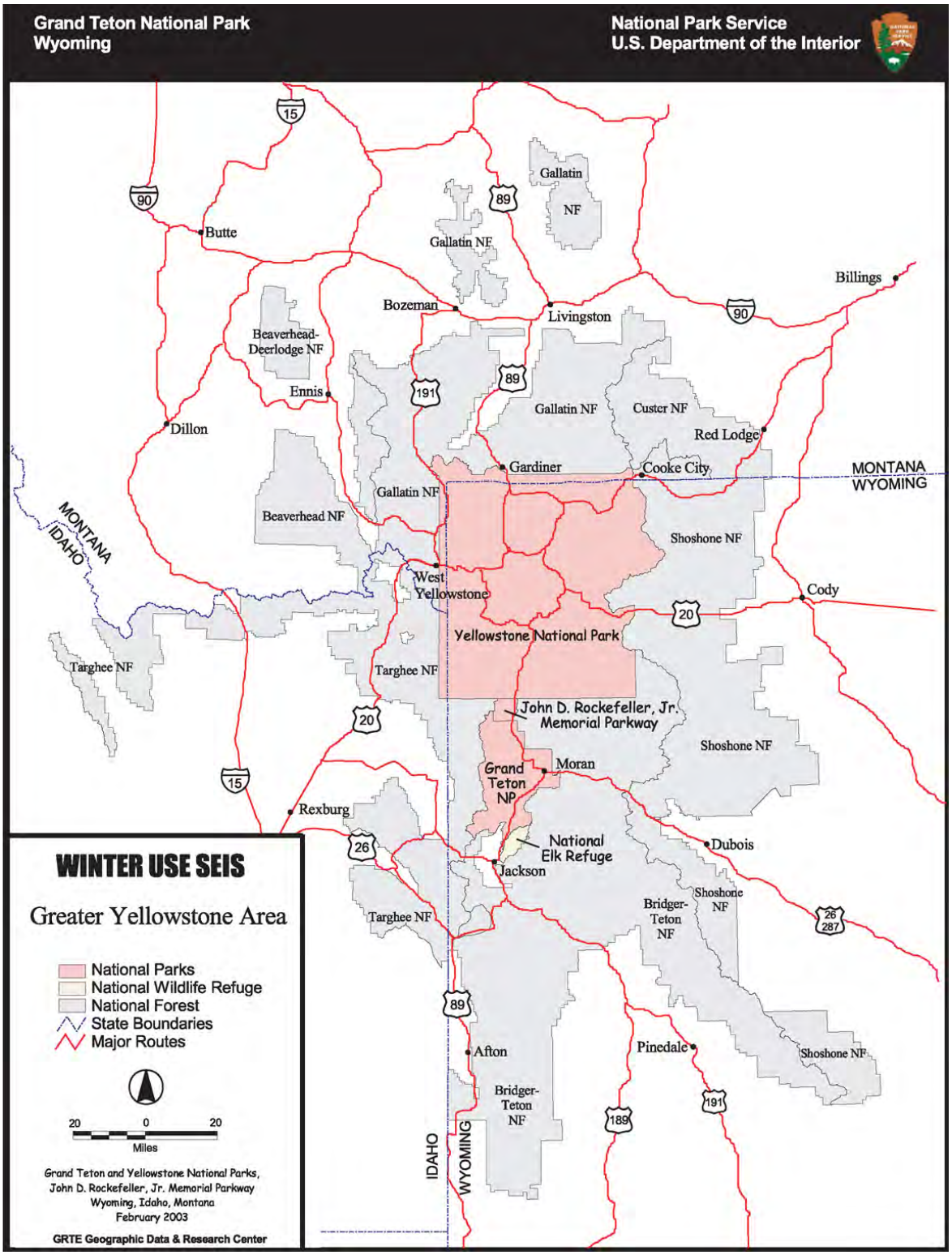
Section 2 describes YNP and the GYA, including the economy and visitation, and provides the background against which the changes brought about by the proposed alternatives are compared.

This section describes YNP and the surrounding areas, including information about the resources in YNP, historic visitation, other opportunities for snowmobiling in the area around YNP, and the economic community. Information about recent visitation is used to derive a forecast for visitation over the next 10 years under Baseline 1 (Alternative 1, which bans oversnow vehicles). This report looks at the impacts of the action alternatives relative to two baselines. The guidelines for rulemakings define the official baseline as what would happen if no new rule were passed. If no new rule were passed, Baseline 1 would be defined by conditions under Alternative 1, which bans all oversnow vehicles (snowmobiles and snowcoaches). In addition, NPS defined a second baseline, Baseline 2, as conditions under Alternative 2, the rule in place for the most recent season. The analysis of Baseline 2 provides information on how conditions might change relative to the last four seasons. Visitation under Alternative 2 is presented in Section 3 with the other action alternatives. Section 4 presents the benefit-cost analysis relative to Baseline 2 (Alternative 2).

2.1 THE GYA

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

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>.

south-central Montana and eastern Idaho. The GYA also includes Grand Teton National Park (GTNP), which encompasses an additional 310,000 acres, and the John D. Rockefeller, Jr., Parkway (the Parkway), which includes 24,000 acres, and both are located in Wyoming. Portions of six national forests—Gallatin, Custer, Shoshone, Bridger-Teton, Caribou-Targhee, and the Beaverhead-Deerlodge—border the park 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.

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.

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.

- 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.

2.2 SNOWMOBILE TRAILS IN 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.

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.

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. 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 2009–2010 season, park rangers reported 90 percent fewer incidents involving oversnow vehicles compared with the 2002–2003 season.

Since the winter of 2003–2004, all snowmobilers have been required to use 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 more than 20 different

companies at the various park entrances. A daily limit of 720 snowmobiles was also introduced during the 2004–2005 winter season.

Since the requirement of guides, incidents involving oversnow vehicle citations and arrests have been reduced dramatically. In the 2002–2003 winter season, there were 282 incidents, while in the 2009–2010 winter season, there were only 27 incidents, a 90 percent reduction in law enforcement incidents relating to oversnow vehicles.

Beginning in 2009, after litigation, oversnow vehicle use was regulated through interim rules that only allowed 318 snowmobiles and 78 snowcoaches access each day into YNP for the 2009–2010, 2010–2011, 2011–2012, and 2012–2013 winter seasons. As of March 15, 2013, oversnow vehicle use is not permitted in YNP until a new regulation is promulgated.

2.4 VISITATION DATA

An analysis of the social benefits and costs of snowmobile and snowcoach use under the proposed management alternatives in YNP relative to the two baselines is presented in Sections 3 and 4. Baseline 1 (Alternative 1) prohibits snowmobiles and snowcoaches in the park. Section 3 contains an analysis of Alternatives 2 through 7 relative to this baseline. To support the development of these analyses, this section presents historical data and projected Baseline 1 winter use and discusses the methodology used to generate the projections.

2.4.1 YNP Total Visitation Data

Total annual recreational visitation in 2011 to YNP was 3,394,326. To provide a sense of how visitation varies over the year, Table 2-1 provides a month-by-month breakdown of visitation for recreational visits for 2011.[1] This is comparable to previous years but represents a significant drop in winter use at YNP compared with seasons prior to 2003–2004.

[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, 2011

Month	Visits
January	24,517
February	28,174
March	18,728
April	28,147
May	207,842
June	634,316
July	906,935
August	805,173
September	536,349
October	175,433
November	12,198
December	16,514
Total	**3,394,326**

Source: NPS visitation records.

Table 2-2 presents data on visitation by entrance since 1996–1997. The table illustrates the uneven impact of the snowmobile regulations on the entrances. The majority of visitors at the North Entrance use a private vehicle to enter the park and visitation has increased over the years. The majority of snowmobiles enter YNP through the West Entrance, and traffic at this entrance is less than half what it was before 2003–2004. Although traffic at the East Entrance is much lower than the other entrances, this entrance has also experienced a significant drop in visitors in recent years.

Table 2-2. Winter Recreational Visitors in YNP, 1996–2012

Winter	North	West	South	East	Total
1996–97	34,902	56,069	19,272	3,212	113,455
1997–98	40,497	54,859	20,486	3,432	119,274
1998–99	41,007	59,928	20,385	2,889	124,209
1999–00	42,903	58,154	22,957	3,366	127,380
2000–01	43,226	66,468	24,718	4,380	138,792
2001–02	48,388	70,392	20,432	4,300	143,512
2002–03	42,743	49,718	17,378	2,897	112,736
2003–04	47,544	28,880	11,706	4,380	92,510
2004–05	46,363	24,510	13,875	917	85,665
2005–06	51,275	28,242	13,900	1,059	94,476
2006–07	47,343	31,686	16,103	543	95,675
2007–08	50,175	32,942	16,308	550	99,975
2008–09	47,259	26,830	12,402	293	86,784
2009–10	54,437	26,243	12,686	472	93,838
2010-11	47,941	29,145	11,249	469	88,804
2011-12	51,812	25,822	11,158	488	89,280

Source: NPS visitation records.

2.4.2 Winter Use Activities Data

In Table 2-3, winter visitation in 1996–1997 through 2011–2012 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, snowmobile passengers made up only 30 percent of winter season users. Snowcoach passengers made up approximately 10 percent of winter season users before 2003–2004 but made up 21 percent of use in 2005–2006. By the 2009–2010 winter season, snowcoach passengers still accounted for 21 percent of park recreational visits, but the fraction of people visiting by snowmobile had declined to 23 percent. In 2009–2010, snowmobile traffic was about one-quarter the level it was in the 1990s and early 2000, while the number of snowcoach passengers had doubled. In the 2011–2012 winter season, snowmobile and snowcoach visitation declined largely due to a

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
2006–07	45,519	144	1,658	289	31,805	20,350	95,675
2007–08	48,404	104	1,667	261	31,420	22,344	99,975
2008–09	45,088	221	1,945	359	23,417	18,963	86,784
2009–10	52,662	643	1,121	496	22,228	20,388	93,838
2010–11	46,891	160	879	380	22,691	22,774	93,775
2011–12	50,101	197	1,495	520	20,157	20,607	93,077

[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 *2002–2003 Winter Visitor Survey* indicates that about 6 percent of visitors participated in cross-country skiing.

Source: NPS visitation records.

lack of snow at the beginning of the season. The North and West Entrances were not open for snowmobile use for the first 16 days of the winter season. Visitation by private vehicles has also increased in recent years.

Estimating the annual number of cross-country skiers in YNP is more difficult than tracking snowmobile and snowcoach visitors. 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-country 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.

2.4.3 Projected Winter Use

In Section 3, we derive the net benefits of each proposed alternative relative to the Baseline 1 over the next 10 years (2013–2014 to 2022–2023). To calculate net benefits, we need to forecast visitation over the next 10 years under each alternative. Previous benefit-cost analyses for YNP created visitation forecasts using results from the *2002–2003 Winter Visitor Survey* (NPS, 2003a) to adjust "historic visitation" (preregulation) based on how the visitors said they would change their behavior under different alternatives. However, regulations setting daily limits and requiring guided tours for snowmobiles have been in place since the winter of 2003–2004, and there is now enough data on visitation under the new conditions to serve the primary baseline from which to forecast visitation in the future and under the different alternatives.

We divided visitors into four categories: wheeled-access visitors (automobiles, buses, and recreational vehicles), skiers (visitors who skied through the entrance), snowcoach visitors, and snowmobile visitors. To create 10-year visitation forecasts for Baseline 1, we set a minimum, mean, and maximum level of visitation for each category based on the averages observed over the last 3 years (when management similar to Alternative 2 has been in place). Under Baseline 1 conditions, all oversnow vehicles in the park would be banned beginning in 2013–2014. For wheeled-access visitors and skiers, we set the mean at the average number of visitors over the last seasons, which assumes that visitation by visitors who do not currently use oversnow vehicles would not change if oversnow vehicles were

prohibited.[2] The minimum was set at 91 percent of the mean for wheeled access and 82 percent of the mean for skiers based on the largest percentage deviation from the mean in the last three seasons. The maximum was set at 113 percent of the mean for wheeled access and 125 percent of the mean for skiers. The *2002–2003 Winter Visitor Survey* (NPS, 2003a) asked about changes in visitation in response to a ban on snowmobiles but not snowcoaches. Survey results indicate that nonsnowmobilers (skiers, including skiers who rode snowcoaches to trails to ski in YNP and wheeled-access visitors) 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. This assumes that banning both snowcoaches and snowmobiles is similar to banning just snowmobiles for wheeled visitors and skiers. Table 2-4 summarizes the mean of the winter use projections in YNP under Baseline 1 baseline conditions. Visitation is assumed to be constant over the next 10 years based on the lack of a clear trend in winter use over the last 10 years.

Table 2-4. Mean Projected Baseline 1 (Alternative 1) Winter Use in YNP by Primary Activity, 2013–2014 through 2022–2023

	Cross-Country Skiing	Wheeled Access	Total Visitors
2013–2014	465	47,227	47,692
2014–2015	465	47,227	47,692
2015–2016	465	47,227	47,692
2016–2017	465	47,227	47,692
2017–2018	465	47,227	47,692
2018–2019	465	47,227	47,692
2019–2020	465	47,227	47,692
2020–2021	465	47,227	47,692
2021–2022	465	47,227	47,692
2022–2023	465	47,227	47,692

[2] Wheeled access is through the North Entrance only. The number of wheeled-access vehicles was set equal to the total number of automobiles, buses, and recreational vehicles minus snowmobile and snowcoach visitors at the North Entrance as reported in NPS online visitation statistics.

2.4.4 Sources of Uncertainty in Visitation Projections

NPS estimates of winter visitation for the seasons 2013–2014 through 2022–2023 are based on the best information available from past visitation and the *2002–2003 Winter Visitor Survey* (NPS, 2003a). However, a variety of unpredictable circumstances could affect visitation in any particular year. Visitation has displayed large variability from 1 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 and uncertainty about what rules would be in place until right before the season started may have had an impact on snowmobile use in recent years. The national economic recession that started in fall 2008 and continues through 2012 may have affected visitation in the most recent years. 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.

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. The Bridger-Teton has 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 Continental Divide Snowmobile Trail (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.

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

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. The impacts are discussed in detail in the Final Supplemental EIS (NPS, 2013) for the current set of alternatives. The primary natural resource topics addressed include

- wildlife and wildlife habitat including federally protected species, and species of concern;
- air quality; and
- soundscapes.

2.8 ECONOMIC ACTIVITY IN THE SURROUNDING COMMUNITIES

Numerous communities rely heavily on income from tourists visiting YNP.

Numerous communities rely heavily on income from tourists visiting YNP. However, the area of analysis for the regional economy is a five-county portion of the GYA that includes the counties in Montana, Wyoming, and Idaho surrounding the park: Fremont in Idaho, Gallatin and Park in Montana, and Park and Teton in Wyoming. This area was chosen to include the park 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 park. However, the proportion of their economies dependent on visitation to the park tends to be much lower than in the counties adjacent to the park. Thus, the focus of the analysis is on the counties most affected by a reduction in visitation.[3]

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;

[3]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 tourism.

- the Parkway (U.S. Highway 89/287), which provides access to Flagg Ranch, 2 miles prior to the South Entrance; and
- U.S. Highways 20 and 287, which provide access to the West Entrance through West Yellowstone.

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

- 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.[4] 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 park 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 park.

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).

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

Table 2-5 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. The arts, entertainment, recreation, retail, and food services sectors made up almost 30 percent of the area's total employment in 2008. Businesses related to recreation in the park 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. In West Yellowstone, NPS identified seven businesses renting snowmobiles for self-guided tours or offering guided snowmobile tours as of the 2011–2012 winter season. In addition, at least six businesses had snowcoaches available and were licensed to provide snowcoach tours within the park, and three provided cross-country ski equipment and guided tours.

Table 2-5. Employment by Industry for Five-County GYA in 2009

Industry Classification	Five-County GYA Area Employment	Percentage of Total Area Employment
Farm employment	3,457	2.8%
Forestry, fishing, and related activities	1,140	0.9%
Mining	1,668	1.3%
Utilities	230	0.2%
Construction	12,302	9.7%
Manufacturing	4,019	3.2%
Wholesale trade	2,065	1.6%
Retail trade	13,755	10.9%
Transportation and warehousing	2,482	2.0%
Information	1,603	1.3%
Finance and insurance	5,691	4.5%
Real estate and rental and leasing	9,459	7.5%
Professional, scientific, and technical services	9,069	7.2%
Management of companies and enterprises	191	0.2%
Administrative and waste services	3,914	3.1%
Educational services	1,728	1.4%
Health care and social assistance	8,350	6.6%
Arts, entertainment, and recreation	4,952	3.9%
Accommodation and food services	15,547	12.3%
Other services, except public administration	6,808	5.4%
Government and government enterprises	17,786	14.1%
Total	126,234	100%

Source: U.S. Department of Commerce, Bureau of Economic Analysis. 2012. Local Area Employment and Income, Series CA05.http://www.bea.gov/regional/reis/.

To the north and east of the park, in areas including Bozeman and Big Sky, Montana, and Cody, Wyoming, four additional companies were licensed to offer cross-country ski tours in the park during the 2011–2012 winter use season, and two 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 (located in Jackson and Moran, Wyoming) during the winter of 2011–2012. An additional two businesses were identified that rented snowmobiles for self-guided tours in Jackson, Moran, and other nearby communities in Wyoming and Idaho. 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 snowmobilers, snowcoach tour operators, Flagg Ranch snowmobile renters, and cross-country skiers. Five snowcoach operators offered tours through the South Entrance of YNP, two located in Jackson, one in Moran, one in Dubois, and one inside the park. Two businesses offered cross-country skiing tours through the South Entrance of YNP in the 2011–2012 winter season. One was located in Jackson, and the other was headquartered inside the park.

Winter lodging facilities within YNP provided a total of 539 hotel rooms and cabins between facilities at Mammoth Hot Springs and Old Faithful during the 2011–2012 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. In addition to these accommodations within the park, numerous lodging establishments are located outside of park boundaries. 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.

3 Benefit-Cost Analysis of the Alternative Regulations Under Baseline 1

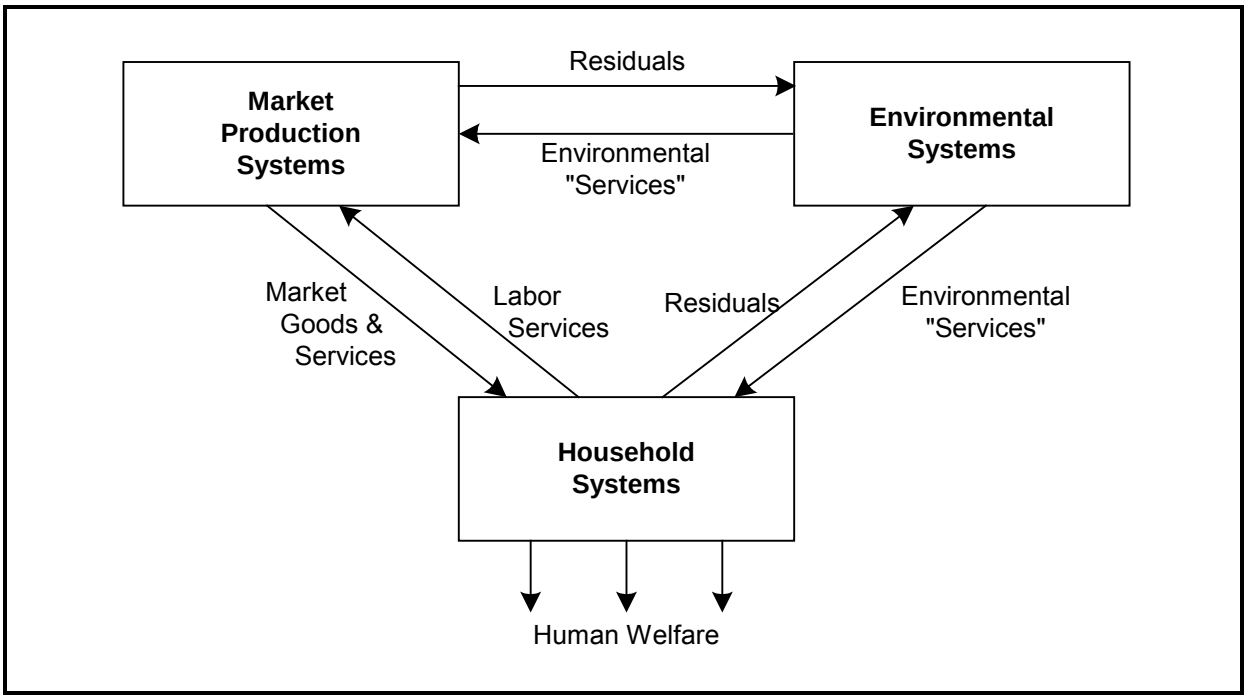
In this section, NPS presents the benefits and costs associated with alternatives considered for managing oversnow vehicle use in YNP relative to Baseline 1 (Alternative 1, the no-action baseline).

