INVESTIGATING SKIER DEMAND FOR ENVIRONMENTALLY SUSTAINABLE SKI HILL MANAGEMENT

by

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ABSTRACT

A discrete choice experiment was used to evaluate the demand of skiers to Whistler (n = 405), British Columbia, for environmentally sustainable ski hill management initiatives as a component of a ski hill's operations. The hypothetical choice sets presented thirteen ski hill attributes. Although few differences emerged between a priori segmentations (such as length of stay and place of residence), through the use of latent class segmentation it was determined that four distinct skier groups exist. Overall, the majority of skiers preferred environmentally certified ski hills, and considered an environmental surcharge to be unacceptable. Generally, skiers also preferred ski hills with greater amounts of skiable terrain, an advanced form of ski run distribution, shorter gondola wait times, and some form of backcountry access. These finding illustrate which ski hill attributes influence destination choice and show that demand exists amongst skiers for some forms of environmentally sustainable ski hill management.

Keywords: Certification, discrete choice experiment, environmental sustainability, latent class segmentation, ski hill, skier preferences, surcharge

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AIC	Akaike Information Criterion
BIC	Bayesian Information Criterion
CSP	Comprehensive Sustainability Plan
CVM	Contingent Valuation Method
DCE	Discrete Choice Experiment or Survey
DST	Decision Support Tool
IIA	Independence of Irrelevant Alternatives
LC	Latent Class
MLE	Maximum Likelihood Estimation
MNL	Multinomial Logit
NGO	Non-Government Organization
PWU	Part worth utility
RMOW	Resort Municipality of Whistler
RUT	Random Utility Theory
TNS	The Natural Step

CHAPTER 1:
INTRODUCTION

1.1 Introduction & Rationale

Never before in the history of humankind have so many people travelled, whether for leisure or business. At the start of the 21st century, roughly 700 million people travel annually (DANTE 2002). Tourism, which now directly accounts for 8.2 percent of total global employment (WTO 2003), has become a powerful force in transforming the economic, socio-cultural and physical environments of tourist destinations. The skiing industry has developed rapidly since the 1960s, and today between 15 and 20 million people (3 percent of all travellers) annually cross international borders to ski (Holden 2000).

Long thought to be a benign, or even beneficial use of land, relative to resource extraction or other heavy industries (Parkinson 1992), today there is growing global recognition that ski resorts require vast amounts of energy, water, and other materials for the production of services and experiences (Draper 1997). For ski hills, these resources are needed to create and maintain the ski hill itself, to transport on-slope skiers and provide on-slope amenities and support facilities such as slope grooming, snowmaking, night skiing, restaurants and snack bars. This consumption of natural resources has exacerbated many environmental problems[1]. It has adversely affected soil, vegetation,

[1] In the context of ski resorts, because ski hill managers have little influence on the level of sustainability associated with travel to and from ski hills, they are generally only held responsible for on-hill resource consumption.

water resources, wildlife and scenic beauty (Todd 1994; Price *et al.* 1997; Williams & Todd 1997; Wilde 1998; Wardle & Fahey 1999; Holden 2000; NSAA 2000; Simpson & Terry 2000; Pelley 2001; Waldron and Williams 2002; Wipf *et al.* 2005). Solutions to these problems must be found.

Currently, a wide variety of strategies for creating more environmentally sustainable ski hills exist (NSAA 2000; Pro Natura 2000; Colorado dept. of public health & environment & Tetra Tech 2002; BCHSSOA 2003; RMOW 2004; 05). These depend on environmentally sustainable management initiatives, such as alternative building designs, enhanced waste disposal methods, and innovative on-slope transportation and service options. Successful implementation of these initiatives also requires the support of stakeholders, including tourism operators, employees and managers, elected decision-makers, environmental organizations, year round and seasonal residents, and, the focus of this study, skiers – all of whom will be affected by changes to the ski hill.

Viewed by many as fundamentally important to ensuring the continued existence of any visitor destination (Carter 1995; Priestley *et al.* 1996; Mihalic 2000; Simpson 2001), advocates of environmentally sustainable management also argue that environmentally proactive destinations that can demonstrate environmental performance will reap long-term economic gains, while those that do not will be penalized in the market place (TIAA 1992; Hudson 2000a; Mihalic 2000; Proebstl 2006). However, despite these convictions, others argue there is little evidence to suggest visitors are interested in this form of management (Fry 1995; Holden 1998; Milne 1998; Swarbrooke 1999), and that certain demographic categories of skiers, such as the young, actually favour ski resort expansions over environmental initiatives (Fry 1995; Holden 1998).

Choosing between these diametrically opposing views is a problem currently being faced by ski hill managers. However, before a choice can be made, managers must first understand skier preferences for environmentally sustainable ski hill management as a component of a ski hill's operations. This understanding will enable managers to establish whether sufficient demand for environmentally sustainable management exists, and the types of initiatives that will prove most popular.

An additional challenge is that preferences are becoming more heterogeneous and complex (Best 2000). Therefore, ski hill managers need to be aware of differences in demand in order to more effectively tailor and promote ski hill initiatives that meet the demand of most, if not all, skiers (Andereck & Caldwelll 1994; Preece & Oosterzee 2000). For example, just because overall demand is for an environmental certification, this does not mean that all, or even most, skiers want ski hills to become environmentally certified. It is possible that this demand outcome is due to a small group of skiers whose preferences for certification are very strong. Thus, while it may seem that skiers want certification, the majority of skiers, because their preferences are more indifferent, may actually prefer ski hills with no environmental certification. Nescience of this heterogeneity may result in the implementation of initiatives that are not supported by all, or even most, skiers.

Processes and techniques for involving stakeholders (e.g., workshops, meetings, and task forces) have been successful in fostering local stakeholder support for environmentally sustainable management (Day *et al.* 2003; Frame *et al.* 2004). Surveys have also proven useful for quantitatively eliciting the demand of transitory stakeholders, such as skiers, who do not reside in or near the destination region (Morey 1981; 84; Greig

1983; Walsh *et al.* 1983; Williams & Basford 1992; Klenosky *et al.* 1993; Williams & Dossa 1994; Ormiston *et al.* 1998; Riddington *et al.* 2000; Ferrand & Vecchiatini 2002; Perdue 2002; Tangian 2002; Siomkos *et al.* 2005; Mulligan 2006). The results of these surveys have increased the understanding of which ski hill attributes are most important in influencing the quality of skier experience, and thus ski hill choice. However, while these results have been used in an informative role by marketing administrations as an advisory tool to help guide and develop marketing strategies, they have rarely been used to better inform ski hill managers. Furthermore, because attempts to understand skier preferences relied on conventional surveys for data collection, they often suffer from a number of weaknesses (Haider 2002; Haider & Rasid 2002). Therefore, despite the multitude of skier surveys that have been conducted, there is still a "lack of empirical research into the attitudes of skiers towards the environment they ski in" (Holden 2000, pp. 255). This is somewhat surprising, as maintaining positive skier experiences requires understanding of how ski hill changes will affect skier experience.

1.2 Research Goals & Objectives

Understanding visitor demand through behavioural research is critical for developing appropriate management decisions, such as the implementation of environmentally sustainable initiatives. For ski hill managers, this means understanding skier preferences for environmentally sustainable management initiatives as a component of a ski hill's operations to determine whether demand exists for this form of management and the types of initiatives that will prove the most popular (Briggs 1997). Based on this need, the first goal of this project is to develop a systematic process for empirically measuring skier preferences for ski hill design and management attributes. Once

measured, these preferences will be used to investigate skier demand for environmentally sustainable ski hill initiatives through the use of a simple Decision Support Tool (DST). Therefore, in order to ensure that ski hills do not become self-destructive, it is paramount that ski hill operators also gain insights about the demand amongst skiers for environmentally sustainable ski hill management and the type of initiatives that can be implemented without negatively impacting skier experience. Finally, in order to ensure that ski hill managers are cognizant of the heterogeneity in skier demand, and not just aggregated demand, the third goal of this project is to examine how demand for ski hill attributes and environmentally sustainable management varies between different skier segments. Achieving these goals will contribute to a more holistic understanding of environmentally sustainable ski hill management. To meet these goals, the research has the following objectives:

- Create and develop a method to empirically measure skier preferences for ski hill design and management attributes;
- Use these preferences to examine if skier demand exists for environmentally sustainable ski hill management initiatives by requiring skiers to make tradeoffs among specific ski hill characteristics and environmentally sustainable management decisions; and
- Determine if skier demand for ski hill attributes and environmentally sustainable ski hill management varies depending upon key characteristics, such as demographics, trip characteristics and activities, travel motivations, and environmental influences and awareness.

1.3 Introduction to Case Study: Whistler, B.C.

1.3.1 Description & History

Whistler is located in British Columbia's coastal mountain range, 40 km east of the Pacific Ocean and only 120 km north of one of Canada's largest urban areas, Vancouver (RMOW 2004). At an elevation of about 668m, the town is nestled in the Whistler Valley between Green Lake in the north and Brandywine Creek in the south. Surrounded by natural beauty and defined by forests, mountains, rivers and lakes, the 16,500ha of land within the municipal boundaries features a variety of terrain, including high elevation coastal forests (~45%), alpine tundra (~9%), residential and commercial development (~8%), wetlands and riparian areas (~1%). The area provides habitat for a diversity of wildlife and fauna, including a number of rare and endangered species (Green 2004; Lindh & Martin 2004; RMOW 2004).

Originally founded on the shores of Alta Lake in the early 1900's, Whistler remained a tiny community throughout the mid-century. The opening of the first ski lifts by the Garibaldi Lift Company in 1966 sparked the growth of Whistler as a skiing destination (RMOW 1997). Whistler Village, along with Blackcomb Mountain and the north side of Whistler Mountain, opened in 1980, and by 1992 Whistler was named the number one ski resort in North America by Snow Country Magazine. In 2005, by adding 400 acres on the west side of Whistler Mountain, and 700 acres of off-piste terrain, Whistler further expanded its skiable terrain by 30% (Travel Weekly 2004). Today, Whistler is home to almost 10,000 permanent residents and draws over 2 million visitors annually (RMOW 2004).

1.3.2 The Future

In recognition of the dangers associated with unfettered growth, and the importance of a well maintained environment to long term success (RMOW 2002), the community of Whistler has recently undertaken several initiatives to ensure its future as a popular skier destination. Among these initiatives are a cap on the number of bed units (RMOW 2004), minimization of total area developed and impervious surfaces created (RMOW 2005), the creation of a protected areas network (RMOW 2005), and adoption of The Natural Step (TNS) framework[2]. For Whistler, this framework includes environmentally sustainable resource use and the integration of sustainable technologies and best practices into all infrastructure and systems that support the ski hill (RMOW 2004). While every effort has gone into obtaining feedback from residents, and involving them in decision-making processes, little effort has gone into understanding skier demand for these environmentally sustainable initiatives. This research attempts to overcome this shortcoming. By enabling ski hill managers to understand skier demand through behavioural research, this study will allow ski hill managers to establish if sufficient demand exists for environmentally sustainable management and the types of initiatives that will prove most popular.

1.4 Report Organization

This document is divided into five chapters. Chapter 1 presented the rationale for the project, its goal and objectives, and gave a brief introduction into the field of study. Chapter 2 reviews literature relevant to sustainable tourism management, the environmental impacts of ski hill operations and sustainable ski hill practices, skier

[2] Whistler/Blackcomb was also a signatory of the The Natural Step framework.

demand and its elicitation, and the potential for using discrete choice experiments. The Third chapter reviews the theoretical background of discrete choice and latent class experiments, as well as the methodology used to develop and implement the web-based survey and decision support tool. Chapter 4 then presents and discusses the results of the survey, including skier demographics, characteristics, the basic multinomial logit model, several key segmentations, the latent class model, and the decision support tool. Finally, Chapter 5 focuses on the key implications of this study for ski hill managers in Whistler and elsewhere.