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 YNP. 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 relative to Baseline 1 (Alternative 1).

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 concept 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 taken to reduce releases of harmful

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



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

residuals (e.g., chemicals or noise pollution) to the environment potentially would reverberate throughout all of these systems. Nevertheless, the impacts of these actions, both the costs and benefits, would 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 would be on visitors who ride oversnow vehicles, whose recreational opportunities would be partially constrained by the restrictions. Restricting oversnow vehicle use would 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 would indirectly affect the welfare of other park visitors and nonvisitors. For example, when regulations restrict snowmobile use (and to a lesser extent, snowcoach use), the park environment may be improved, and this change would

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 would 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 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 would 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.

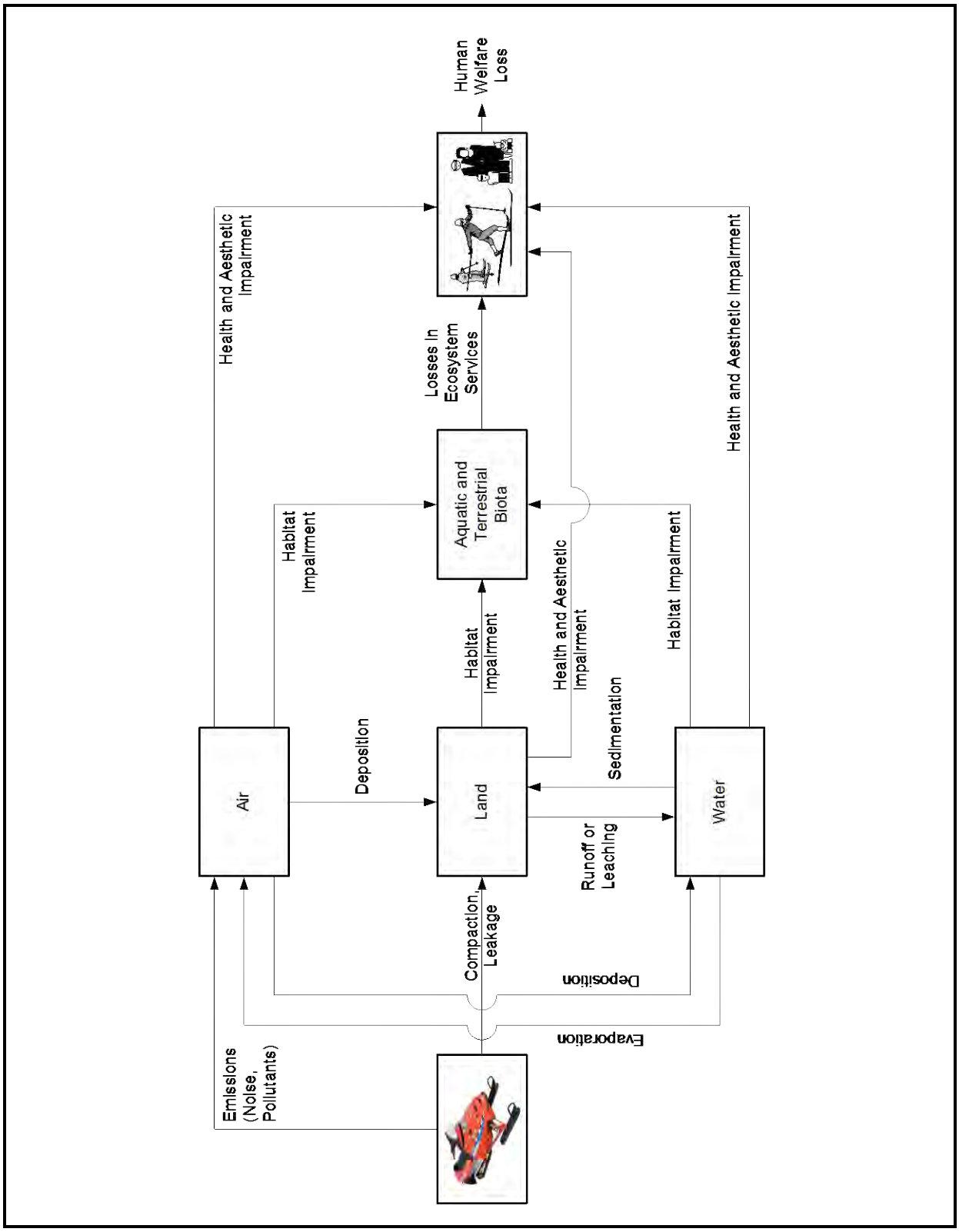
Table 3-1. Classification of Potential Negative Impacts from Oversnow Vehicle Use in National Parks

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

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



potential adverse effects to the environment through which oversnow vehicles in national parks can impose welfare losses on society. In this discussion, we focus on snowmobiles, but if snowcoach use increased significantly they would generate many of the same impacts.

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 would 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 would be individuals who value the quality of the park environment. Many of these beneficiaries would 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. Consumer surplus is the difference between the maximum amount of money that a good or service is worth to an individual (the maximum they would be willing to pay for it) and the cost of the good or service to the individual. These are the types of recreation values that would 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

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 at http://www.bls.gov/cpi/cpi_dr.htm#2003. Numbers in parentheses represent the number of observations (i.e., studies).

[b]Studies estimating nationwide values.

Source: Rosenberger, R., and J. 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.

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 benefits associated with regulations restricting snowmobile use in national parks is provided in the Supplemental FEIS (NPS, 2013).

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 would 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 market, 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 would 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) would 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 would 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 would overstate the true net social welfare associated with the activity.

3.2 RESULTS FOR YNP

Data from visitation in past winter seasons and the 2002–2003 survey of winter visitors to YNP were used to estimate Baseline 1 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 2, 3, and 4—for YNP. 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, Baseline 1 (Alternative 1, the no-action alternative) serves as the baseline to which the other alternatives are compared. As described in Section 1, Baseline 1 eliminates the use of all oversnow vehicles, both snowmobiles and snowcoaches.

Data from visitation in past winter seasons and *2002–2003 Winter Visitor Survey* (NPS, 2003a, see Appendix 1) were used to estimate Baseline 1 visitation numbers presented in Section 2 and the estimates of visitation changes for each action alternative presented in Section 3.2.2. Compared with previous reports, this report relies more heavily on visitation patterns in the last few years to create the visitation forecasts, rather than using historic visitation (pre–2004) and the 2002–2003 visitor survey results. The survey, conducted before any changes to management had been made, asked visitors how they might change their visitation under different management alternatives. Now that management proposals requiring guided tours and imposing daily limits have been in place for a number of years, these data were selected as a more reliable indicator of likely visitation under the alternatives currently under evaluation. However, the survey results were used to provide monetary estimates of consumer and producer surplus gains

and losses to visitors and businesses because of a lack of other studies that estimate WTP for winter visits to YNP.

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 is affected by changes in regulations, or snowmobilers currently riding in areas other than YNP, whose riding experience may be altered by YNP regulations (trails outside the park may be less crowded if snowmobile use is not restricted in the park).
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.
4. The general public who may care about YNP, 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 (e.g., cross-country 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.)

The Supplemental FEIS (NPS, 2013) identifies the major externalities associated with snowmobile and snowcoach use in the park. These externalities are described below.

Wildlife and Habitat

YNP currently has three species listed on the endangered species list (Canada lynx, gray wolf, and the grizzly bear). Although the grizzly is not affected by oversnow vehicle use, the other two endangered species and other species in need of special protection were evaluated for the impacts of oversnow vehicle use. Many of these species have ranges outside of the

park boundary and are expected to experience only negligible to minor adverse impacts from oversnow vehicle use.

Air Quality

All alternatives increase oversnow vehicle use, which would lead to an increase in tailpipe emissions relative to Alternative 1, the no-action alternative. These emissions can cause negative impacts to soils, water quality, visibility, and wildlife and cause acid rain production. However, since the park has required snowmobiles and snowcoaches with BAT, emissions have declined. These current emission levels do not compromise the health of the ecosystem.

Soundscapes

The ability to hear natural sounds is an important part of the visitor experience, but it is also vital to the ecosystem because species require the ability to interact. YNP currently has natural and nonnatural soundscapes within the park. Oversnow vehicle use would increase the nonnatural soundscapes. However, with the requirement of BAT in recent years, the nonnatural soundscapes due to oversnow vehicles have declined.

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. Baseline 1 places the greatest restrictions on visitation of all the alternatives, banning both snowmobiles and snowcoaches (see Table 1-1 for a summary of the alternatives). All three action alternatives permit snowcoaches, and all but Alternative 3 (starting in the 2021–2022 season) permit snowmobiles in the park. Visitation under Alternatives 2, 3, and 4 relative to the baseline depends on factors such as the number of entrances that are opened and whether commercial guiding is required for snowmobiles.

Predicting changes in winter visitation to the five-county GYA over the 10-year period starting in 2012–2014 as a result of implementing any of the alternatives is subject to a number of sources of uncertainty. To capture some of the uncertainty, the analysis uses low, mean, and high visitation scenarios for each alternative. Table 3-3 presents the assumptions for visitation and the percentage change from the mean for each alternative.

Table 3-3. Summary of Assumptions (Minimum, Mean, Maximum) Used to Estimate Visitation Changes for YNP (Percentage change from mean and number of visitors)

		Alternative 1	Alternative 2	Alternative 3 2013–14 to 2016–17	Alternative 3 2017–18 to 2019–20	Alternative 3 2020–21 to 2022–23	Alternative 4
Wheeled-access visitors	Minimum	91%	91%	91%	91%	91%	91%
		42,959	42,959	42,959	42,959	42,959	42,959
	Mean	100%	100%	100%	100%	100%	100%
		47,227	47,227	47,227	47,227	47,227	47,227
	Maximum	113%	112%	112%	112%	113%	112%
		53,366	52,894	52,894	52,894	53,366	52,894
Skiers (skiing through entrance gates)	Minimum	82%	82%	82%	82%	82%	82%
		380	380	380	380	380	380
	Mean	100%	100%	100%	100%	100%	100%
		465	465	465	465	465	465
	Maximum	125%	112%	112%	112%	125%	112%
		582	520	520	520	582	520
Snowcoach riders	Minimum	0%	96%	96%	96%	96%	96%
		0	20,161	20,161	20,161	20,161	20,161
	Mean	0%	100%	100%	100%	100%	100%
		0	21,001	21,001	21,001	21,001	21,001
	Maximum	0%	140%	140%	140%	150%	140%
		0	29,402	29,402	29,402	31,502	29,402

(continued)

Table 3-3. Summary of Assumptions (Minimum, Mean, Maximum) Used to Estimate Visitation Changes for YNP (Percentage change from mean and number of visitors) (continued)

		Alternative 1	Alternative 2	Alternative 3 2013–14 to 2016–17	Alternative 3 2017–18 to 2019–20	Alternative 3 2020–21 to 2022–23	Alternative 4
Snowmobile riders, commercially guided	Minimum	0%	87%	87%	88%	0%	87%
		0	17,639	17,639	10,685	0	17,639
	Mean	0%	100%	100%	100%	0%	100%
		0	20,275	20,275	12,020	0	20,275
	Maximum	0%	140%	140%	111%	0%	150%
		0	28,385	28,385	13,356	0	30,412
Snowmobile riders, noncommercially guided	Minimum	0%	0%	0%	0%	0%	66%
		0	0	0	0	0	891
	Mean	0%	0%	0%	0%	0%	100%
		0	0	0	0	0	1,350
	Maximum	0%	0%	0%	0%	0%	133%
		0	0	0	0	0	1,796

The high scenario is not based on the highest number of visitors possible under the daily limits but is meant to be realistic and conservative based on observed visitation, survey data, and the possibility for future visitation growth under the alternative.

For the analysis, visitors were divided into five categories. Wheeled-access visitors are visitors who tour the park in a car, bus, or recreational vehicle. The North Entrance is the only entrance that allows wheeled access, and the number of wheeled-access visitors was adjusted to subtract out visitors who drive into the North Entrance to ride a snowmobile or snowcoach.

The category "skiers" counts only those skiers who skied through the entrance gates. Other skiers in the park take snowcoaches or snowmobiles to trailheads in the park. These skiers are counted as snowmobile or snowcoach riders because their access to the park is affected by the rules governing snowmobile and snowcoach use.

Finally, there are three categories of oversnow vehicle visitors: snowcoach riders, commercially guided snowmobile tours, and noncommercially guided snowmobile tours. Only Alternative 4 allows noncommercially guided snowmobiles tours. The commercially and noncommercially guided tours are separated because they have different implications for businesses and because the riders on noncommercially guided tours may be snowmobile owners, rather than renters.

Starting with Alternative 1, oversnow vehicles are prohibited so the only visitation would be wheeled vehicles through the North Entrance (automobiles, buses, and recreational vehicles) and visitors who ski or snowshoe through the entrances. Mean visitation is set at the average visitation for wheeled vehicles and skiers through the gates over the last 3 years. The minimum is adjusted for the percentage change from average to the lowest visitation over the last 3 years. Maximum visitation is based on the *2002–2003 Winter Visitor Survey* (NPS, 2003a). Based on responses to the survey, wheeled-access visitors indicated they would increase their trips by 13 percent and skiers by 25 percent under a scenario that prohibited snowmobiles but still allowed snowcoaches. Although Alternative 1 also prohibits snowcoaches, the situation was judged to be similar to just banning snowmobiles for these

visitors (who do not currently use oversnow vehicles for transportation in the park).

Alternative 2 continues management that has been in place for the past 3 years with a daily limit of 318 snowmobiles and a requirement for commercially guided tours. We used the average number of visitors over the last 3 years as the mean visitation expected in the future. For wheeled-vehicle visitors and visitors who ski in through the gates, the minimum and maximum are based on the high and low percentage changes over the last 3 years compared with the average. For snowmobiles and snowcoaches, the minimum is based on the percentage change from average to the lowest visitation over the last 3 years. The maximum allows for a larger number of snowmobiles and snowcoaches than has been reached since the daily limit of 318 went into place but not the maximum possible under the alternative. There has been significant regulatory uncertainty regarding the management of oversnow vehicles since 2004, and often the rule for the coming season has not been put in place until just before the season starts. The uncertainty has affected the ability of visitors to make reservations in advance and for businesses and the park to advertise vacations to YNP. Many business owners believe this uncertainty has depressed visitation, especially for snowmobile riders. Introducing long-term regulations may result in increased snowmobile visitation compared with previous years, even if the daily cap is lower than or equal to the caps in previous years. Snowcoach passengers have been generally increasing over time since 2004.

Alternative 3 was divided into three time periods. From 2013–14 to 2016–17, Alternative 3 follows the same daily limits as Alternative 2. The winter season of 2017–18 starts a 3-year phaseout of snowmobiles. For the visitation forecasts, we set the maximum based on a daily average of 106 snowmobiles (with 1.4 riders per snowmobile based on recent visitation data). The mean and minimum are 90 percent and 80 percent of the maximum, respectively. Snowcoach visitation was assumed to be similar to Alternative 2 for the first 8 years. For the final 3 years of the 10-year forecast, snowmobiles are prohibited. The minimum and mean levels of snowcoach visitation remain the same as in previous years, but the maximum is higher based on results from the 2002–2003 visitor survey that suggests when snowmobiles are prohibited

some snowmobile riders would switch to snowcoaches. The maximum number of visitors in wheeled vehicles and skiing through the entrance is higher in the last 3 years when snowmobiles are banned (similar to the assumptions under Alternative 1).

Finally, Alternative 4 allows for transportation events that can be a group of snowmobiles or a snowcoach. Alternative 4 has a higher daily limit on snowmobiles and snowcoaches than Alternative 2. Mean and minimum visitation numbers under Alternative 4 are assumed to be similar to current visitation and the forecast for Alternative 2. However, the maximum visitation forecast for commercially guided snowmobiles is higher under Alternative 4 because of the higher daily limits and the potential for even higher daily limits if the snowmobile and snowcoaches in the park achieve stricter technology requirements for noise and air emissions (known as enhanced BAT). Looking at visitation since 2004, years when the daily limit was higher (either 720 or 540) snowmobile visitation was higher (see the Supplemental FFEIS for more details (NPS, 2013)).

Alternative 4 also allows for noncommercially guided groups of snowmobiles (one group of five snowmobiles from each entrance per day). We assumed that the maximum visitation for noncommercially guided snowmobiles equals the maximum allowed under the alternative (20 snowmobiles per day). The mean visitation assumed 15 snowmobiles per day and the minimum assumed 10 snowmobiles per day.

Table 3-4 provides the incremental impacts on winter use patterns for the mean scenario resulting from implementing Alternative 2, 3, or 4 relative to Baseline 1 for YNP in 2020–2021, the first year in which snowmobiles are banned under Alternative 3. The incremental visitation change equals the total visitation predicted for each alternative and visitor group minus the total visitation predicted under Baseline 1 for each visitor group. Compared with Baseline 1, visitation would increase under all the action alternatives. Only under the maximum scenarios does the number of wheeled-access visitors and cross-country skiers fall.

The incremental change in visitation is lowest under Alternative 3 once snowmobiles are prohibited. Alternative 4 generates the

Table 3-4. Mean Incremental Change in Winter Visitation Relative to Baseline 1 in YNP for 2020–2021 (Number of Visitors)

	Wheeled Access	Cross-Country Skiing	Snowcoach	Snowmobile Commercially Guided	Snowmobile Non-commercially Guided	Total Incremental Change in Visitors
Alternative 2	0	0	21,001	20,275	0	41,276
Alternative 3 2012–13 to 2016–17	0	0	21,001	20,275	0	41,276
Alternative 3 2017–18 to 2019–20	0	0	21,001	12,020	0	33,022
Alternative 3 2020–21 to 2021–22	0	0	21,001	0	0	21,001
Alternative 4	0	0	21,001	20,275	1,350	42,626

Note: Incremental impacts were calculated as the difference between mean visitation under each action alternative and Baseline 1 (Alternative 1, the no-action alternative).

highest number of expected visitors because of the addition of the noncommercially guided tours, which increased the number of snowmobiles allowed each day.

3.2.3 Benefits

Benefits to Snowmobilers and Snowcoach Riders

Baseline 1 requires a complete ban on snowmobiles and snowcoaches for the 2013–2014 winter season. As discussed above in Section 3.2.2, Alternatives 2, 3, and 4 would benefit snowmobilers (except Alternative 3 starting in 2020–2021), snowcoach riders, and providers of services to these visitors by allowing oversnow vehicle access to the park. If implemented, the benefits of these management alternatives would begin accruing to oversnow vehicle visitors in the 2013–2014 winter season. This section describes the consumer surplus benefits to snowmobilers and snowcoach riders that would result from implementing the less-restrictive management options compared with baseline conditions.

As discussed in Section 3.1, 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. For each individual, consumer surplus for the chosen activity accounts for the value for substitute activities. 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 would be less crowded and the potential problems of noise, air emissions, and safety considerations associated with snowmobiles would be lessened.

To calculate the consumer surplus benefits to snowmobilers and snowcoach riders of moving from Baseline 1 (a ban on oversnow vehicles) to the different action alternatives, WTP estimates derived from the *2002–2003 Winter Visitor Survey* (NPS, 2003a) were used. Estimates were based on the stated choice conjoint experiment, Model 2 (mixed logit) from Table 6-7 of Appendix 1.[1] The survey and regression models

[1]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.

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:

- Baseline 1, snowmobile and snowcoach riders not in the park (opt-out level of utility)
- Alternative 2, 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 3, until 2017–2018 same as Alternative 2; starting in 2017–2018 all the trips for activities allowed under the alternative would experience low crowding days (low crowding at entrance and destination, smooth road surface, low noise and emissions)
- Alternative 4, 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 Baseline 1, conditions become noisier and more crowded, leading to a loss of utility. Snowmobilers and snowcoach riders do not visit the park under baseline conditions. For these visitors, utility increases when they are allowed into the park under the action alternatives.

Table 3-5 contains the WTP point estimates for snowmobile and snowcoach riders for each alternative. The WTP for noncommercially guided trips was estimated using snowmobile owner results from the visitor survey, while snowmobile renter results were used for the commercially guided trips. Snowmobile owners placed a higher WTP on unguided trips in the visitor survey, and noncommercially guided trips were

Table 3-5. Mean per-Day WTP for Commercially Guided Snowmobile and Snowcoach Riders and Noncommercially Guided Snowmobile Riders to Change from Baseline 1 to Alternatives 2, 3, and 4[a]

	Commercially Guided Snowmobile	Noncommercially Guided Snowmobile	Snowcoach
Alternative 2 weighted average	$212	NA	$194
Alternative 3 weighted average (2012–2013 to 2016–2017)	$212	NA	$194
Alternative 3 weighted average (2017–2018 to 2019–2020)	$321	NA	$277
Alternative 3 weighted average (2020–2021 to 2021–2022)	NA	NA	$368
Alternative 4 weighted average	$212	$485	$194

[a]Change in utility based on regression results for Model 2 for visiting under conditions when snowmobiles are 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 from the visitor survey were inflated to 2011 dollars using the consumer price index for recreation available from the Bureau of Labor Statistics at http://www.bls.gov/cpi/cpi_dr.htm#2003.

assumed to be more similar to unguided trips than commercially guided trips (snowmobile owners who responded to the visitor survey indicated they would prefer not to visit YNP if they had to take a commercially guided tour). The WTP values reported in Table 3-6 represent mean estimates (within a range of uncertainty) based on the modeling approaches discussed in Appendix 1. For each action alternative, the expected numbers of low and moderate crowding days were calculated based on visitation over the last three seasons and forecasted visitation for the alternative. Using the predicted percentage of low and moderate crowding under each action alternative, a weighted WTP was created. Table 3-6 presents the percentage of low and moderate crowding expected under each alternative, based on the definitions of moderate and low crowding used in the *2002–2003 Winter 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.

The survey did not include an attribute describing whether all the other snowmobiles in the park were on guided tours; thus, the measured WTP of snowcoach riders is not affected by this management provision. To the extent that snowcoach riders prefer that snowmobile riders are part of a guided tour, the welfare gains in Alternatives 2, 3, and 4 may be larger.

Table 3-6. 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 2	0%	Destination: 50%	Entrance: 100% Destination: 50%
Alternative 3 weighted average (2012–2013 to 2016–2017)	0%	Destination: 50%	Entrance: 100% Destination: 50%
Alternative 3 weighted average (2017–2018 to 2019–2020)	0%	0%	Entrance: 100% Destination: 100%
Alternative 3 weighted average (2020–2021 to 2021–2022)	0%	0%	0%
Alternative 4	0%	Destination: 50%	Entrance: 100% Destination: 50%

[a]Moderate and low crowding are defined as in the survey described in Appendix 1 with the following adjustment: moderate is defined as 250 to 700 machines in YNP per day and low is defined as fewer than 250 machines in YNP per day.

Consumer Surplus Gains of Alternatives 2, 3, and 4

Using the WTP values from Table 3-5, the total consumer surplus benefits for snowmobilers and snowcoach riders under Alternatives 2, 3, and 4 relative to Baseline 1 were calculated. Table 3-7 presents the mean estimates of total consumer surplus gains for 2020–2021 (the first year snowmobiles are prohibited under Alternative 3) based on the incremental changes in visitation and WTP values for each alternative.

Table 3-7. Mean Estimated Consumer Surplus Gains for Snowmobile and Snowcoach Riders in YNP Relative to Baseline 1, 2020–2021

	Snowcoach	Commercially Guided Snowmobile	Noncommercially Guided Snowmobile	Total
Alternative 2	$4,083,478	$4,295,538	$0	$8,379,016
Alternative 3	$7,717,990	$0	$0	$7,717,990
Alternative 4	$4,083,478	$4,295,538	$654,845	$9,033,861

Note: 2011 dollars.

Alternative 4 provides the largest gains in consumer surplus relative to Baseline 1 because of the provision allowing noncommercially guided tours. Alternative 3 yields the lowest gains once snowmobiles are prohibited, although in the 3-year transition (2017–2018 to 2019–2020), consumer surplus gains

are actually larger under Alternative 3 than Alternative 4 because with fewer snowmobiles in the park, the higher consumer surplus per trip balances out the loss of visitors.

The snowmobile technology requirements imposed by Alternatives 2, 3, and 4 are a potential limiting factor in the consumer surplus gains that are not reflected in the WTP estimates. BAT snowmobile technology is required for snowmobiles by 2017. Local snowmobilers who own traditional two-stroke models may experience lower consumer surplus gains because they would be unable to use their machines in YNP. However, renters and individuals who already own the permitted models should experience welfare gains. Those who snowmobile in the park would be able to do so in a way that causes less environmental damage and would be less likely to suffer snowmobile-related health effects than YNP snowmobilers in past seasons.

Benefits to Businesses

Compared with Baseline 1, Alternatives 2, 3, and 4 would result in increased numbers of visitors in YNP. The increase would positively affect the suppliers of oversnow vehicle and other tourism-related services in the GYA.

Compared with Baseline 1, Alternatives 2, 3, and 4 would result in increased numbers of visitors in YNP. The increase would 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 Baseline 1 were calculated. For each alternative, revenue changes are reported for six 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 per day) spending in each category, where per-visitor spending is based on responses to the 2002–2003 visitor survey (NPS, 2003a) and current costs of guided snowmobile and snowcoach trips.[2] For Alternative 4, we assumed that 50 percent of the noncommercially guided trips were snowmobile owners and 50% were renters.

[2]The cost of a commercially guided snowmobile trip was set to $160, half the cost of a two-person snowmobile tour offered by Xanterra Parks and Resorts (based on prices from their Web site accessed in June 2012). The cost of a snowcoach tour was set to $135, also based on the cost from Xanterra Parks and Resorts. Tour providers offered a variety of snowmobile and snowcoach trips, some of which cost more and some of which cost less. Actual revenue changes in the future will depend on the types of tours offered and their costs.

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 a measure of profit margins for the Standard Industrial Classification (SIC) codes associated with the six spending categories provided by Dun & Bradstreet (D&B, 2010).[3]

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.

Table 3-8 summarizes the total estimated change in producer surplus forecasted for 2020–2021 (the first year snowmobiles are prohibited under Alternative 3) for each sector in the GYA relative to Baseline 1 for YNP. The calculations presented in Table 3-8 assume that each snowmobile or snowcoach visitor represents a new visitor to the area and, thus, additional spending relative to Baseline 1. Alternative 4 results in the greatest increase in producer surplus because of the higher visitation forecast.

Impacts through National Park Expenditures in YNP of Alternatives 2, 3, and 4

In 2011–2012, snowmobilers paid $20 for a 7-day pass to enter the park, and snowcoaches also paid an entrance fee based on the number of passengers.[4] Under Alternatives 2, 3, and 4, revenue from entrance fees would be higher relative to Baseline 1 (Alternative 1). An increase in entrance fee revenue may have welfare impacts on local businesses, local residents, and

[3]The analysis used the average of the upper quartile profit margins from D&B (2010) for the affected SIC codes. For comparison, the upper and lower quartile profit margins are snowmobile and snowcoach rentals (SIC 7999) 8.3 percent to −2.9 percent; lodging (SIC 7011) 7.7 percent to −9.3 percent; restaurants and bars (SIC 5812) 6.1 percent to −1.0 percent; grocery stores (SIC 5411) 2.6 percent to 0.4 percent; gas and oil (SIC 5541) 2.1 percent to 0.2 percent; souvenir shops and other retail establishments (SIC 5947) 5.7 percent to 0.0 percent.

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

Table 3-8. Mean Estimated Producer Surplus Gains for Businesses in YNP Relative to Baseline 1 for 2020–2021

	Alternative 2	Alternative 3	Alternative 4
Recreation services (including tours)	$6,079,180	$2,835,180	$6,187,180
Grocery	$391,093	$163,810	$406,281
Lodging	$2,185,155	$841,733	$2,272,689
Restaurant	$1,666,638	$651,671	$1,733,881
Transportation/gas	$884,467	$336,231	$920,593
Retail	$609,577	$225,974	$634,984
Total	$11,816,111	$5,054,601	$12,155,609

Note: 2011 dollars.

visitors. To the extent that local workers or businesses are hired by YNP to work in the park, there may be gains in producer surplus if the park spends more money in the surrounding communities. Park visitors' welfare may be affected to the extent that there is more revenue for maintenance and improvements in the park.

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

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 2, 3, or 4 relative to Baseline 1 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 Section 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. The

Supplemental FEIS (NPS, 2013) specifically describes the impacts on natural resources and other visitors that could result from snowmobile use within the boundaries of YNP. This section assesses the costs of the management alternatives resulting from the negative impacts of snowmobile and snowcoach use. Many of the costs are difficult to quantify, so a monetary value is not estimated.

Through the 2012–2013 winter season, snowmobiling and snowcoaches in YNP were 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.

Nonsnowmobiling winter recreators in YNP 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 park.

Nonsnowmobiling winter recreators in YNP whose park experience is negatively affected by the presence of snowmobiles bear the bulk of the costs from regulations allowing continued oversnow access to the park. Among the more popular activities and means of experiencing the park during the winter season other than snowmobiling and riding a snowcoach are cross-country skiing, snowshoeing, winter hiking, and automobile touring.

Negative externalities associated with snowmobiles and snowcoaches may reduce the value of trips to YNP, causing a loss of consumer surplus for other visitors.[5] Cross-country skiers recreating in the vicinity of snowmobile and snowcoach routes are forced to breathe emissions and hear the noise of the engines and may feel unsafe sharing the road with motorized recreation. Wheeled vehicles in the northern part of YNP have very limited contact with snowcoaches because they do not share the same roads, so they may be less affected than

[5]Snowcoach passengers are also susceptible to the externalities of snowmobile use. Snowcoach passengers share snowmobilers' routes through the park and can be exposed to high concentrations of exhaust and noise at popular stopping points. The loss in consumer surplus to snowcoach riders from the presence of snowmobiles is factored into the WTP values presented in Section 3.2.3.

cross-country skiers. Responses to the *2002–2003 Winter Visitor Survey* (NPS, 2003a) suggest that some snowcoach riders are bothered by snowmobiles. Snowcoach passengers share snowmobilers' routes through the park and can be exposed to high concentrations of exhaust and noise at popular stopping points. Likewise, snowmobile groups may be bothered by the presence of snowcoaches on the roads. The loss in consumer surplus to snowcoach or snowmobile riders from the presence of other oversnow vehicles is factored into the WTP values presented in Section 3.2.3.

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 Baseline 1 to Alternatives 2 through 4. 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 were used for skiers and wheeled-vehicle passengers. Table 3-9 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 no snowmobiles and snowcoaches under Baseline 1 to the alternative on low or moderate crowding days was calculated. WTP is negative because skiers and wheeled-vehicle passengers are generally worse off under Alternatives 2, 3, and 4 than under Baseline 1. A negative value implies that these visitors would need to be compensated to reach the same level of welfare they experienced under the baseline. The values are based on average WTP estimates for all nonoversnow vehicle visitors. In Table 3-9, the consumer surplus loss is lower in the later years of Alternative 3 because there are fewer snowmobiles in the park. The survey used to generate the WTP values did not include scenarios where snowcoaches were prohibited. The WTP values for no snowmobiles in the park were used for Alternative 1, which prohibits snowcoaches as well. Thus, there is no difference in WTP for visits under Alternative 1 and the last years of Alterative 3 when just snowmobiles are prohibited. It is possible that some skiers may be worse off under Baseline 1 if they skied on roads that were groomed for snowmobiles and snowcoaches. To the extent that

Table 3-9. Mean of per-Day WTP for Nonoversnow Visitors to Change from Baseline 1 to Alternatives 2, 3, and 4[a]

	Cross-Country Ski through the Entrance	Wheeled Access
Alternative 2 weighted average	−$152	−$152
Alternative 3 weighted average (2013–2014 to 2016–2017)	−$152	−$152
Alternative 3 weighted average (2017–2018 to 2019–2020)	−$89	−$89
Alternative 3 weighted average (2020–2021 to 2022–2023)	$0	$0
Alternative 4 weighted average	−$152	−$152

[a]Change in utility based on regression results for Model 2 for visiting under conditions when snowmobiles are banned; see Table 6-7 of Appendix 1. Weighted average WTP based on percentage of moderate and low crowding days during the season. 2011 dollars.

this is true, the WTP measures overstate the losses associated with the action alternatives for skiers.

Using the predicted percentage of low and moderate crowding days under each alternative, NPS created a weighted WTP (see Table 3-6 for the percentage of low and moderate crowding days selected under each alternative). For skiers and wheeled-vehicle passengers, Baseline 1 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 2, 3, and 4.

Using the WTP values from Table 3-9 and visitation under each alternative, NPS calculated the total consumer surplus losses for nonoversnow visitors under Alternatives 2, 3, and 4 compared with Baseline 1. Table 3-10 summarizes the annual estimated consumer surplus losses. Consumer surplus losses are lowest under the later years of Alternative 3 because there are fewer or no snowmobiles in the park.

Costs to the General Public

Costs to "nonusers" of the park are also likely to result from continued snowmobile use in the park (see Section 3.1). For example, individuals who do not visit the park 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 park's resources is

Table 3-10. Mean Estimated Consumer Surplus Losses for Cross-Country Skiers and Wheeled Access Visitors Relative to Baseline 1 in YNP

	Wheeled Access	Cross-Country Skiing	Total
Alternative 2	−$7,164,722	−$70,595	−$7,235,318
Alternative 3 (2013–2014 to 2016–2017)	−$7,164,722	−$70,595	−$7,235,318
Alternative 3 (2017–2018 to 2019–2020)	−$4,220,349	−$41,584	−$4,261,933
Alternative 3 (2020–2021 to 2022–2023)	$0	$0	$0
Alternative 4	−$7,164,722	−$70,595	−$7,235,318

Note: 2011 dollars.

being protected for the enjoyment of future generations. To the extent that park resources degrade under Alternatives 2, 3, and 4, nonusers would incur costs arising from the disutility of knowing that resources in the park may be compromised by the presence of snowmobiles.[6]

Costs to Businesses for Upgrading Snowcoach Fleet

As of December 15, 2017, every snowcoach would be required to have EPA Tier 2–compliant engines and exhaust emission controls. *Tier 2 Rule* (65 FR 6697, February 10, 2000) instituted a comprehensive regulatory program designed to significantly reduce the emissions from new passenger cars and light trucks, including pickup trucks, vans, minivans, and sport-utility vehicles. These reductions provide for cleaner air and greater public health protection, primarily by reducing ozone and PM pollution. The program treats vehicles and fuels as a system, combining requirements for much cleaner vehicles with requirements for much lower levels of sulfur in gasoline. The program phases in a single set of tailpipe emission standards that apply to all passenger cars, light trucks, and larger passenger vehicles operated on any fuel. Tier 2 engines and emission control equipment include vehicle computers, a full

[6]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.

complement of sensors including engine control module computers, onboard diagnostics systems, and exhaust after treatment equipment that is standard original equipment manufacturer equipment included with on-road vehicles or engines. The emissions standards for BAT snowcoaches would therefore be based on technology specifications (technical standard). Technical standard specifications would differ depending on whether the vehicle was gasoline or diesel powered.

This requirement would not apply to Alternative 1 (with no oversnow vehicle use). Under the action alternatives, between 60 and 212 snowcoaches would be allowed to operate in YNP per day.

This requirement could involve replacing engine and emission control systems so that the vehicle is in compliance with Tier 2 technical standards or purchasing new vehicles that are Tier 2 compliant. Coaches would also need to meet a sound emission requirement. Once approved, a snowcoach could operate for 10 years without being upgraded or replaced.

During the winter season of 2011–2012, out of the 78 snowcoaches that were in operation, 22 were Bombardiers (28% of the fleet); 37 were full-size vans and SUVs (47.4% of the fleet); and 19 were small and mid-sized coaches such as Glavals, Krystals, and Vanterras (24.4% of the fleet).

To calculate the cost of the snowcoach upgrades required by the alternatives, NPS assumed the following:

- The 22 Bombardiers would continue to operate and their engine and emission control systems would be upgraded to meet 2007 EPA Tier 2 requirements for spark ignition engines. The cost would be approximately $35,000 per vehicle for a total of $770,000.
- Of the current 37 standard-size vans and SUVs, 30 would be 10 or more years old by December 2017 (model year 2006 or older) and would be replaced through normal replacement. No additional cost is assumed because these vehicles would need to be replaced anyhow. Of the remaining 7 vehicles in this class that are 2007 or newer, 6 are gasoline and would therefore meet EPA Tier 2 standards and do not need to be replaced. The remaining vehicle, a 2009 diesel van, would not meet the 2010 Tier 2 standard and would need to be replaced. The cost of replacement of this

vehicle and associated track systems would be approximately $125,000.

- Of the 19 small and mid-sized snowcoaches, 4 would be 10 or more years old by December 2017 (model year 2006 or older) and would be replaced through normal replacement. No additional cost is assumed because these vehicles would need to be replaced anyhow. Of the remaining 15 vehicles in this class that are 2007 or newer, 5 are diesel and model year 2007 to 2009 and would not meet the proposed BAT standard and would therefore need to be replaced. The cost of replacing these 5 vehicles and associated track systems is $825,000 ($165,000/each). Of the remaining 10 vehicles, all would meet EPA Tier 2 standards and would not need to be replaced.

Based on these assumptions, the total cost of converting the current fleet to meet the new requirements would be approximately $1,720,000. For purposes of the analysis, we assumed the costs would be spread over 5 years starting in 2017 with an 8 percent annual interest rate, resulting in costs of approximately $430,785 per year for 5 years spread across all the businesses that offer snowcoach tours.

All snowcoach companies are also authorized to provide summer tours in the park. The conversion vehicles would be available for wheeled summer tours; they are not purpose-built winter vehicles like the Bombardiers. Existing, older conversion vehicles could continue to be operated in the summer for wheeled-vehicle tours. The investment in new vehicles would be spread over both seasons and a 10-year life span for the vehicle.

Costs to Park Operations in YNP of Alternatives 2, 3, and 4

Baseline 1 would reduce operating costs for the park during the winter. The resources devoted to grooming roads, controlling avalanches at the East Entrance, and staffing in the winter under the action alternatives could be 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 would result in a loss to park staff, visitors, and parts of the general public.

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 park. 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.[7] Restrictions would also benefit nonsnowmobiling recreators by reducing their risks of being involved in accidents with snowmobiles. Reducing snowmobile-related accidents would also reduce the costs to NPS associated with medical/rescue operations, which would allow these resources to be redirected to other park management activities. Alternatives 2, 3, and 4 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 roads and providing fuel, equipment repairs, minor first aid, directions, and emergency medical services as part of their regular activities. Incidents in the park that require the assistance of either general ranger support or law enforcement 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. Consequently, Alternatives 2, 3, and 4 impose costs on the park by requiring it to continue to devote resources toward managing snowmobiles and, to a lesser extent, snowcoaches in the park that could be diverted to other uses under Baseline 1.

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

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 affect the estimated costs and benefits associated with the winter management alternatives being analyzed. Three potential visitation scenarios were developed for Alternatives 2, 3, and 4 to show the range of impacts from varying assumptions concerning the number of visitors that would 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:

- As discussed in the *2002–2003 Winter Visitor Survey* report (included in Appendix 1), the benefits to snowmobilers of Alternatives 2, 3, and 4 may be understated because the survey focused on day trips. From the survey results, it appears that in 2002–2003 snowmobilers on a 1-day trip might prefer to be outside the park but might still prefer to visit YNP as one part of a multiday trip to the GYA. In other words, although they may have higher WTP for trips outside the park 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 park and they may choose not to make the trip to the GYA if the parks is not available for snowmobiling. Thus, focusing on day trips may understate the value of being able to snowmobile in the park to snowmobilers' consumer surplus.
- The stated behavior questions in the *2002–2003 Winter 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 should 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 Alternative 4 (alternative where noncommercial guided access is allowed) may 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 values could increase the consumer surplus losses associated with Alternatives 2, 3, and 4.
- The rule proposal process itself may have affected the number of snowmobile users who visited YNP in recent years. Some businesses believe that the continuing regulatory uncertainty has reduced demand because

visitors, especially snowmobile riders, cannot plan in advance. Any change in visitation due to uncertainty over future restrictions in the park that has occurred over the last few years will influence all of the projections used in the analysis.

- The estimates of producer surplus gains do not account for adaptations that businesses may make if snowmobiles and/or snowcoaches are not permitted in the park. Businesses may be 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 overstate gains to local businesses from permitting snowmobile and snowcoach use relative to Alternative 1.