CHAPTER 2:
LITERATURE REVIEW

This chapter reviews literature related to environmentally sustainable ski hill management. It begins with an overview of the concept of sustainable management, followed by a description of the environmental impacts and environmentally sustainable practices of ski hills. The next section identifies the importance of understanding skier demand. The final component reviews the weaknesses of current techniques used to elicit this demand and elucidates how discrete choice experiments overcome these challenges.

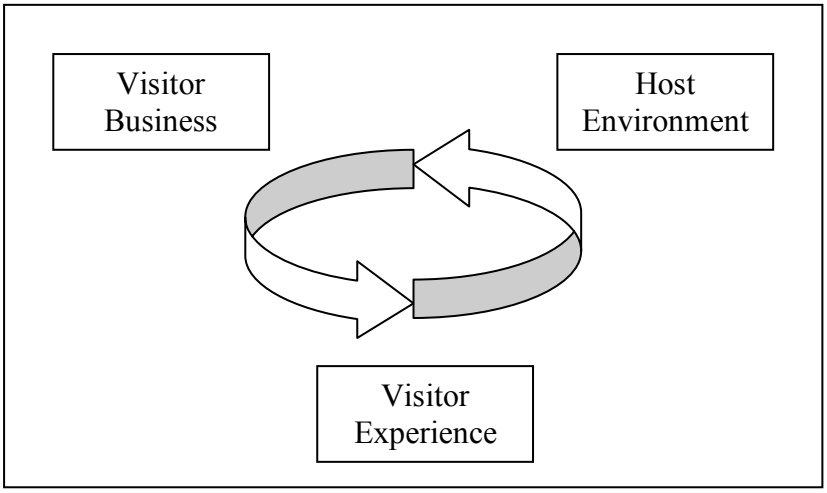
2.1 Sustainable Management in Visitor Destinations

If carefully planned, developed, and managed, tourism can have many positive impacts on the surrounding natural environment. These include providing incentives for landscape conservation, habitat restoration, reductions in the exploitation pressures on wildlife, and the 'cleaning up' of surrounding areas (Phillips 1985; Leslie 1986; Murphy 1986; Inskeep 1991; Hunter & Green 1995). Despite these 'potentials', there is increasing recognition that tourism development, and subsequent operations, are a growing source of pressure on environmental resources. These impacts include alteration and fragmentation of the landscape (Theobald *et al.* 1997), damage to vegetation (Price 1985; Fahey & Wardle 1998; Holden 1998; Wardle & Fahey 1999; Holden 2000) disruption and endangerment of animal behaviour and ecological systems (Hunter & Green 1995; Riebsame *et al.* 1996; McNicol 1997; Holden 1998; 99a; 2000; Czech *et al.* 2000; Simpson and Terry 2000; Chace *et al.* 2003; George 2003), air, noise and visual pollution

(Inskeep 1991; Raemakers 1991; Hunter & Green 1995; May 1995; Holden 1998; 99a; 2000; NSAA 2000; McNicol 1997; George 2004).

Realization that tourism places a strain on the surrounding environment, and thus is in danger of becoming a self-destructive enterprise, is especially warranted for destinations with a major focus on the outdoors, such as ski resorts. This is because their natural setting and scenic beauty is one of the attractions (Culbertson *et al.* 1991; Inskeep 1991; Williams & Dossa 1994; Carter 1995; Fry 1995; Priestley *et al.* 1996; Williams & Todd 1997; Mihalic 2000; Simpson 2001; Ahn *et al.* 2002). Priestley et al. (1996) summarize this circular relationship between visitor destinations, the surrounding environment, and the cumulative effects of tourism by pointing out that because visitor satisfaction is greatly dependant upon natural resources, destinations with such resources will attract greater visitation. Increased visitation will adversely affect the natural resources at the destination, and thus the destination becomes threatened by its own success (Figure 2.1).