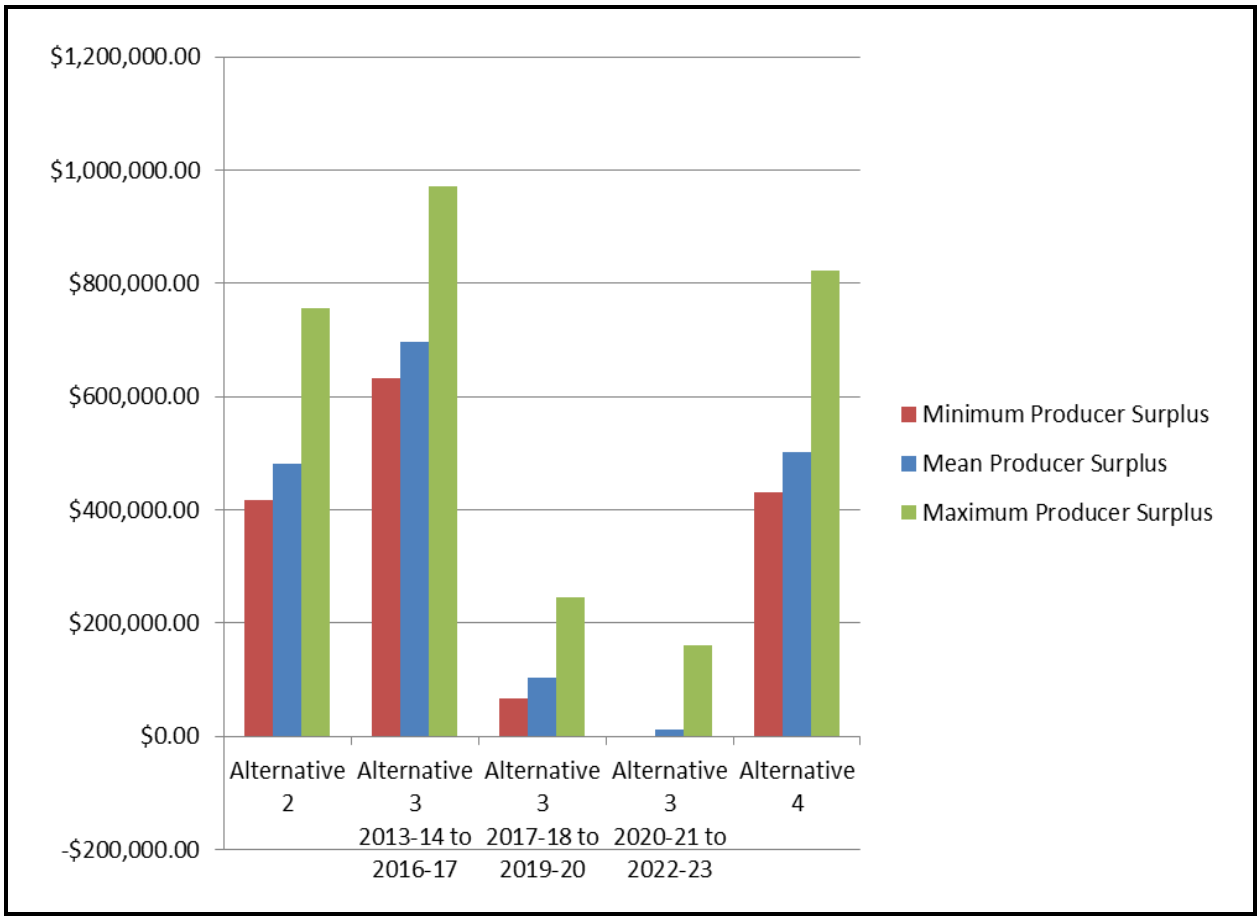
3.3 SUMMARY

Three winter use management alternatives are analyzed relative to Baseline 1 to examine the effect of allowing the use of snowmobiles and snowcoaches in YNP. Under Baseline 1, snowmobile and snowcoach use would be prohibited. Alternatives 2, 3, and 4 allow for continued recreational snowmobile use (except Alternative 3 starting in 2020–2021) and snowcoach use subject to daily limits on the number of snowmobiles and snowcoaches that can enter the park, BAT restrictions, and requirements that all of the snowmobiles be on guided tours.

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

Figure 3-3 displays the minimum, mean, and maximum annual estimates of producer surplus by alternative. Because visitation increases under all the action alternatives relative to Baseline 1, producer surplus is positive for all the action alternatives. Producer surplus gains are largest under Alternative 4, which also has the highest visitation levels. Producer surplus declines over time in Alternative 3 as snowmobiles are phased out and replaced with snowcoaches, resulting from the forecast decline in visitation.

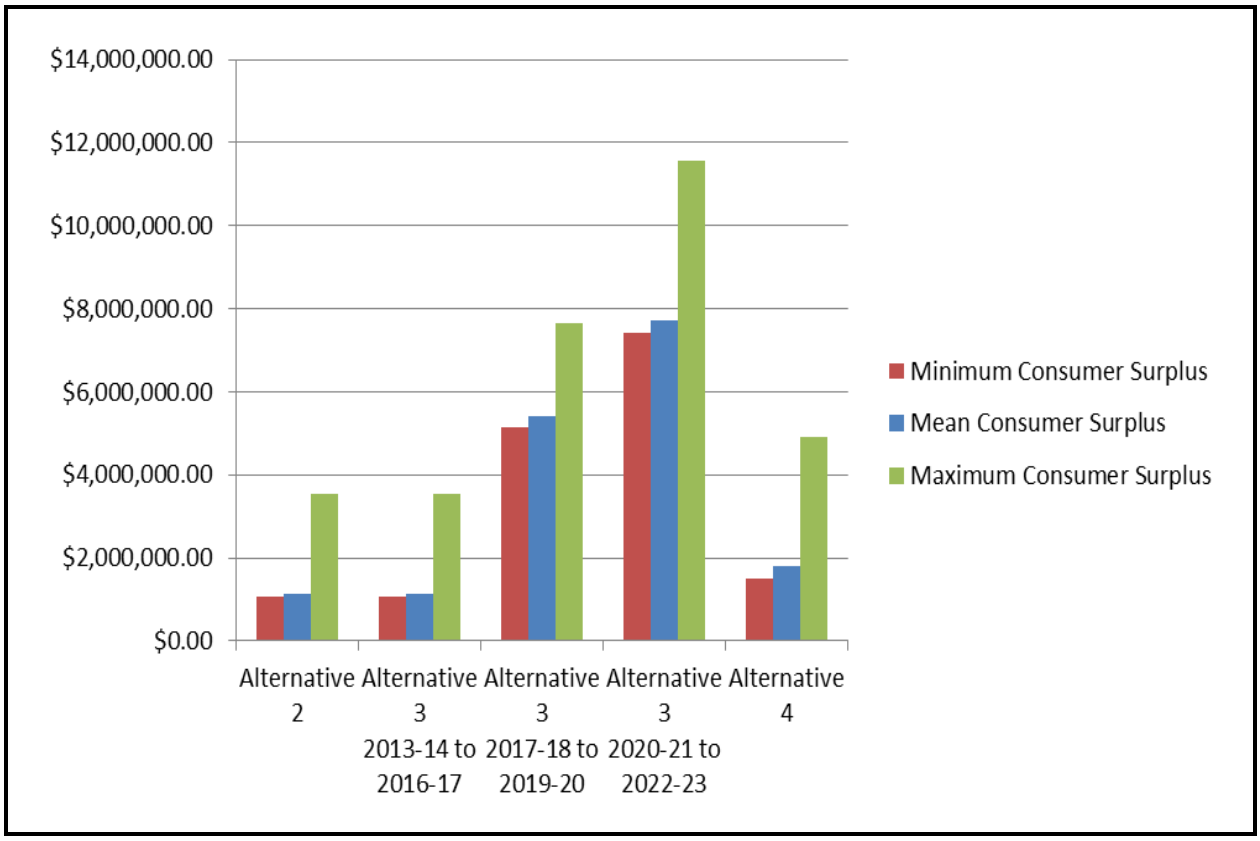
Figure 3-3. Mean Annual Producer Surplus by Alternative



Note: 2011 dollars.

Figure 3-4 shows the minimum, mean, and maximum annual estimates of consumer surplus by alternative. The total consumer surplus gain or loss is the sum of the gains and losses to individual visitors, so the size of the bars in Figure 3-4 reflect both the number of visitors engaged in the activity and the average WTP by each visitor.

Figure 3-4. Mean Annual Consumer Surplus by Alternative



The consumer surplus estimates are much larger than the producer surplus estimates, because the value that a visitor places on their trip is greater, sometimes much greater, than the cost of the trip.

Alternative 3 generates the highest consumer surplus because nonsnowmobiling visitors expressed a high value for being in the park with fewer or no snowmobiles. Alternative 4 has the next highest consumer surplus values because visitation is higher and we assumed that many of the noncommercially guided snowmobile tours would include snowmobile owners, who place a higher value for snowmobile trips than snowmobile renters.

Putting the benefits and costs together, Table 3-11 presents the mean present value of total quantified net benefits for YNP. Net benefits represent the sum of consumer and producer surplus losses and gains, along with the cost of upgrading the

Table 3-11. Mean of Present Value of Total Quantified Net Benefits for YNP Relative to Baseline 1, 2013–2014 through 2022–2023

	Discount Rate	Present Value of Total Quantified Net Benefits
Alternative 2	Discounted at 3%[a]	$13,949,945
	Discounted at 7%[b]	$11,581,847
Alternative 3	Discounted at 3%[a]	$38,491,539
	Discounted at 7%[b]	$29,910,356
Alternative 4	Discounted at 3%[a]	$19,706,768
	Discounted at 7%[b]	$16,321,889

Note: 2011 dollars.

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

[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.

snowcoach fleet for Alternative 3.[8] Estimates of the present value of total quantified net benefits expected from Alternatives 2, 3, and 4 are calculated over a 10-year horizon from the 2013–2014 winter season through the 2022–2023 winter season. Table 3-13 presents quantified net benefits per year for the same analysis period. Because the benefits and costs are the same every year under Alternatives 2 and 4, the yearly net benefits are the same for both discount rates.

Based on the results of this analysis, the gains to oversnow passengers and local businesses outweigh the losses to other visitors. The mean estimate of quantified net benefits is highest under Alternative 3 because of the high WTP values for being in the park with fewer or no snowmobiles. The next highest present value of net benefits is Alternative 4.

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. Figure 3-5 provides the range of estimates including minimum, mean, and maximum net present value using the 7 percent discount rate.

[8] The cost of upgrading the snowcoach fleet assumes that the total cost of $1,720,000 will be spread over the 5 years starting in 2017 at an annual interest rate of 8 percent ($430,785 per year).

Table 3-12. Quantified Net Benefits per Year for YNP Relative to Baseline 1, 2013–2014 through 2022–2023

	Discount Rate	Quantified Net Benefits per Year[a]
Alternative 2	Discounted at 3%[b]	$1,635,359
	Discounted at 7%[c]	$1,357,746
Alternative 3	Discounted at 3%[b]	$4,512,383
	Discounted at 7%[c]	$3,506,406
Alternative 4	Discounted at 3%[b]	$2,310,235
	Discounted at 7%[c]	$1,913,423

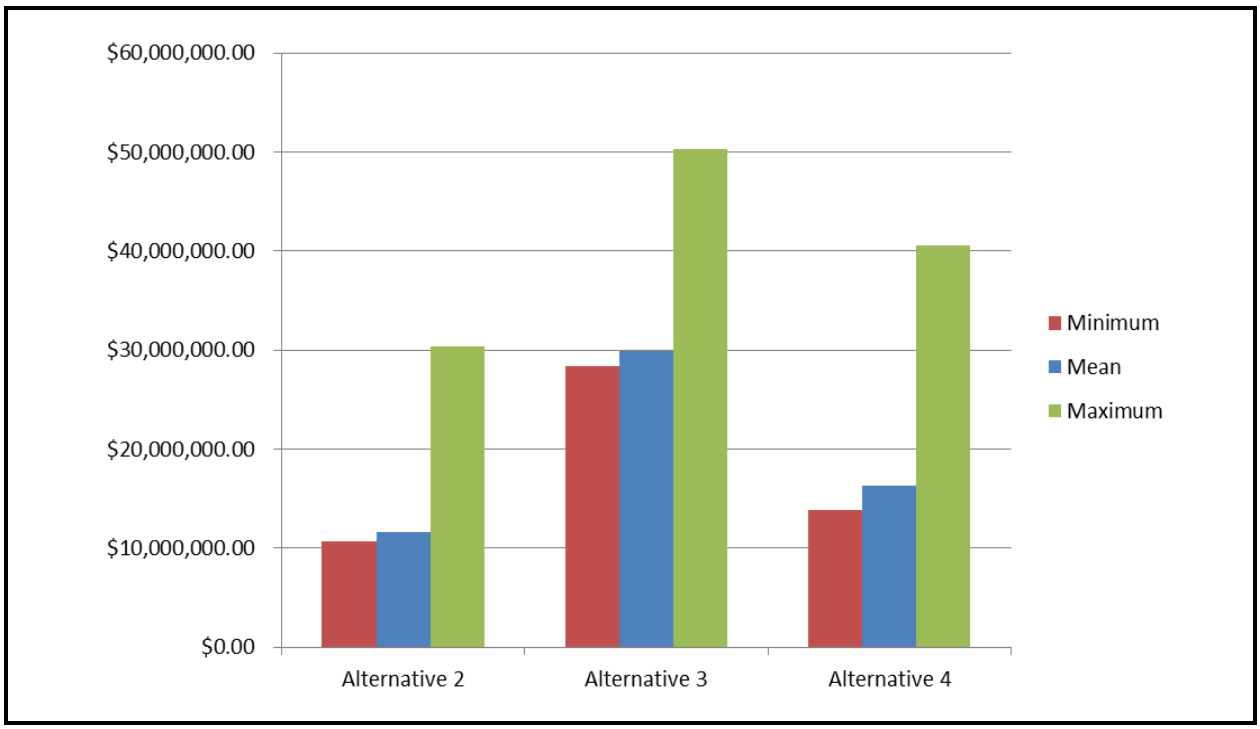
Note: 2011 dollars.

[a]This is the total present value of quantified net benefits reported in Table 3-11 amortized over the 10-year analysis time frame at the indicated discount rate.

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

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

Figure 3-5. Range of Present Value of Total Net Benefits Using 7% Discount Rate



Overall, snowmobile and snowcoach riders benefit from the action alternatives, while the wheeled-access and nonmotorized visitors lose relative to Baseline 1.

Businesses gain under all the alternatives because all the alternatives are expected to attract more visitors to the area. Alternative 3 has the largest present value of total monetized net benefits.

The quantified net benefits are based in part on data from the *2002–2003 Winter Visitor Survey* (NPS, 2003a). The survey does not necessarily 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 estimate the number of people who do not currently visit.

3.4 ALTERNATIVE 4: THE PREFERRED ALTERNATIVE

NPS selected Alternative 4 as the preferred alternative; however, Alternative 3 has higher levels 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 distributive equity concerns, Alternative 4 better balances the visitor experiences of all visitor groups compared with Alternative 3. The costs and benefits accruing to the different visitor groups are more evenly distributed in Alternative 4. The benefits of Alternative 3 are disproportionately associated with snowcoach riders. For these reasons, NPS selected Alternative 4 as the preferred alternative.

4 Benefit-Cost Analysis of the Alternative Regulations Under Baseline 2

In this section, NPS presents the benefits and costs associated with alternatives considered for managing oversnow vehicle use in YNP relative to Baseline 2, as defined by Alternative 2.

This section presents the benefits and costs of the alternatives using Baseline 2. Although Baseline 1 (Alternative 1) is the legal baseline, Baseline 2 represents management in the park for the last three winter seasons. Using Baseline 2 as the baseline highlights the changes each proposed alternative would bring relative to the most recent winter, as opposed to Baseline 1, which has never been in place in YNP. Consumer and producer surplus were calculated using the same methods described in Section 3. This section describes the summary measures of consumer surplus, producer surplus, and the present value of total quantified net benefits associated with Baseline 2.

4.1 SUMMARY OF RESULTS USING BASELINE 2

Three winter use management alternatives were analyzed relative to Baseline 2 to examine the impact of the alternatives relative to current conditions. Baseline 2 limits snowmobiles to 318 daily. Alternatives 3 and 4 allow for continued recreational snowmobile use (until 2020–2021, when snowmobiles are prohibited under Alternative 3) and for snowcoach use subject to daily limits on the number of snowmobiles and snowcoaches that can enter the parks, BAT restrictions, and requirements that all of the snowmobiles be on guided tours. Alternative 4 adds noncommercially guided snowmobile tours. Alternative 1

prohibits oversnow vehicles in the park (both snowmobiles and snowcoaches).

Table 4-1 shows the mean and maximum incremental change in visitation by alternative for each activity compared with Baseline 2 in the 2020–2021 winter season when snowmobiles are banned under Alternative 3. For Alternative 1, the change in visitation, consumer surplus, and producer surplus were set as the negative of the impact in Section 3. Table 4-1 uses the negative of the incremental changes for Baseline 2 from Table 3-4 for Alternative 1 only. Alternative 3 results in a loss of visitors after snowmobiles are banned relative to Alternative 2. Alternative 4 is predicted to result in a gain in visitors because of the noncommercially guided snowmobile tours. Alternative 4 also allows for a higher daily limit for snowmobiles, which is reflected in the higher maximum number of visitors for Alternative 4 relative to Alternative 2. In addition, Alternative 4 allows for an additional snowmobile or snowcoach to be added to a group if the machines meet higher standards for noise and air emissions. Based on snowmobile visitation over the last three seasons, which was below 318 snowmobiles per day, the higher daily limit for Alternative 4 is not forecast to generate higher commercially guided snowmobile visitation in the short term (as reflected in the mean visitation assumptions). However, to the extent that more certainty about the snowmobile visitation will encourage more visitors, Alternative 4 would accommodate greater growth in visitation. See Section 3 for more details on the visitation forecasts.

Table 4-2 displays the mean and maximum annual estimates of producer surplus by alternative. Because producer surplus closely follows visitation, only Alternative 4 results in greater producer surplus than Baseline 2. Mean visitation forecasts are the same for Alternatives 2 and 3 during the first 4 years, which results in no change in producer surplus.

Table 4-3 shows the mean annual estimates of consumer surplus by alternative for each of the different user groups forecasted relative to Baseline 2. The total consumer surplus gain or loss is the sum of the gains and losses to individual visitors, so the size of the estimate reflects both the number of visitors engaged in the activity and the average WTP by each visitor. The consumer surplus estimates are much larger than the producer surplus estimates, because the value that a visitor

Table 4-1. Mean and Maximum Incremental Change in Winter Visitation Relative to Baseline 2 in YNP for 2020–2021 (Number of Visitors)

	Wheeled Access	Cross-Country Skiing	Snowcoach	Snowmobile Commercially Guided	Snowmobile Noncomm-ercially Guided	Total Incremental Change in Visitors
Alternative 1 Mean	0	0	−21,001	−20,275	0	−41,276
Alternative 1 Maximum	472	62	−29,402	−28,385	0	−57,253
Alternative 3 (2020–2021) Mean	0	0	0	−20,275	0	−20,275
Alternative 3 (2020–2021) Maximum	472	62	2,100	−28,385	0	−25,751
Alternative 4 Mean	0	0	0	0	1,350	1,350
Alternative 4 Maximum	0	0	0	2,028	1,796	3,824

Note: Incremental impacts were calculated as the difference between visitation under each action alternative and Baseline 2.

Table 4-2. Mean and Maximum Annual Estimated Producer Surplus Relative to Baseline 2

	Mean Total Annual Change in Producer Surplus	Maximum Total Annual Change in Producer Surplus
Alternative 1	−$912,543	−$1,186,998
Alternative 3 2013–14 to 2016–17	$0	$0
Alternative 3 2017–18 to 2019–20	−$593,202	−$726,494
Alternative 3 2020–21 to 2022-23	−$686,119	−$811,463
Alternative 4	−$195,362	−$148,859

places on their trip is greater, sometimes much greater, than the cost of the trip. Looking at consumer surplus, Alternative 3 generates the highest level of consumer surplus compared with Baseline 2. As discussed in Section 3, nonsnowmobilers reported very high values for recreating in the park with fewer or no snowmobiles. Thus, all visitors except those on snowmobiles experience consumer surplus gains in the later years of Alternative 3 relative to Alternative 2. Alternative 4 generates more consumer surplus than Alternative 2 because visitation is forecast to be higher.

Table 4-3. Mean Annual Estimated Consumer Surplus Gains Relative to Baseline 2

	Wheeled Access	Skiers	Snowcoach	Commercially Guided Snowmobile	Non-commercially Guided Snowmobile	Total
Alternative 1	$7,164,722	$70,595	−$4,083,478	−$4,295,538	$0	−$1,143,698
Alternative 3 2013–14 to 2016–17	$0	$0	$0	$0	$0	$0
Alternative 3 2017–18 to 2019–20	$2,944,373	$29,011	$1,743,478	−$440,639	$0	$4, 276, 224
Alternative 3 2020–21 to 2022-23	$7,164,722	$70,595	$3,634,512	−$4,295,538	$0	$6,574,292
Alternative 4	$0	$0	$0	$0	$654,845	$654,845

Note: 2011 dollars.

Putting the benefits and costs together, Table 4-4 presents the present value of total quantified net benefits for YNP under the mean and maximum visitation assumptions. Estimates of the present value of total quantified net benefits expected from Alternatives 1, 3, and 4 were calculated over a 10-year horizon from the 2013–2014 winter season through the 2022–2023 winter season relative to Baseline 2. Table 4-5 presents quantified net benefits per year for the same analysis period. The consumer surplus changes are larger than the producer surplus changes, so the present value calculations are heavily influenced by the consumer surplus estimates. The highest present value comes from Alternative 3 because of the large consumer surplus generated by this alternative.

Alternative 4 also generates positive net benefits relative to Alternative 2 because of the higher projected visitation. Compared with Alternative 2, Alternative 4 also provides for greater growth in the future beyond what is forecast in this analysis with higher daily limits. Alternative 1 generates lower net benefits because of the lower projected visitation, despite the consumer surplus gains for wheeled-vehicle visitors and skiers who enter through the gates.

Table 4-4. Mean and Maximum of Present Value of Total Quantified Net Benefits for YNP Relative to Baseline 2, 2013–2014 through 2022–2023

	Discount Rate	Mean Present Value of Total Quantified Net Benefits	Maximum Present Value of Total Quantified Net Benefits
Alternative 1	Discounted at 3%[a]	−$17,455,683	−$40,291,020
	Discounted at 7%[b]	−$14,276,857	−$33,078,971
Alternative 3	Discounted at 3%[a]	$22,788,727	$23,983,482
	Discounted at 7%[b]	$16,981,005	$17,750,175
Alternative 4	Discounted at 3%[a]	$4,003,953	$9,908,180
	Discounted at 7%[b]	$3,392,536	$8,253,947

Note: 2011 dollars.

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

[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 4-5. Quantified Net Benefits per Year for YNP Relative to Baseline 2, 2013–2014 through 2022–2023

	Discount Rate	Mean Quantified Net Benefits per Year[a]	Maximum Quantified Net Benefits per Year[a]
Alternative 1	Discounted at 3%[b]	−$2,046,339	−$4,723,337
	Discounted at 7%[c]	−$1,673,683	−$3,877,865
Alternative 3	Discounted at 3%[b]	$2,671,534	$,2,811,566
	Discounted at 7%[c]	$1,990,692	$,2,080,862
Alternative 4	Discounted at 3%[b]	$469,385	$1,161,541
	Discounted at 7%[c]	$397,708	$967,614

Note: 2011 dollars.

[a]This is the total present value of quantified net benefits reported in Table 4-4 amortized over the 10-year analysis time frame at the indicated discount rate.

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

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

5 Small Entity Impact Analysis Under Baseline 1

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

Changes to the management of oversnow vehicle use in YNP 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, and E.O. 13272 require 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 would 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 Baseline 1 (Alternative 1). 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.

5.1 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 park. There were 21 different businesses identified that are authorized to provide snowmobile rentals and tours inside the park, 11 companies offering snowcoach tours, and 15 companies offering guided cross-country skiing tours through the park, although there may be others. The total number of unique businesses identified was only 34 because many of these businesses offer more than one recreational activity.

There were 21 snowmobile rental businesses authorized to lead tours through the park, 11 companies offering snowcoach tours, and 15 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 large number of the snowmobile and snowcoach companies that operate in YNP are located in West Yellowstone. Seven offer snowmobile rentals, and six provide snowcoach rentals in West Yellowstone. Overall, nine establishments owned by companies providing winter recreational services in YNP were identified in West Yellowstone. Jackson, Wyoming, was second to West Yellowstone in number of snowmobile rental companies operating in YNP, with seven companies identified.

The Small Business Administration's (SBA's) 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 $7

million as small.[1] When available, revenue estimates were obtained for the rest of the firms from Hoover's Online (2012). Among the businesses offering snowmobile, snowcoach, and/or cross-country skiing rentals and tours with available data, 12 have sales less than $500,000, 6 have sales between $500,000 and $1 million, 7 have sales between $1 and $3 million, and 3 firms have estimated sales greater than $3 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 6 companies identified.

Using the SBA criterion above and available sales estimates, 26 out of 28 businesses offering snowmobile rentals or guided tours (snowmobile, snowcoach, or skiing) with available revenue estimates were classified as small businesses.

Using the SBA criterion above and available sales estimates, 26 out of 28 businesses offering snowmobile rentals or guided tours (snowmobile, snowcoach, or skiing) with available revenue estimates were classified as small businesses.[2] For the purposes of this analysis, the remaining 6 companies for which no revenue estimates could be located were assumed to be small businesses. Thus, 32 out of 34 companies offering recreational services in the area were classified as small businesses.

Although these rental shops and tour operators would be affected most directly, numerous hotels, restaurants, gas stations, and retail establishments may also experience an impact from the regulation. Because the primary 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.

[1]Seven million dollars is also the threshold for restaurants (NAICS 722110) and souvenir shops (NAICS 453220) to be classified as small businesses. For hotels and motels, the threshold is $30 million. For gas stations without convenience stores (NAICS 447190), the small business threshold is $14 million. For supermarkets and grocery stores (NAICS 445110), the cutoff is $30 million. For gas stations with convenience stores (NAICS 447110), the cutoff is $27.0 million (SBA, 2012).

[2]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.

5.2 IMPACT ANALYSIS

After considering the economic impacts of Alternatives 2, 3, and 4 on small entities, NPS concludes these management options would mitigate the impacts on most small businesses relative to the impacts under Baseline 1. In cases where the alternatives cause reduced revenues for a few specific firms compared with Baseline 1, NPS expects that the declines would be very small. NPS made this determination using RFA implementation guidance provided by other agencies (EPA, 2006; SBA, 2010) and provides the following factual basis for this determination:

- This rule is not expected to substantially reduce area businesses' profit margins or reduce the competitiveness of the snowmobile rental and sales businesses.
- In a quantitative assessment of changes in producer surplus in Section 3.2.3, NPS projects higher total levels of revenue for firms providing goods and services related to snowmobiling and snowcoach tours under all the alternatives compared with baseline conditions.
- Firms offering snowcoach tours would be required to use vehicles that meet EPA Tier 2 compliant engines and exhaust emission controls by December 15, 2017. The cost to update the current fleet is estimated to be $1,720,000. This cost would be spread out across the 11 companies that are currently permitted to provide snowcoach tours in YNP. Firms using older vehicles would bear a higher percentage of the cost. However, under Baseline 1, no snowcoaches would be allowed in the park. Implementing Baseline 1 would leave the current owners of snowcoaches with idle capital and no stream of winter revenue to continue payment on any loans taken out to purchase the vehicles. Thus, even though firms that currently own snowcoaches would bear the cost of upgrading the vehicles, all the action alternatives would be beneficial to owners of snowcoaches relative to Baseline 1.
- NPS expects that a few firms that cater primarily to cross-country skiers and other nonmotorized recreators who might prefer YNP under Baseline 1 might see lower levels of revenue than under baseline conditions. However, most firms providing services in the GYA have diversified sources of revenue from other activities. Overall visitation is expected to increase for all the alternatives relative to Baseline 1, and the expected reduction in the number of skiers and other

nonmotorized visitors is small. There is no evidence suggesting that losses to businesses that cater to nonmotorized recreators resulting from implementing the alternatives relative to the baseline alternative would be sufficiently high to affect any small firm significantly.

- NPS expects higher levels of revenue for other businesses (including hotels, restaurants, grocery stores, gas stations, and souvenir shops) in the GYA under all the alternatives compared with the baseline rule.

5.2.1 Affordability Analysis

An affordability analysis is an assessment of the ability of affected entities to meet costs imposed by regulatory policies. In this case, the small businesses identified are expected to have increases in revenue under Alternatives 2, 3 and 4 relative to Alternative 1.

5.2.2 Disproportionality Analysis

NPS does not expect small entities to be substantially disadvantaged relative to large entities under the action alternatives because the action alternatives are forecast to increase revenue relative to Alternative 1.

5.2.3 Business Closure Analysis

As noted above, small businesses are expected to have increased revenue under Alternatives 2, 3, and 4 relative to Baseline 1.

5.3 FINAL REGULATORY FLEXIBILITY ANALYSIS

The threshold analysis was used to determine the expected impacts of the alternatives. The above discussion demonstrates that Alternatives 2, 3, and 4 result in positive impacts relative to Baseline 1.

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.

5.3.1 Reasons Why the Park Service is Considering the Rule

The regulations analyzed in the current report are necessary to implement a new rule to replace the temporary rule that covered through the 2012–2013 winter season.

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 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 Baseline 1 one 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 the 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. Another temporary rule was passed for the 2007–2008 to 2008–2009 winter seasons. Finally, another temporary rule was passed for the 2009–2010 through 2011–2012 seasons, which was extended for the 2012-2013 season.

The new management alternatives are being considered for the winter season 2013–2014.

5.3.2 The Objectives and Legal Basis for the Rule

The proposed rule (Alternative 4) would benefit small businesses, as would Alternatives 2 and 3 relative to Alternative 1. Alternative 1 prohibits snowmobile and snowcoach use, while Alternative 3 prohibits snowmobile use starting in the 2020–2021 season. Under Alternatives 2, 3, and 4, snowcoaches must meet BAT standards by the start of the 2017–2018 winter season. These requirements would allow continued winter use of the parks while reducing the impacts on park resources and values from snowmobile and snowcoach use.

Snowmobile and snowcoach 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. YNP currently has a park-specific regulation that designates areas and routes open to snowmobiles and snowcoaches. Although the temporary winter use plan allows temporary restricted access to oversnow vehicles, the regulations expire after the 2012–2013 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.

5.3.3 The Kind and Number of Small Entities to Which the Rule Will Apply

The proposed rule would affect numerous small entities that supply rentals and tours for snowmobiles, snowcoaches, and cross-country skiing each having $7 million or less in annual sales, in addition to other small businesses in local communities

involved in lodging, restaurants, gas, and other retail. There were 34 businesses offering snowmobile rentals, snowcoach rentals, and/or cross-country ski rentals identified in the region. Based on revenue data from Hoover's Online (2012) for these companies, NPS estimates that as many as 32 are small businesses.

NPS expects the proposed rule (Alternative 4) to have no negative impacts on all identified small entities as well as additional small entities that could not be identified. NPS also expects that Alternatives 2 and 3 would not have significant adverse impacts on small businesses.

5.3.4 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.

5.3.5 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.

5.3.6 Alternatives that May Reduce the Impacts on Small Businesses

Alternative 4 has the highest daily snowmobile and snowcoach limits. This alternative would most likely result in the largest number of snowmobilers visiting the park.

Small businesses near the East Entrance and the town of Cody, Wyoming, would benefit long term most from Alternative 4, which allows snowmobile traffic through the East Entrance. Alternative 3 allows snowmobiles and snowcoaches through the East Entrance leading up to the phaseout of snowmobiles in 2020–2021. Starting in 2020–2021, snowmobiles would be banned and the East Entrance would be closed to snowcoaches.

5.4 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 Alternative 4 will have positive impacts and will not have significant negative impacts on small businesses relative to the Alternative 1 baseline. Alternatives 2 and 3 are also expected to have positive impacts and will not

have significant negative impacts on small businesses relative to the Alternative 1 baseline.

6 Small Entity Impact Analysis Under Baseline 2

This section assesses the potential for changes to the management of oversnow vehicle use in YNP to affect small businesses relative to Baseline 2.

Changes to the management of oversnow vehicle use in YNP 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, and E.O. 13272 require 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. The analyses were prepared using RFA implementation guidance provided by other agencies (EPA, 2006; SBA, 2010).

Baseline 1 (Alternative 1) is the official baseline for analysis of the proposed action alternatives for winter use in YNP. As discussed in Section 1, Baseline 2, which represents the rule in place for the most recent seasons, is also a logical point of comparison. Section 4 outlines the impacts on producer and consumer surplus relative to Baseline 2. In this section, NPS presents a discussion of the potential impacts on small businesses for Alternatives 1, 3, and 4 relative to Baseline 2.

6.1 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, snowcoach riding, 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 park. NPS identified 21 different businesses that are authorized to provide snowmobile rentals and tours inside the park, 11 companies offering snowcoach tours, and 15 companies offering guided cross-country skiing tours through the park, although there may be others. The total number of unique businesses identified was only 34 because many of these businesses offer more than one recreational activity.

NPS identified 21 different businesses that are authorized to provide snowmobile rentals and tours inside the park, 11 companies offering snowcoach tours, and 15 companies offering guided cross-country skiing tours through the park, although there may be others.

A number of these businesses have multiple establishments in the area. A large number of the snowmobile and snowcoach companies that operate in YNP are located in West Yellowstone. Seven offer snowmobile rentals, and six provide snowcoach rentals in West Yellowstone. Overall, nine establishments owned by companies providing winter recreational services in YNP were identified in West Yellowstone. Jackson, Wyoming, was second to West Yellowstone in number of snowmobile rental companies, with seven companies identified.

The Small Business Administration's (SBA's) 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 $7 million as small.[1] When available, revenue estimates were obtained for the rest of the firms from Hoover's Online (2012).

[1]Seven million dollars is also the threshold for restaurants (NAICS 722110) and souvenir shops (NAICS 453220) to be classified as small businesses. For hotels and motels, the threshold is $30 million. For gas stations without convenience stores (NAICS 447190), the small business threshold is $14 million. For supermarkets and grocery stores (NAICS 445110), the cutoff is $30 million. For gas stations with convenience stores (NAICS 447110), the cutoff is $27.0 million (U.S. SBA, 2012)

Using the SBA criterion above and available sales estimates, 26 out of 28 businesses offering snowmobile rentals or guided tours (snowmobile, snowcoach, or skiing) with available revenue estimates were classified as small businesses.

Among the businesses offering snowmobile, snowcoach, and/or cross-country skiing rentals and tours with available data, 12 have sales less than $500,000, 6 have sales between $500,000 and $1 million, 7 have sales between $1 and $3 million, and 3 firms have estimated sales greater than $3 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 6 companies identified.

Using the SBA criterion above and available sales estimates, 26 out of 28 businesses offering snowmobile rentals or guided tours (snowmobile, snowcoach, or skiing) with available revenue estimates were classified as small businesses.[2] For the purposes of this analysis, the remaining 6 companies for which no revenue estimates could be located were assumed to be small businesses. Thus, 32 out of 34 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 impacts 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.

6.2 IMPACT ANALYSIS

Below, the potential impacts on small businesses of each alternative are discussed relative to Baseline 2. For the analysis, we focus on companies that provide snowmobile, snowcoach, and ski tours in YNP. The economy of the GYA is heavily dependent on tourists, so changes in visitation will affect lodging, restaurants, souvenir shops, and other businesses that serve tourists visiting YNP in the winter. However, the impacts on snowmobile and snowcoach

[2]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.

businesses will likely be among the largest and serve as an indicator of the impacts on other business sectors.

The SBA classifies businesses in the recreational goods rental and tour operators sectors as small if annual revenue is less than $7 million. The small businesses in YNP fell into three categories: (1) less than $500,000, (2) between $500,000 and $1 million, and (3) between $1 and $3.5 million (Hoover's Online, 2012). Only two companies had revenue above $7 million. The profit margins for the industry range from −2.9 percent to 8.3 percent, for an average of 2.7 percent (D&B, 2010).

Table 6-1 shows the average annual change in sales (revenue) for the mean and maximum change in revenue for rental companies (based on the revenue changes for rental companies used to calculate change in producer surplus in Section 4) and assuming 32 small companies. For each annual sales size category, the ratio of the change in revenue per business to average revenue per business (using the mid-point for the revenue category) was calculated. Although there are no firm guidelines as to what constitutes a significant impact, some federal agencies have used profit ratios for the industry as a guide, while others have used a threshold such as 3 percent (0.30). Results are presented for 2020–21 because that is the first year when snowmobiles are banned under Alternative 3, so the results provide a better picture of change in revenue under Alternative 3. The cost of upgrading the snowcoach fleet under Alternatives 3 and 4 is discussed in the next section.

Based on the results in Table 6-1, we discuss the potential impacts of each alternative below.

- Alternative 1 has the potential to generate significant losses for small businesses because of the decrease in visitors when snowmobiles and snowcoaches are banned.
- Alternative 3 also has the potential to generate significant losses, again because of the drop in visitation after snowmobiles are banned. In addition, starting in 2020–2021 the East Entrance would be closed for snowcoaches, which will affect the small businesses that serve the East Entrance.
- Alternative 4 is projected to increase revenue for small businesses based on the forecasts for increased visitation.

Table 6-1. Ratio of Annual Change in Revenue to Average Revenue by Annual Sales Category for Each Alternative Relative to Baseline 2 in 2020–2021

	Average Change in Revenue per Business	Ratio of Change in Revenue to Average Revenue by Revenue Category		
		Less than $500,000	$500,000 to $1 Million	$1 Million to $3.5 Million
Alternative 1 Mean Change in Revenue	−$189,974	−0.760	−0.253	−0.084
Alternative 1 Maximum Change in Revenue	−$265,394	−1.062	−0.354	−0.118
Alternative 3 Mean Change in Revenue	−$101,375	−0.405	−0.135	−0.045
Alternative 3 Maximum Change in Revenue	−$132,495	−0.530	−0.177	−0.059
Alternative 4 Mean Change in Revenue	$3,375	0.014	0.005	0.002
Alternative 4 Maximum Change in Revenue	$14,626	0.059	0.020	0.007

Note: 2010 dollars.

6.2.1 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 small businesses identified are expected to have increases in revenue under Alternative 4. Thus, these businesses should be able to afford compliance with the regulatory alternatives. Alternatives 1 and 3 may affect small businesses, because visitation is forecast to be much lower relative to Baseline 2.

One consideration is the cost of BAT snowcoaches. Alternatives 2, 3, and 4 require snowcoaches to have EPA Tier 2–compliant engine and exhaust emission controls by December 15, 2017. The 11 companies that offer snowcoach tours in YNP would collectively spend an estimated $1,720,000 by December 2017 to upgrade the current fleet or an average of approximately $156,364 per company for the 11 companies that offered snowcoach tours in 2011–2012. Assuming the costs are spread over the 5 years starting in 2017 with an annual interest rate of 8 percent, the annual cost per year for 4 years would be $430,785 or approximately $39,162 per firm averaged across the 11 firms. The costs of the upgrade will be similar under Alternatives 2, 3, and 4, although costs may be somewhat

higher under Alternative 3 because all visitors will ride snowcoaches so businesses may have to purchase more snowcoaches. Under Alternative 1, the firms would not need to upgrade to EPA Tier 2 snowcoaches. However, firms that currently own snowcoaches would be left with excess capital if Alternative 1 was put into place.

6.2.2 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, over 90 percent of operators identified are small businesses. Second, most small entities are expected to be positively affected under Alternative 4, the preferred alternative, relative to Baseline 2. Alternatives 1 and 3 would disproportionately hurt small businesses if small businesses derive a larger share of their revenue from oversnow tours than the few large businesses.

6.2.3 Business Closure Analysis

As noted above, small businesses are generally expected to have increased revenue under Alternative 4 relative to Baseline 2. Alternatives 1 and 3 may have significant impacts on small businesses, which could result in the closure of businesses that are not able to diversify.

6.3 FINAL REGULATORY FLEXIBILITY ANALYSIS

The threshold analysis was used to determine the expected impacts of the alternatives. The above discussion demonstrates that Alternative 4 results in positive impacts relative to Baseline 2. However, Alternatives 1 and 3 may result in significant 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.

6.3.1 Reasons Why the Park Service is Considering the Rule

The regulations analyzed in the current report are necessary to implement a new rule to replace the temporary rule that covered through the 2012–2013 winter season.

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 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 Baseline 1 one 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 the 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. Another temporary rule was passed for the 2007–2008 to 2008–2009 winter seasons. Finally, another temporary rule was passed for the 2009–2010 through 2011–2012 seasons, which was extended for the 2012-2013 season.

The new management alternatives are being considered for the winter season 2013–2014.

6.3.2 The Objectives and Legal Basis for the Rule

The proposed rule (Alternative 4) would benefit small businesses. However, Alternatives 1 and 3 may harm small businesses through the specific plans to manage snowmobile and snowcoach use in YNP. Alternative 1 prohibits snowmobile and snowcoach use, while Alternative 3 prohibits snowmobile use starting in the 2020–2021 season. Under Alternatives 2, 3, and 4, snowcoaches must meet BAT standards by the start of the 2017–2018 winter season. These requirements would allow continued winter use of the parks while reducing the impacts on park resources and values from snowmobile and snowcoach use.

Snowmobile and snowcoach 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. YNP currently has a park-specific regulation that designates areas and routes open to snowmobiles and snowcoaches. Although the temporary winter use plan allows temporary restricted access to oversnow vehicles, the regulations expire after the 2012–2013 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.

6.3.3 The Kind and Number of Small Entities to Which the Rule Will Apply

The proposed rule would affect numerous small entities that supply rentals and tours for snowmobiles, snowcoaches, and cross-country skiing each having $7 million or less in annual sales, in addition to other small businesses in local communities involved in lodging, restaurants, gas, and other retail. There

were 34 businesses offering snowmobile rentals, snowcoach rentals, and/or cross-country ski rentals identified in the region. Based on revenue data from Hoover's Online (2012) for these companies, NPS estimates that as many as 32 are small businesses. NPS expects the proposed rule (Alternative 4) to have no negative impacts on all identified small entities as well as additional small entities that could not be identified. NPS expects that Alternatives 1 and 3 may have significant impacts on small businesses.

6.3.4 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.

6.3.5 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.

6.3.6 Alternatives that May Reduce the Impacts on Small Businesses

Alternative 4 has the highest daily snowmobile and snowcoach limits. This alternative would most likely result in the largest number of snowmobilers visiting the park.

Small businesses near the East Entrance and the town of Cody, Wyoming, would benefit long term most from Alternative 4, which allows snowmobile traffic through the East Entrance. Alternative 3 allows snowmobiles and snowcoaches through the East Entrance leading up to the phaseout of snowmobiles in 2020–2021. Starting in 2020–2021, snowmobiles would be banned and the East Entrance would be closed to snowcoaches.

6.4 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 Alternative 4 will have positive impacts and will not have significant negative impacts on small businesses relative to the Baseline 2 baseline. Alternatives 1 and 3 are expected to have significant negative impacts on small businesses.

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Appendix 1

July 2005

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

Revised Final Report

Prepared for

National Park Service
Environmental Quality Division
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RTI International
Health, Social, and Economics Research
Research Triangle Park, NC 27709

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*RTI International is a trade name of Research Triangle Institute.

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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.

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[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)

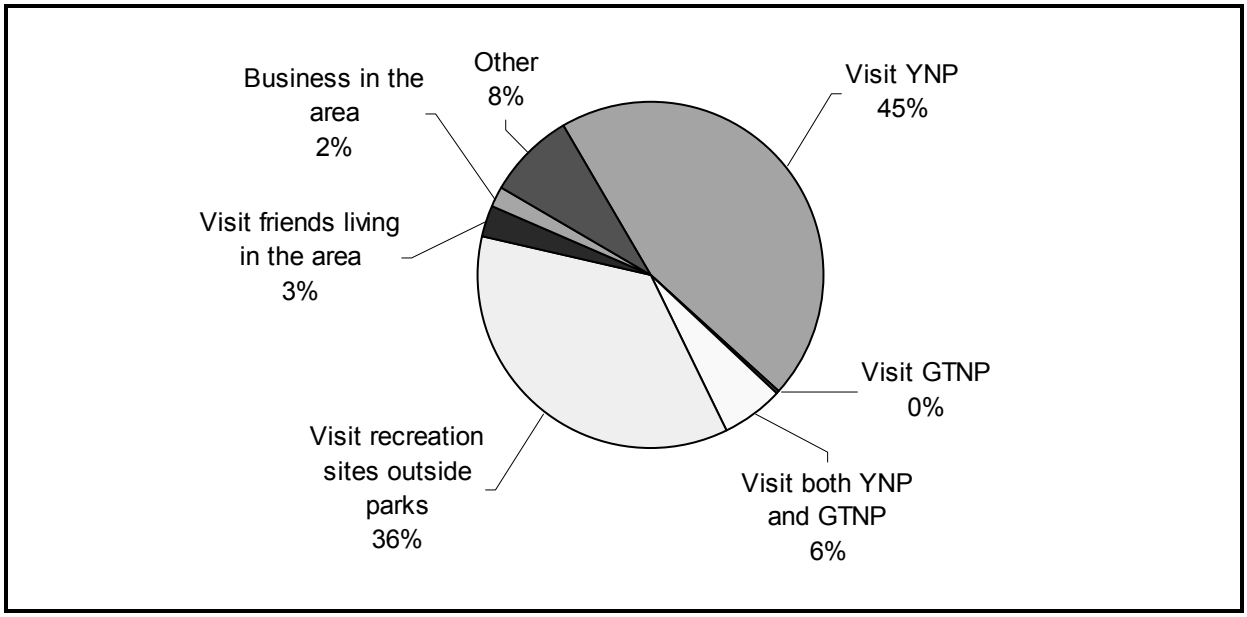
	Total	Snowmobilers	Nonsnowmobilers
Number of days in YNP so far this season and anticipated[b]			
Mean	1.57 (0.04)	1.54 (0.04)	1.66 (0.11)
Median	0.73	0.74	0.69
Number of days in GTNP so far this season and anticipated[b]			
Mean	0.57 (0.07)	0.59 (0.08)	0.48 (0.08)
What one thing about your trip would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

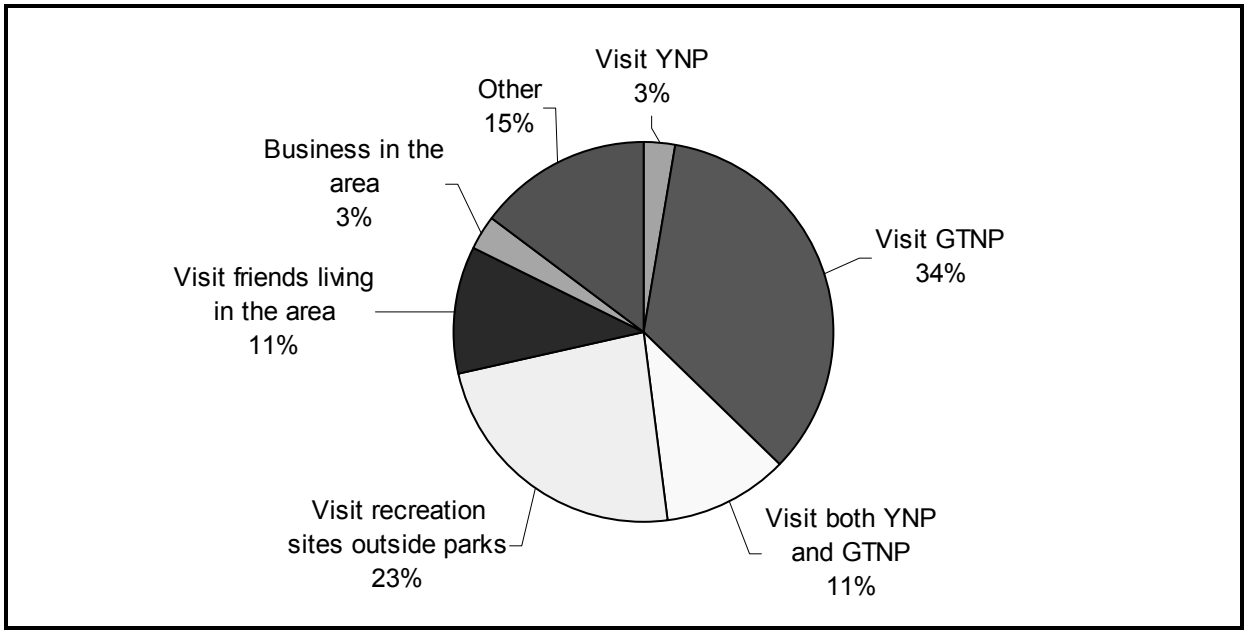
[a]n is the number of people who answered each question; the total sample size is 220, except where noted.

[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:

$$U^i_{jt} = V^i(X_{jt}, Z^i, p_{jt}; \beta^i, \delta^i) + e^i_{jt} \qquad (6.6)$$

where

U^i_{jt} is individual i's utility for a trip, where j = 0, 1, 2, denoting the three alternative trips in each choice set, and t = 1,...,6;

$V^i(\cdot)$ is the nonstochastic part of the utility function;

X_{jt} is a vector of attribute levels for the trip;

Z^i is a vector of personal characteristics;

p_{jt} is the cost of the trip;

β^i is a vector of attribute parameters;

δ^i is the marginal utility of money; and

e^i_{jt} is a disturbance term.

The linear specification of utility for the three alternatives is

$$\begin{aligned} U^i_{jt} &= V^i_{jt} + e^i_{jt} = \gamma^i_0 + e^i_{jt} \quad j = 0 \\ U^i_{jt} &= V^i_{jt} + e^i_{jt} = X_{jt}\beta^i + p_{jt}\delta^i + e^i_{jt} \quad j = 1, 2 \end{aligned} \tag{6.7}$$

where U^i_{jt}, j = 0, 1, 2 is the utility of each of the three trip alternatives. U^i_{0t} is the utility of the opt-out choice, which in a simple model is just γ_0, an alternative-specific constant for the opt-out choice. The utility of Trip A is U^i_{1t} and the utility of Trip B is U^i_{2t}.

Stochastic utility maximization asserts that individual i will choose alternative j from among the full set of available alternatives K if, and only if, alternative j provides a higher overall level of utility than all other alternatives in the choice set.[6] Assuming the disturbance term follows a Type I extreme-value error structure, the probability that alternative j will be selected from choice set t is the standard conditional-logit expression:

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

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

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

$V^i_{jt} - V^i_{kt} > e^i_{kt} - e^i_{jt}$.

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

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.

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[7]The basic exposition of the properties of this model can be found in McFadden (1981).

[8]Technically, this is only true when the definition of one or more stochastic effects is shared across alternatives.

Modifying Eq. (6.7) to introduce subject-specific stochastic components for each β,

$$\begin{aligned} U^i_{jt} &= V^i_{jt} + e^i_{jt} \equiv \left(\gamma^i_0 + \eta^i_0\right) + e^i_{jt} && j = 0 \\ U^i_{jt} &= V^i_{jt} + e^i_{jt} \equiv X_{jt}\left(\beta + \eta^i\right) + \delta^i P_{jt} + e^i_{jt} && j = 1, 2 \end{aligned} \tag{6.9}$$

Eq. (6.8) now becomes

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

where now $\beta^* = (\beta + \eta^i)$. In contrast to conditional logit, the stochastic part of utility now may be correlated among alternatives and across the sequence of choices via the common influence of η^i. McFadden and Train (2000) show that any RUM model can be approximated by some mixed logit specification.

The heterogeneity of preferences among winter visitors in YNP represents a challenge for estimating welfare impacts using the results of the stated preference questions. The biggest differences in the summary statistics presented in Section 5.2 appear to be between snowmobile riders and other winter visitors. To control for the heterogeneity, we estimated separate models for these two groups where snowmobile riders are those whose general primary activity was riding a snowmobile on their most recent trip and other winter visitors indicated their general primary activity as either snowcoach tour, auto touring, or cross-country skiing/snowshoeing (see Table 5-5).[9]

Cost is the only continuous variable in the model. The other variables, except the "No crowding at the entrance/destination" and opt-out variables, are modeled using effects coding instead of traditional dummy variables. Using effects coding, the base level of the variable (the excluded category in the regression) is coded as –1. The value of the excluded category is the negative sum of the coefficients for the other levels. Thus zero is normalized as the

[9] Each of the models assumed stochastic effects are normally distributed.

mean effect and statistical significance tests relate to the mean effect rather than the omitted category. "No crowding at the entrance/destination" and opt out are defined as a traditional dummy variable where 1 indicates that there were no snowmobiles in the park or that opt out was chosen, respectively.

Snowmobile Rider Results

Starting with the snowmobile riders, column 2 of Table 6-7 contains the results from a simple conditional logit, while column 3 contains the same specification estimated using the mixed logit. The mixed logit provides an estimate of both the parameter and the standard deviation for each variable except cost, which is held constant. Thus the mixed logit results indicate the degree of taste heterogeneity by the relative size of the standard deviation parameters relative to the corresponding point estimates.

Looking at Table 6-7, there are some differences between the two models in terms of the significance of the coefficients, but overall the models provide similar qualitative results. In both models, cost is negative and significant. In terms of activities, not surprisingly snowmobile riders were more likely to select snowmobile trips 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 $\mathrm{var}\left(\sum X_i\right) = \sum \mathrm{var}(X_i) + 2 \cdot \sum_{i>j}^{n} \sum_{j=1}^{n-1} \mathrm{cov}(X_i, X_j)$ 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.

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Appendix A: Winter Visitor Contact Form

1. On this trip, are you staying away from home overnight?
   ____ Yes, I am staying away from home overnight on this trip
   ____ No, I am here on a day trip

2. Are you snowmobiling in the park during this trip [if visitor is in a wheeled vehicle]?
   ____ Yes
   ____ No

3. If you are riding a snowmobile on this trip, is this trip the first time you have ridden a snowmobile?
   ____ Yes, this trip is my first time on a snowmobile
   ____ No, I have ridden a snowmobile before

_____

First Name Last Name

_____ _____

Street Address Email address

_____ _____ _____

City State Zip Code

Staff Use: Indicate mode of transportation **Date:**_____
____Snowmobile ____Snowcoach ___Auto, bus, van, RV ___Skis
___Other_____

Appendix B: Survey Instrument

Section B.1 contains a copy of one version of the survey—the version for nonlocal, experienced snowmobile riders. The other versions of the survey contained mostly identical questions with the following exceptions:

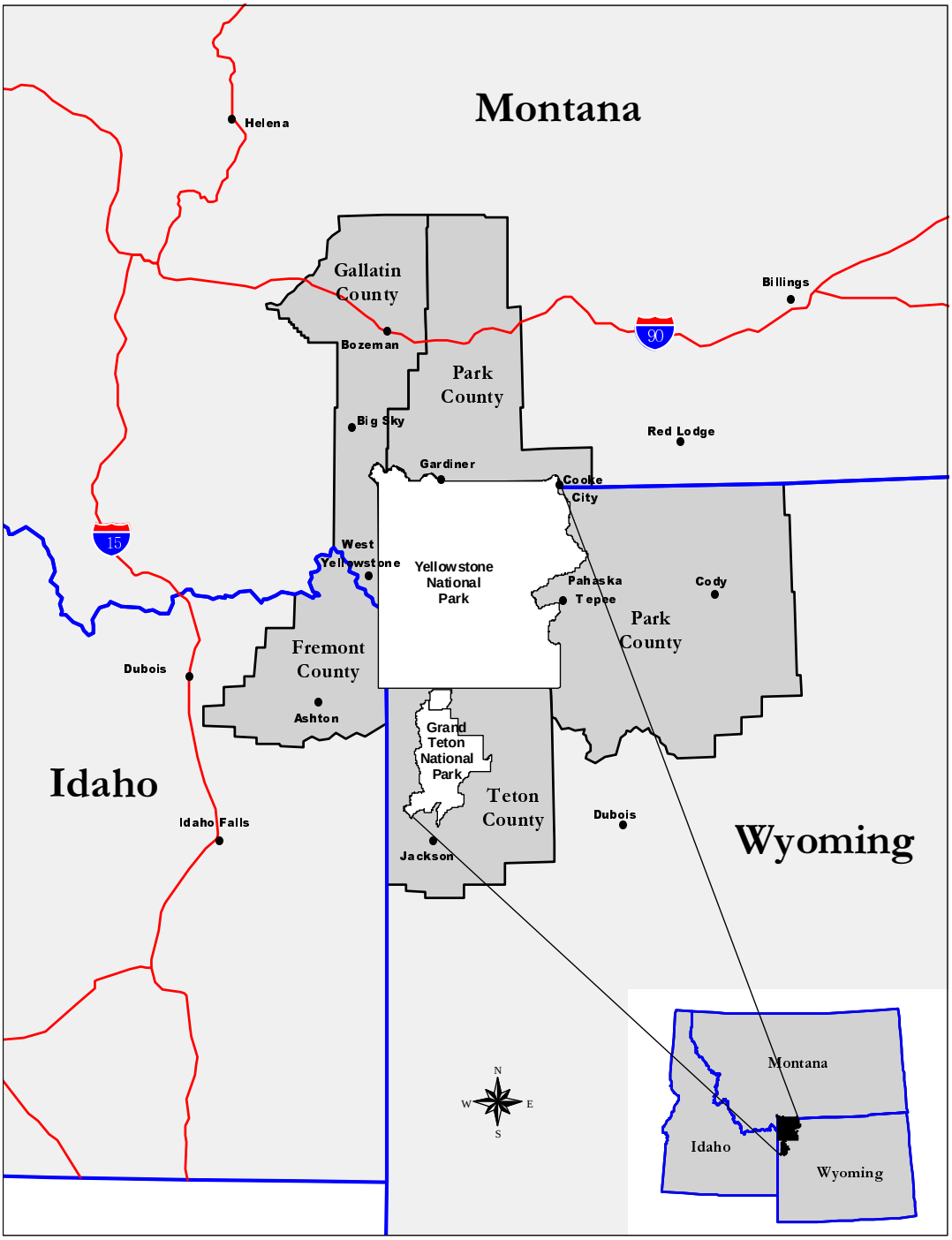
- The version for local visitors on day trips contains the same questions, except in a different order.[1]
- Question 19 was different for nonsnowmobile riders or for first-time snowmobile riders. Section B.2 contains the text of the alternative question asking about winter recreation trips.
- Questions 22 through 27 are the stated preference conjoint questions. The attributes of Trip A and Trip B varied according to an experimental design that was used to create four blocks of six questions each. The four blocks were randomized across respondents. The survey in this appendix contains one of the four blocks. The other blocks were similar. Section 5 contains more details on the design of the stated preference conjoint questions and the analysis of the data from these questions.
- Questions 28 and 29 are the stated behavior questions. There were three versions of the stated behavior questions. Each respondent only answered one of the three questions, and the three questions were distributed randomly across respondents. The survey in Section B.1 contains the stated behavior question based on a proposed winter management plan that would cap the number of snowmobiles allowed in YNP and GTNP each day. The text of the other two stated behavior questions is contained in Section B.3. The two other questions describe two additional proposed winter management plans: one banning snowmobiles from the parks and the other capping the number of snowmobiles allowed in the parks every day and requiring snowmobiles to be on a guided tour.

[1]For the first survey mailing, the local survey contained expenditure questions relevant only to day trips. However, concerns about accuracy of the answers to the screening questions led to the inclusion of expenditure questions relevant to overnight trips on one page of the local survey.

SECTION B.1

National Park Winter Recreation Survey

Greater Yellowstone Area including Yellowstone and Grand Teton National Parks and the 5 surrounding counties



ID # NLS_____
3Ac

16 U.S.C. 1a-7 authorizes collection of this information. This information will be used by park managers to better serve the public. Response to this request is voluntary. No action may be taken against you for refusing to supply the information requested. Your name is requested for follow-up mailing purposes only. When analysis of the questionnaire is completed, all name and address files will be destroyed. Thus permanent data will be anonymous. Data collected through visitor surveys may be disclosed in aggregate form without any personal identifying information to the Department of Justice when relevant to litigation or anticipated litigation, or to appropriate Federal, State, local or foreign agencies responsible for investigating or prosecuting a violation of law. Your name and address will remain totally confidential. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Burden estimate statement: Public reporting for this form is estimated to average 30 minutes per response. Direct comments regarding the burden estimate or any other aspect of this form to the Information Collection Clearance Officer, WASO Administrative Program Center, National Park Service, 1849 C Street, NW, Washington, D.C. 20240.

OMB Approval #1024-0224 (NPS #03-004)
Expiration Date: 09/30/2003

INTRODUCTION

Thank you for agreeing to take this survey. Your answers are important for future decisions about winter management of the parks and will help the National Park Service better understand winter visitation in Yellowstone and Grand Teton National Parks and the Greater Yellowstone Area. The "Greater Yellowstone Area" includes the five counties surrounding Yellowstone and Grand Teton National Parks: Teton and Park counties in Wyoming, Park and Gallatin counties in Montana, and Fremont county in Idaho. This area is shown on the map on the cover of the survey.

PLEASE TELL US ABOUT YOUR RECENT TRIP

1. What was the date of your trip to the Greater Yellowstone Area on which you agreed to take this survey?

   Date the trip started _____

   Date the trip ended _____

In this survey, when we ask you about **your recent trip**, we are talking about the trip during which we contacted you about this survey.

2. How long was your recent trip to the Greater Yellowstone Area?

   ☐ Multiple days

   ☐ One day, ***please skip to Question 4***

3. If you were on a multiple day trip:

   3a. How many days or parts of a day did you spend in the Greater Yellowstone Area **in total (see cover map)**? _____

   3b. How many days or parts of a day did you spend inside **Yellowstone National Park**? _____

   3c. How many days or parts of a day did you spend inside **Grand Teton National Park**? _____

   3d. How many days or parts of a day did you spend in the Greater Yellowstone Area **outside the parks**? _____

4. Which of the following statements ***best*** describes how you decided to visit the Greater Yellowstone Area on your recent trip?

   ☐ Limited planning was necessary since I live relatively close.

   ☐ I decided on a winter trip to the Greater Yellowstone Area, and then decided how many days to stay.

- ☐ I decided to spend a fixed number of days on a winter vacation, and then chose the Greater Yellowstone Area over a number of other alternatives.
- ☐ Other (please describe) _____

5. Which of the following statements ***best*** describes how you chose your activities on your recent trip?

- ☐ I decided to visit the Greater Yellowstone Area and then looked for available activities to try.
- ☐ I decided to visit the Greater Yellowstone Area based on a particular activity I wanted to do there.
- ☐ Other (please describe) _____

6. What was the **primary purpose** of your recent trip to the Greater Yellowstone Area? (***please check only one box).***

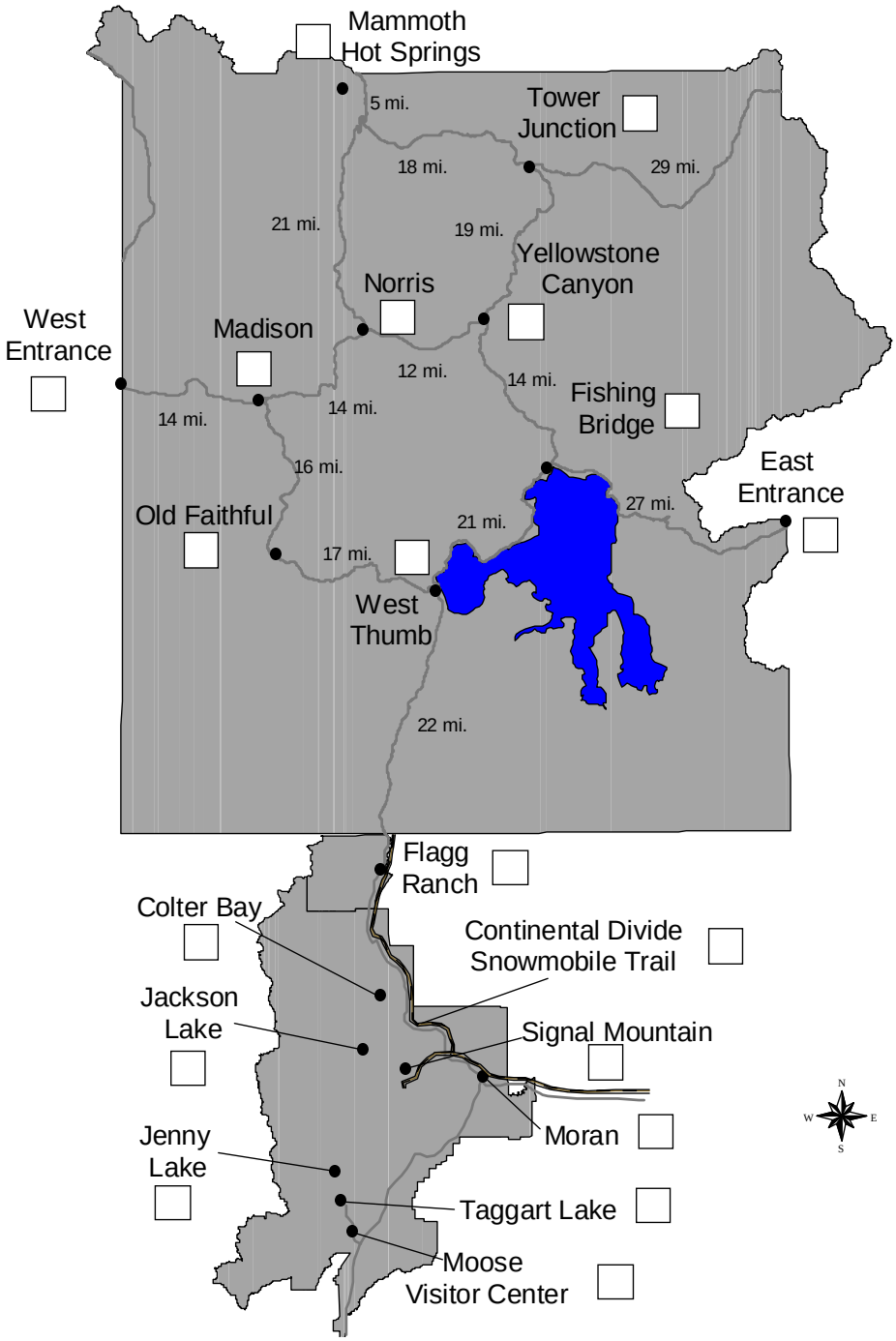
- ☐ Visit Yellowstone National Park
- ☐ Visit Grand Teton National Park
- ☐ Visit both Yellowstone and Grand Teton National Parks
- ☐ Visit recreation sites outside Yellowstone or Grand Teton National Parks (for example, downhill skiing, cross-country skiing, or riding a snowmobile in the National Forests or other areas around the parks)
- ☐ Visit friends living in the area
- ☐ Business in the area
- ☐ Other (please describe) _____

7. We are interested in all the activities you did during your most recent trip to the Greater Yellowstone Area, both inside and outside the parks. **For each activity, please check all the locations that apply. If you did not participate in a particular activity leave that line blank.**

	Yellowstone National Park	Grand Teton National Park	Outside the Parks in the Greater Yellowstone Area
a. Snowmobiling without a commercial tour guide	☐	☐	☐
b. Snowmobiling with a commercial tour guide	☐	☐	☐
c. Cross-country skiing without a tour guide	☐	☐	☐
d. Cross-country skiing with a commercial tour guide	☐	☐	☐
e. Cross-country skiing with a National Park Service guide	☐	☐	☐
f. Snow Shoeing	☐	☐	☐
g. Snowcoach tour of park sights	☐	☐	☐
h. Driving tour of park sights in a car	☐	☐	☐
i. Bus tour of park sights	☐	☐	☐
j. Educational tours led by a National Park Service guide	☐	☐	☐
k. Winter Camping	☐	☐	☐
l. Downhill Skiing	☐	☐	☐
m. Other, please specify _____	☐	☐	☐

8. Looking at the activities you selected in Question 7, please write the letter or name of the activity that you consider the ***primary* activity** of your most recent trip to the Greater Yellowstone Area? (For example, write "K" for winter camping.) **Please choose only one.** _____

9. On the map below, check **all** the places you and your group visited during your recent trip to the Greater Yellowstone Area. Simply check the box beside each place you visited. If you did not visit a place, leave the box blank.



The following questions are for visitors who ride a snowmobile. Please skip to Question 15 on the following page if you have never ridden a snowmobile.

10. Do you own your own snowmobile?

    ☐ Yes
    ☐ No, skip to Question 12

11. If you own your own snowmobile, do you own a

    ☐ 2-stroke engine snowmobile
    ☐ A fuel-injected 2-stroke engine snowmobile
    ☐ 4-stroke engine snowmobile
    ☐ Don't know

12. Approximately how many years have you been riding a snowmobile? _____

13. Did you rent a snowmobile for your recent trip?

    ☐ Yes
    ☐ No, skip to Question 15

14. Which type of snowmobile did you rent?

    ☐ 2-stroke engine snowmobile
    ☐ 4-stroke engine snowmobile
    ☐ Don't know

15. How much time have you spent visiting the **Greater Yellowstone Area** so far this winter season (including your most recent trip)?

    _____ total number of *trips*
    _____ total number of *days*

16. How many of these days were spent inside **Yellowstone National Park**?

_____days

17. How many of these days were spent inside **Grand Teton National Park**?

_____days

18. Approximately how much ***additional*** time (if any) do you plan to spend visiting the **Greater Yellowstone Area** during the rest of this winter season?

_____ total number of **trips**

_____ total number of **days**

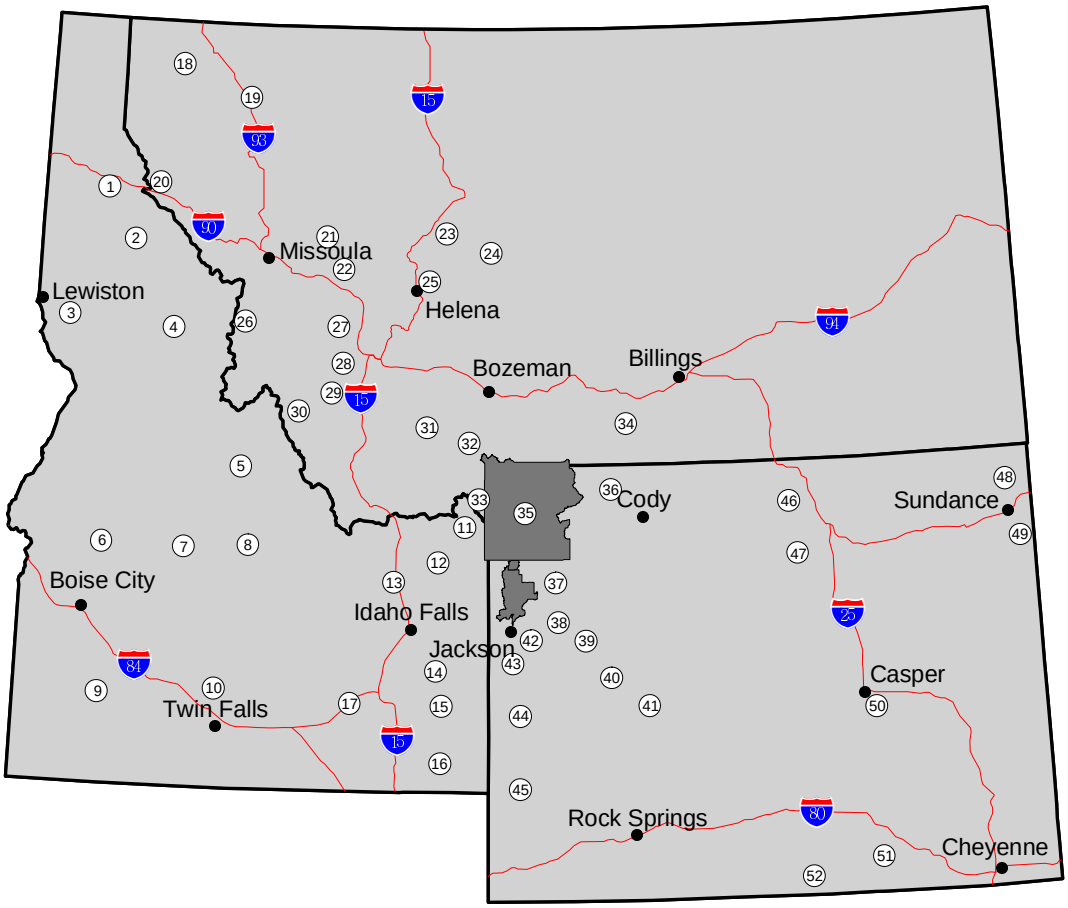
18a. How many of these days do you **plan** to spend inside **Yellowstone National Park**?

_____days

18b. How many of these days do you **plan** to spend inside **Grand Teton National Park**?

_____days

We would now like to ask about your snowmobiling activity* last *winter (December 2001-March 2002). We will ask you about trips you made to areas in Idaho, Wyoming, and Montana using the map and general area list on this page for reference.



Idaho

1. Wallace Area Trails
2. Northern Idaho Trails
3. Grangeville Area Trails
4. North-Central Idaho Trails
5. Salmon/Challis Area Trails
6. Smith's Ferry Area Trails
7. Stanley Area Trails
8. Central Idaho Trails
9. South-Western Idaho Trails
10. South-Central Idaho Trails
11. Big Springs Area Trails
12. Ashton Area Trails
13. Eastern Idaho Trails
14. Bone Snowmobile Trails
15. Pocatello Area Trails
16. Bear Lake Area Trails
17. South-Eastern Idaho Trails

Montana

18. Kootenai Country
19. Flathead Valley
20. Haugan
21. Seeley Lake
22. Garnet
23. Lincoln
24. Kings Hill/Little Belts
25. Helena
26. Lolo Pass
27. Georgetown Lake
28. Wise River
29. Dillion/Polaris
30. Wisdom/Jackson/Sula
31. Virginia City/Ennis
32. Bozeman/Big Sky
33. West Yellowstone
34. Cooke City/Silver Gate

Wyoming

35. Yellowstone/Grand Teton National Parks
36. Bear Tooth
37. Continental Divide Togwotee
38. Continental Divide Gros Ventre
39. Continental Divide Dubois
40. Wyoming Range Kemmerer
41. Continental Divide Lander
42. Granite Hot Springs
43. Wyoming Range Alpine
44. Casper Mountain
45. Wyoming Ranger Kemmerer
46. North Big Horn Mountains
47. South Big Horn Mountains
48. Bear Lodge Mountains
49. Black Hills of WY
50. Wyoming Range Afton
51. Snowy Range
52. Sierra Madre Mountains

19. Please list the numbers corresponding to the areas you visited last winter (December 2001–March 2002) and indicate the number of trips you made to that area and the total days you spent in the area on all the trips. If during a single trip you visited multiple areas list the area where you spent most of your time. If you visited an area not included on this list, please add this under the "other areas" category.

Snowmobile Areas	Number of Trips	Total Days
Montana		
Areas from list (numbers):		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
Other areas (please name area and nearest city):		
_____	_____	_____
Idaho		
Areas from list (numbers):		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
Other areas (please name area and nearest city):		
_____	_____	_____
Wyoming		
Areas from list (numbers):		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
Other areas (please name area and nearest city):		
_____	_____	_____

ACTIVITY CHOICES

We will now ask you to think about different activities you might do for a day inside Yellowstone or Grand Teton National Parks. To begin, we will ask you to describe a typical day on your own recent trip to Yellowstone or Grand Teton National Park (the trip when we contacted you about the survey).

Instruction 1: Look at the table on the next page. Each row describes a different feature of your trip. Think about one day on your recent trip that was typical of your experience. In the column called "Your Trip," **please answer the questions in rows "a" through "h" by choosing the category that best describes conditions on one day during "Your Trip" in Yellowstone or Grand Teton National Parks.**

We describe the level of snowmobile traffic at two points on "Your Trip"—the number of snowmobiles that enter the park each day at the entrance where you entered the park, which captures congestion at the entrance and along the roads near the entrance, and the number of snowmobiles at the most crowded area of the park you visited.

Instruction 2: In the row labeled "Cost" (row i), please enter your best estimate of the cost for you of the day's activities inside the park including park entrance fees, supplies, equipment rentals , gas, and guided tour charges, **but do not include the cost of food or lodging**.

Instruction 3: After you fill out the table, look at the columns for "Your Trip" and "Trip B." **Imagine that "Your Trip" and "Trip B" were the only trips inside Yellowstone or Grand Teton National Park that you could choose from.**

Please check the box in the last row of the table (row j) indicating which trip you would prefer. If you did not enjoy your trip and you do not like "Trip B," you should choose the "Not Visit" option. "Not Visit" means you would stay home or you would still visit the Greater Yellowstone Area, but just not enter either of the parks.

20.

Features of Trip	Your Trip (please check ONE BOX in each row that best describes Your Trip)	Trip B	Not Visit
a. Activity?	☐ Snowmobile ☐ Snowcoach tour ☐ Snowcoach Shuttle to ski or snowshoe ☐ Drive car to sightsee, ski or snowshoe ☐ Other	Snowmobile	**I would not enter Yellowstone or Grand Teton National Park if these were my only choices**
b. Entrance where you started the day?	☐ Yellowstone West near West Yellowstone, MT ☐ Yellowstone East near Cody, WY ☐ Yellowstone North near Gardiner, MT ☐ Yellowstone South near Flagg Ranch ☐ Grand Teton Moose entrance near Jackson Hole, WY ☐ Grand Teton Moran entrance near Flagg Ranch ☐ Other (please describe)	Yellowstone West Entrance	
c. Did you take a guided tour?	☐ Yes ☐ No	Unguided	
d. Daily snowmobile traffic at the entrance where you started?	☐ High, 800 to 1,500 snowmobiles (typical West Entrance on a holiday or crowded weekend) ☐ Moderate, 300 to 600 snowmobiles (typical West Entrance on weekdays and South entrance on busy holiday weeks) ☐ Low, 200 or fewer snowmobiles (typical North and East entrances on all days and South entrance on most weekdays and weekends) ☐ I did not see any snowmobiles near the entrance where my trip started	Low, 200 or fewer snowmobiles	
e. Level of snowmobile traffic at the most crowded area of the park you visited?	☐ High, 800 to 1,500 snowmobiles (typical Old Faithful on a holiday and busy weekends or weekdays in late January and February) ☐ Moderate, 300 to 600 snowmobiles (typical Old Faithful on less crowded weekdays and weekends) ☐ Low, 200 or fewer snowmobiles (very uncrowded days at Old Faithful) ☐ I did not see any snowmobiles on my most recent trip	Moderate 300 to 600 snowmobiles	
f. Condition of snow on road or trail surface?	☐ Bumpy and rough for all or most of the trip ☐ Bumpy and rough for some of the trip ☐ Smooth	Smooth	
g. Noise level at the noisiest part of the park you visited?	☐ Loud, standing next to the road you could not converse with someone standing next to you, noise level similar to standing next to a gas-powered lawn mower or a busy highway ☐ Moderate, you would need to raise your voice to talk to someone standing next to you, noise like a busy city street ☐ Low noise, occasional	Moderate	
h. Level of exhaust emissions during your day?	☐ Very noticeable for most or all of the trip ☐ Noticeable for some of the trip ☐ I did not notice any exhaust emissions	Noticeable for some of the trip	
i. Cost per person for day?	$_____	$100	
j. I would choose… (check only one)	Your Trip ☐	Trip B ☐	Not Visit ☐

21. If you could change **one** thing about your trip, what would you change?

- ☐ Number of other visitors
- ☐ Number of other snowmobiles
- ☐ Number of other cars
- ☐ Noise level
- ☐ Smoother road surface
- ☐ Level of exhaust emissions
- ☐ Cost
- ☐ Other, please describe _____
- ☐ I would not change anything about my trip

The next 6 questions offer similar choices. There are no right or wrong answers. We are interested in the activities and other features of the trips that appeal to you.

Please indicate your choice in each question by checking the box at the bottom of the column.

Please assume you are staying close to the entrance where the trip starts, rather than where you stayed on your recent trip. The maps on the cover and on page 5 of the survey may help if you are not familiar with all the entrances. The map on page 5 provides mileage between roads in Yellowstone National Park.

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

22. CHOICE 1: Which do you prefer—Trip A, Trip B or "Not Visit"?

Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B or Not Visit. If you choose Trip A or Trip B, write the number of days you spend on a trip doing only that activity.

Note that we shaded the boxes that are the same for both trips. The conditions and prices described in this question may be different than what the parks are like today.

		Trip A	Trip B	Not Visit
Activity		Take a guided snowcoach tour to see park sights in Yellowstone starting at the South entrance (near Flagg Ranch)	Take an unguided snowmobile trip in Yellowstone starting from the West entrance (near West Yellowstone)	**I would not enter Yellowstone or Grand Teton National Park if these were my only choices**
Conditions during day trip	**Daily snowmobile traffic at the entrance where you started**	High (800 to 1,500 snowmobiles)	Moderate (300 to 600 snowmobiles)	
	Snowmobile traffic at most crowded part of the trip	High (800 to 1,500 snowmobiles)	Moderate (300 to 600 snowmobiles)	
	Condition of snow on the road or trail surface for all or most of the trip	Smooth	Bumpy and rough	
	Highest noise level experienced on trip	Loud (Like a gas-powered lawn mower or a busy highway)	Loud (Like a gas-powered lawn mower or a busy highway)	
	Exhaust emission levels	Very noticeable	Very noticeable	
	Total Cost for DAY per person	$230	$50	
I would choose… (check only one)		☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ **go to Question 22b below**

22b. Answer this question if you chose "Not Visit": What would you likely do instead?

- ☐ Stay at home; I would not travel to the Greater Yellowstone Area
- ☐ Travel to the Greater Yellowstone Area to snowmobile outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to cross-country ski outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to downhill ski at Big Sky or one of the ski areas near Jackson Hole.
- ☐ Other, please describe activity _____
  location _____

23. CHOICE 2: Which do you prefer—Trip A, Trip B or "Not Visit"?

Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B or Not Visit. If you choose Trip A or Trip B, write the number of days you spend on a trip doing only that activity.

Note that we shaded the boxes that are the same for both trips. The conditions and prices described in this question may be different than what the parks are like today.

		Trip A	Trip B	Not Visit
Activity		Take a guided snowcoach tour to see park sights in Yellowstone starting at the West entrance (near West Yellowstone)	Drive your car to auto-tour, cross-country ski or hike unguided in Grand Teton National Park	**I would not enter Yellowstone or Grand Teton National Park if these were my only choices**
Conditions during day trip	**Daily snowmobile traffic at the entrance where you started**	Moderate (300 to 600 snowmobiles)	Moderate (300 to 600 snowmobiles)	
	Snowmobile traffic at most crowded part of the trip	Low (200 or fewer snowmobiles)	Moderate (300 to 600 snowmobiles)	
	Condition of snow on the road or trail surface for all or most of the trip	Smooth	Bumpy and rough	
	Highest noise level experienced on trip	Moderate (Like a busy city street)	Low noise, occasional	
	Exhaust emission levels	Noticeable	Noticeable	
	Total Cost for DAY per person	$100	$20	
I would choose… (check only one)		☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ **go to Question 23b below**

23b. Answer this question if you chose "Not Visit": What would you likely do instead?

☐ Stay at home; I would not travel to the Greater Yellowstone Area

☐ Travel to the Greater Yellowstone Area to snowmobile outside the Parks.

☐ Travel to the Greater Yellowstone Area to cross-country ski outside the Parks.

☐ Travel to the Greater Yellowstone Area to downhill ski at Big Sky or one of the ski areas near Jackson Hole.

☐ Other, please describe activity _____
location _____

24. CHOICE 3: Which do you prefer—Trip A, Trip B or "Not Visit"?

Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B or Not Visit. If you choose Trip A or Trip B, write the number of days you spend on a trip doing only that activity.

Note that we shaded the boxes that are the same for both trips. The conditions and prices described in this question may be different than what the parks are like today.

		Trip A	Trip B	Not Visit
Activity		Take a guided tour into Yellowstone on a snowcoach shuttle to cross-country ski or hike starting at the West entrance (near West Yellowstone)	Drive your car to auto-tour, cross-country ski or hike unguided in Grand Teton National Park	**I would not enter Yellowstone or Grand Teton National Parks if these were my only choices**
Conditions during day trip	**Daily snowmobile traffic at the entrance where you started**	Moderate (300 to 600 snowmobiles)	No snowmobiles in the park	
	Snowmobile traffic at most crowded part of the trip	Moderate (300 to 600 snowmobiles)	No snowmobiles in the park	
	Condition of snow on the road or trail surface for all or most of the trip	Smooth	Smooth	
	Highest noise level experienced on trip	Loud (Like a gas-powered lawn mower or a busy highway)	Low noise, occasional	
	Exhaust emission levels	Not noticeable	Not noticeable	
	Total Cost for DAY per person	$150	$75	
I would choose… (check only one)		☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ **go to Question 24b below**

24b. Answer this question if you chose "Not Visit": What would you likely do instead?

- ☐ Stay at home; I would not travel to the Greater Yellowstone Area
- ☐ Travel to the Greater Yellowstone Area to snowmobile outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to cross-country ski outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to downhill ski at Big Sky or one of the ski areas near Jackson Hole.
- ☐ Other, please describe activity _____
  location _____

25. CHOICE 4: Which do you prefer—Trip A, Trip B or "Not Visit"?

Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B or Not Visit. If you choose Trip A or Trip B, write the number of days you spend on a trip doing only that activity.

Note that we shaded the boxes that are the same for both trips. The conditions and prices described in this question may be different than what the parks are like today.

		Trip A	Trip B	Not Visit
Activity		Take an unguided snowmobile trip in Yellowstone starting at the North entrance (near Gardiner)	Take a guided tour into Yellowstone on a snowcoach shuttle to cross-country ski or hike starting at the West entrance (near West Yellowstone)	**I would not enter Yellowstone or Grand Teton National Park if these were my only choices**
Conditions during day trip	**Daily snowmobile traffic at the entrance where you started**	Low (200 or fewer snowmobiles)	Moderate (300 to 600 snowmobiles)	
	Snowmobile traffic at most crowded part of the trip	Low (200 or fewer snowmobiles)	Low (200 or fewer snowmobiles)	
	Condition of snow on the road or trail surface for all or most of the trip	Bumpy and rough	Smooth	
	Highest noise level experienced on trip	Moderate (Like a busy city street)	Low noise, occasional	
	Exhaust emission levels	Noticeable	Noticeable	
	Total Cost for DAY per person	$150	$100	
I would choose… (check only one)		☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ **go to Question 25b below**

25b. Answer this question if you chose "Not Visit": What would you likely do instead?

- ☐ Stay at home; I would not travel to the Greater Yellowstone Area
- ☐ Travel to the Greater Yellowstone Area to snowmobile outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to cross-country ski outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to downhill ski at Big Sky or one of the ski areas near Jackson Hole.
- ☐ Other, please describe activity _____
  location _____

26. CHOICE 5: Which do you prefer—Trip A, Trip B or "Not Visit"?

Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B or Not Visit. If you choose Trip A or Trip B, write the number of days you spend on a trip doing only that activity.

Note that we shaded the boxes that are the same for both trips. The conditions and prices described in this question may be different than what the parks are like today.

		Trip A	Trip B	Not Visit
Activity		Take a guided tour into Yellowstone on a snowcoach shuttle to cross-country ski or hike starting at the West entrance (near West Yellowstone)	Drive your car to auto-tour, cross-country ski or hike unguided in Yellowstone starting at the North entrance on the road to Cooke City (from Gardiner to Cooke City)	**I would not enter Yellowstone or Grand Teton National Park if these were my only choices**
Conditions during day trip	**Daily snowmobile traffic at the entrance where you started**	No snowmobiles in the park	Moderate (300 to 600 snowmobiles)	
	Snowmobile traffic at most crowded part of the trip	No snowmobiles in the park	Moderate (300 to 600 snowmobiles)	
	Condition of snow on the road or trail surface for all or most of the trip	Smooth	Smooth	
	Highest noise level experienced on trip	Low noise, occasional	Low noise, occasional	
	Exhaust emission levels	Not noticeable	Noticeable	
	Total Cost for DAY per person	$100	$20	
I would choose… (check only one)		☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ **go to Question 26b below**

26b. Answer this question if you chose "Not Visit": What would you likely do instead?

- ☐ Stay at home; I would not travel to the Greater Yellowstone Area
- ☐ Travel to the Greater Yellowstone Area to snowmobile outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to cross-country ski outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to downhill ski at Big Sky or one of the ski areas near Jackson Hole.
- ☐ Other, please describe activity _____
  location _____

27. CHOICE 6: Which do you prefer—Trip A, Trip B or "Not Visit"?

Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B or Not Visit. If you choose Trip A or Trip B, write the number of days you spend on a trip doing only that activity.

Note that we shaded the boxes that are the same for both trips. The conditions and prices described in this question may be different than what the parks are like today.

		Trip A	Trip B	Not Visit
Activity		Take an unguided snowmobile trip in Yellowstone starting from the North entrance (near Gardiner)	Drive your car to auto-tour, cross-country ski or hike unguided in Grand Teton National Park	**I would not enter Yellowstone or Grand Teton National Park if these were my only choices**
Conditions during day trip	**Daily snowmobile traffic at the entrance where you started**	Low (200 or fewer snowmobiles)	High (800 to 1,500 snowmobiles)	
	Snowmobile traffic at most crowded part of the trip	Low (200 or fewer snowmobiles)	High (800 to 1,500 snowmobiles)	
	Condition of snow on the road or trail surface for all or most of the trip	Bumpy and rough	Bumpy and rough	
	Highest noise level experienced on trip	Moderate (Like a busy city street)	Loud (Like a gas-powered lawn mower or a busy highway)	
	Exhaust emission levels	Noticeable	Very noticeable	
	Total Cost for DAY per person	$125	$35	
I would choose… (check only one box)		☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ If you planned a trip doing just this activity, how many days would you spend on the trip? _____ days	☐ **go to Question 27b below**

27b. Answer this question if you chose "Not Visit": What would you likely do instead?

- ☐ Stay at home; I would not travel to the Greater Yellowstone Area
- ☐ Travel to the Greater Yellowstone Area to snowmobile outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to cross-country ski outside the Parks.
- ☐ Travel to the Greater Yellowstone Area to downhill ski at Big Sky or one of the ski areas near Jackson Hole.
- ☐ Other, please describe activity _____
  location _____

As you may know Yellowstone and Grand Teton National Parks are evaluating the way winter access to the parks is managed. The parks are making plans for next winter season, but plans in future seasons may change. The following question will help us understand how you feel about one possible management option.

One proposed winter management plan for Yellowstone or Grand Teton National Parks would be phased in over several years.

- **Set daily limits on the number of snowmobiles allowed in the park that would primarily affect the West and South entrances to Yellowstone**
  - 550 per day from the West entrance and 250 per day from the South entrance. The current daily average at the West entrance is 538 snowmobiles each day and at the South 176 each day. Visitation is higher on holidays and weekends
- **Require all snowmobiles to be equipped with 4-stroke engine technology**
- **The average cost of entering the park for you could change (your actual costs might be somewhat higher or lower):**
  - Renting a 4-stroke snowmobile would cost on average $100 per day per person
  - A park entrance fee of $35 per person
- **Snowmobile trails and access in the surrounding National Forest areas would be unchanged.**
- **Expected changes in traffic, road conditions, noise, and level of exhaust fumes as a result of this plan are**:
  - Snowmobile traffic at the most crowded parts of Yellowstone National Park would be reduced from High (800 to 1,500) to Moderate (300 to 600) on a typical Saturday
  - Road conditions on a typical Saturday would generally be bumpy from the West entrance, but smooth from all other entrances
  - Noise levels on a typical Saturday would be reduced from high to moderate
  - Level of exhaust emissions on a typical Saturday would be reduced from very noticeable to noticeable some of your trip

28. If this plan had been in effect this winter season how would your decision to make your *recent trip* to Yellowstone or Grand Teton National Park have been affected? Please check only one.

- ☐ My visit would not have been different.
- ☐ I would have stayed *fewer* days. → How many fewer days? _____
- ☐ I would have stayed *more* days. → How many more days? _____
- ☐ I would not have visited the park.

29. If this plan were in effect this winter season how would your *total visits* to Yellowstone and Grand Teton National Parks be affected? Please check only one.

- ☐ No change in total visits.
- ☐ I would visit *less* often. → I would take _____fewer annual trips
- ☐ I would visit *more* often. → I would take _____more annual trips
- ☐ I would not visit Yellowstone and Grand Teton National Parks.

The questions below will be used to calculate the economic impact of park visitors on the local communities.

30. Where did you stay on your most recent trip to the Greater Yellowstone area? The map on the cover of the survey shows the location of the cities listed. **Please check all that apply and indicate the number of nights spent in each place.**

- ☐ West Yellowstone → number of nights _____
- ☐ Gardiner → number of nights _____
- ☐ Jackson → number of nights _____
- ☐ Pahaska Tepee at the East Entrance to Yellowstone → number of nights _____
- ☐ Cody → number of nights _____
- ☐ Old Faithful Snowlodge in Yellowstone National Park → number of nights _____
- ☐ Mammoth Hot Springs Hotel in Yellowstone National Park → number of nights _____
- ☐ Bozeman → number of nights _____
- ☐ Big Sky → number of nights _____
- ☐ Other → number of nights _____

31. Please indicate how you **traveled** from your home **to the Greater Yellowstone Area on your recent visit**. **Please check all that apply.**

- ☐ Personal vehicle
- ☐ Plane
- ☐ Rental car
- ☐ Other, please specify _____

32. If you drove, what type of vehicle did you drive from your home to get to the Greater Yellowstone Area?

- ☐ Car
- ☐ Minivan
- ☐ Sport utility vehicle (SUV)
- ☐ Pick-up truck
- ☐ Recreational vehicle (RV) or motor home
- ☐ Snowmobile
- ☐ Other _____
- ☐ I did not drive

33. On your recent trip, what kind of group were you with? **Please check all that apply**:

- ☐ Alone, please go to Question 35
- ☐ With family
- ☐ With friends
- ☐ With a club or other organized group
- ☐ Other _____

34a. If you were not alone how many adults (age 18 or older) were in your group? _____

34b. If you were not alone how many children (under age 18) were in your group? _____

35. Did you share expenses with people in the group on your most recent trip?

- ☐ Yes, I shared expenses with the other people in the group
  How many people did you share expenses with? _____
- ☐ No, I paid my own expenses and no one else's.
- ☐ Someone else paid for my trip expenses.

36. Did you reserve part or all of your recent trip to the Greater Yellowstone Area as a package?

- ☐ No, I purchased services individually
- ☐ Yes, I purchased a package

How much did the package cost per person? _____

Please check all the items that were included in the package:

- ❑ Lodging → number of nights _____
- ❑ Snowmobile rental → number of days _____
- ❑ Snowmobile guided tour → number of days _____
- ❑ Snowcoach tour → number of days _____
- ❑ Meals → number of meals _____
- ❑ Park entry fees
- ❑ Other, please indicate _____

37. On your recent trip, what was the cost just for you in each of the categories below or what was your share of the expenses? For example, if you shared a hotel room that cost $100 with one other person, your share is $50. If you did not spend any money on an item, please write 0. You do not need to repeat information about items included in a package trip from Question 36.

		My cost was
a. Lodging during my stay in the Greater Yellowstone Area	$	
b. Lodging during **travel to** the Greater Yellowstone Area	$	
c. Food/drink at restaurants or bars during my stay in the Greater Yellowstone Area	$	
d. Food/drink from grocery or convenience stores during my stay in the Greater Yellowstone Area	$	
e. Transportation (airfare, gas, etc.) to **travel to** the Greater Yellowstone Area	$	
f. Transportation in the Greater Yellowstone Area (rental vehicle or other transport including gas)	$	
g. Park entry fees	$	
h. Souvenirs or gifts	$	
i. Tour or activity fees Please describe _____	$	
j. Equipment rental Please describe _____	$	
k. Other expenses Please specify _____	$	

Finally we would like to ask a few questions about you. These questions are needed to make sure our sample is representative of all types of visitors. Your answers will be kept strictly confidential.

38. What is your home zip code? _____

39. Which of the following categories best represents your level of schooling?

- ☐ Some high school
- ☐ High school graduate
- ☐ Some college or technical school
- ☐ College graduate
- ☐ Some graduate school
- ☐ Graduate degree

40. Which of these categories best describes your household employment status? Please check all that apply.

	You	***Spouse/Partner***
Employed full time	☐	☐
Employed part time	☐	☐
Retired	☐	☐
Student	☐	☐
Full time homemaker	☐	☐
Unemployed	☐	☐
Other (please specify)	_____	_____

41. If you are currently employed, do you have the option of working additional hours to increase your total income?

- ☐ No
- ☐ Yes, at $____ per _____.

42. If you are employed, how many weeks of vacation do you get annually? _____

43. If you are currently employed and you had the opportunity to work fewer hours and receive less income or work more hours and receive more income at your current rate of pay, would you change your hours? Please indicate the appropriate response.

- ☐ I would work more hours and receive more income
- ☐ I would work less hours and receive less income
- ☐ I would not change my working time.

44. Do you belong to any of the following (check all that apply):

- ☐ Snowmobile club or association
- ☐ Cross-country ski club or association
- ☐ Environmental organization
- ☐ Civic or business organization
- ☐ Other, _____

45. Do you own any of the following (check all that apply):

- ☐ Snowmobile
  Make, model, and year _____
- ☐ Cross-country skis
- ☐ Downhill skis
- ☐ Snowshoes
- ☐ Other winter activity equipment (please list) _____

46. Marital/family status:

- ☐ Married/long term relationship
- ☐ Single
- ☐ Divorced

47. What is your age? _____ years old

48. Number of children under age 18 living at home _____

49. What is your approximate total household annual income (before taxes) in 2002?

- ☐ Under $15,000
- ☐ $15,000–$24,999
- ☐ $25,000–$34,999
- ☐ $35,000–$44,999
- ☐ $45,000–$59,999
- ☐ $60,000–$74,999
- ☐ $75,000–$99,999
- ☐ $100,000–$124,999
- ☐ Over $125,000

50. If you are currently employed, are you paid by the hour or are you paid a fixed salary? (If you are not currently employed, please skip.)

- ☐ Hourly
- ☐ Salary

51. Are you?

- ☐ Male
- ☐ Female

Thank you very much for your help. Is there anything else you would like to tell us about winter use of Yellowstone National Park or Grand Teton National Park? Please use the space below if you would like to provide any additional information. Once you are done, please mail this completed questionnaire back to us in the postage-paid return envelope. If you have any questions, you can contact us toll-free at 1-866-590-7462 or email us at yellowstone_survey@rti.org.

COMMENTS:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Thank you for taking time to complete this survey.

B.2 Alternative to Question 19: Winter Recreation Trips

We would like to ask about your cross-country skiing, snowshoeing, winter hiking, and winter camping trips during the previous winter season (December 2001–March 2002).

11. Did you cross-country ski, snowshoe, winter hike, or winter camp during the previous winter season (December 2001–March 2002)? **Please check all that apply.**

    - ☐ Cross-country ski
    - ☐ Snowshoe
    - ☐ Winter hiking
    - ☐ Winter camping
    - ☐ No, I did not participate in these activities last winter—please skip to page 10.

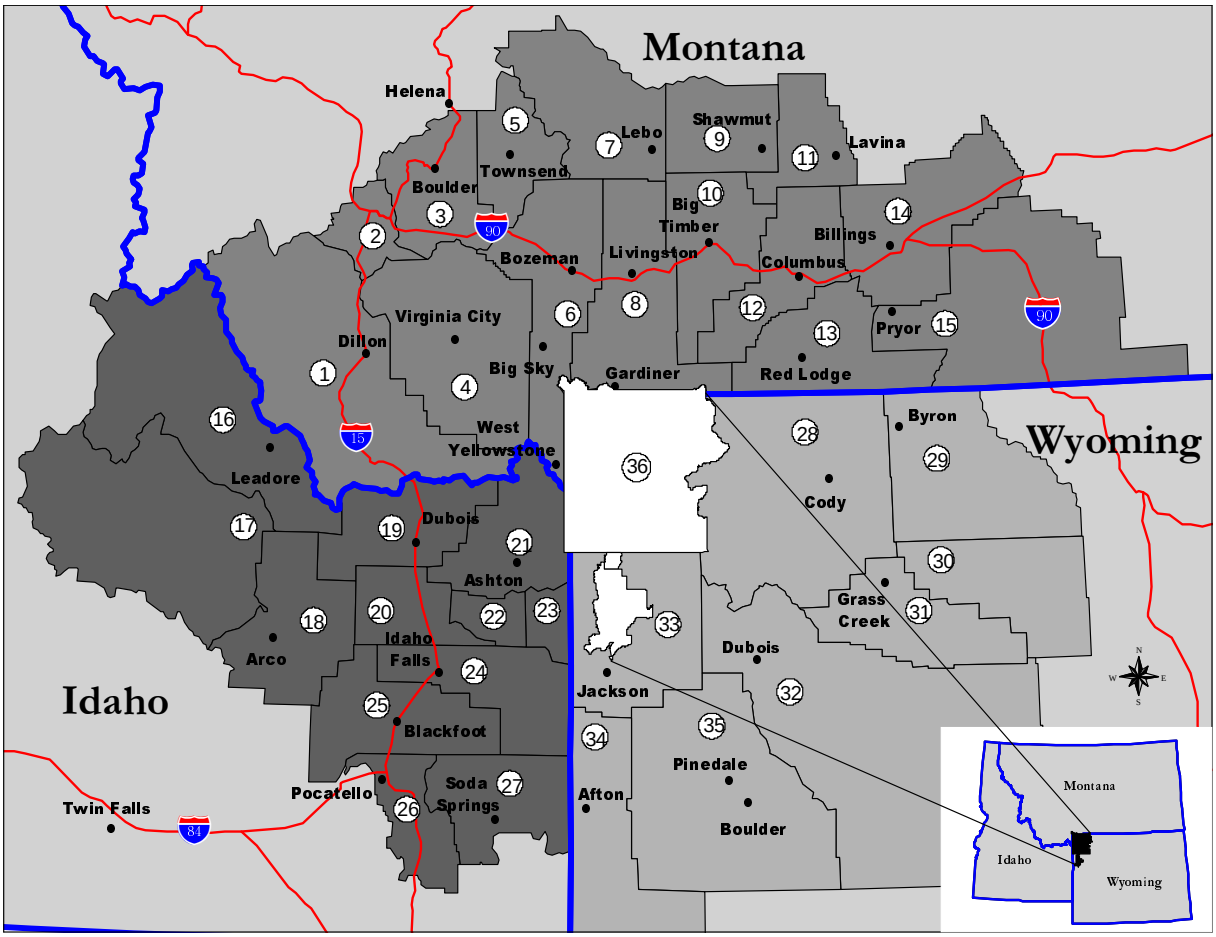
12. Looking at the map on the next page, did you make any trips in the counties in or around Yellowstone and Grand Teton National Parks during the previous winter season (December 2001–March 2002)?

    - ☐ Yes—please fill out the following table using the map on the next page for reference.
    - ☐ No—please skip to page 10.

Using the map and county list on the following page for reference please indicate the counties you visited and the number of trips you made in this county during the previous winter season for cross-country skiing, snowshoeing, winter hiking, and winter camping. If you visited more than one county on a trip please list the county where you spent the most time. Trips can be a day outing or a longer visit.

Counties Visited for Winter Recreation	# Trips	Total Days
(List numbers from map)		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Counties Surrounding Yellowstone and Grand Teton National Parks



Montana	Idaho	Wyoming
1. Beaverhead	16. Lemhi	28. Park
2. Silver Bow	17. Custer	29. Big Horn
3. Jefferson	18. Butte	30. Washakie
4. Madison	19. Clark	31. Hot Springs
5. Broadwater	20. Jefferson	32. Fremont
6. Gallatin	21. Fremont	33. Teton
7. Meagher	22. Madison	34. Wyoming
8. Park	23. Teton	35. Sublette
9. Wheatland	24. Bonneville	36. Yellowstone and Grand Teton National Parks
10. Sweet Grass	25. Bingham	
11. Golden Valley	26. Bannock	
12. Stillwater	27. Caribou	
13. Carbon		
14. Yellowstone		
15. Big Horn		

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 $\bar{m}(r,s,t) = \frac{1}{m(r,s,t)} \sum_{i=1}^{M(r,s,t)} \sum_{j=1}^{N_i(r,s,t)} m(i,j|r,s,t)\; I_R(i,j|r,s,t)$

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[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

$$W_2(i, j|r,s,t) = \begin{cases} \dfrac{1}{m(i, j|r,s,t)} & \text{if person j is a respondent on day i} \\ \dfrac{1}{\bar{m}(r,s,t)} & \text{otherwise} \end{cases}$$ [2]

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

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