Figure 2.1: Circular relationship between tourism development and its resources



Source: Adapted from Timur (2003)

Increased awareness of the inseparability of ski resorts and their surrounding environment has resulted in demand for environmentally sustainable management. Probably the best-known and most frequently quoted definition of sustainable development is that provided by the World Commission on Economic Development (WCED) in the Brundtland Report. It defines sustainability as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987, pp. 8). For visitor destinations, Hunter and Green (1995, pp. 70) suggest that sustainable development "seeks to maintain and enhance the quality of life, and the quality of the tourist experience, at destination areas through the promotion of economic developments which conserve (and where necessary preserve), local natural, built, and cultural resources."

While the absence of a universally accepted definition has resulted in its application without "regard for accuracy or consistency" (Bartlett 1997, pp. 9), this is less important than a general movement in the right direction (Clarke 1997). Regardless of these semantic disputes, it is important that ski hill managers protect ski resorts from becoming self-destructive enterprises (Culbertson *et al.* 1991; Fry 1995; Williams & Todd 1997). The next section reviews why the concept of sustainable management is so important for ski hills in general.

2.2 Environmental Impacts of Ski Hills

Compared to resource extraction and other heavy industries, ski hills have long been considered a benign, or even beneficial, use of land (Parkinson 1992). This view is changing, and many environmental groups have recently drawn attention to the environmental damage caused by ski hills. These groups argue that due to the large

numbers of visitors attracted to a small area, ski hills are not only worse for the environment than other industries, but that their impacts are permanent and extend well beyond their boundaries (Minger 1991; Banff-Bow Valley Study 1996).

Ski hills operate in mountainous areas where, due to harsh climatic conditions and ecological sensitivity, the impacts of human activities on the environment are felt much more strongly than in lower elevations (Price *et al.* 1997; Schwanke 1997; Holden 2000; Hudson 2000a). These impacts have increased in recent years as ski hills have expanded to higher altitudes, more extreme conditions, and across whole slopes (Price *et al.* 1997; Tuppen 2000). This trend is especially disconcerting because research shows that one of the driving forces behind the desire to ski is to experience the beauty of the mountains (Culbertson *et al.* 1991; Fry 1995).

The most immediate and apparent environmental impact of ski hills occurs during the construction and expansion stages (Todd & Williams 1996; Price *et al.* 1997; Holden 1998; 99a; Wipf *et al.* 2005). Beyond these initial stages, hill maintenance, on-slope skier transportation, on-slope amenities and support facilities - such as slope grooming and snowmaking - also have adverse impacts (Wingle 1991; Todd 1994; Price *et al.* 1997; Wilde 1998; Wardle & Fahey 1999; Holden 2000; NSAA 2000; Simpson & Terry 2000; Pelley 2001; Waldron and Williams 2002; Wemple *et al.* 2003; David *et al.* 2005; Wipf *et al.* 2005). These impacts can be grouped into two main categories:

- Disturbance and alteration of vegetation, wildlife and natural resources through everyday ski hill use and operation of on-slope facilities; and
- Impacts on scenic beauty through construction and use of on-hill facilities.

Damage to vegetation is most severe during times of low snow levels, since skiers flatten shrubs and snap off protruding branches (Price 1985; Fahey & Wardle 1998; Holden 1998). Soil erosion and compaction[3], because of snow grooming and recreational activities, also impede vegetation growth (Fahey & Wardle 1998; Wardle & Fahey 1999; Holden 2000) and can lead to flash floods that cause damage to both ski roads and surrounding trees (Holden 1998). The operation of on-slope transportation facilities, on and off-piste recreational activities, skiable terrain creation, night skiing and on-slope restaurants and snack bars, contribute to wildlife disturbance and habitat destruction (Riebsame *et al.* 1996; McNicol 1997; Holden 1998; 99a; 2000; NSAA 2000; Simpson & Terry 2000; George 2003; 04; RMOW 2005). This includes the disruption of animal migration routes caused by ski hill buildings and ski runs (McNicol 1997), the direct disturbance of animals and nesting birds by skiers, and the injuries caused to birds by ski lift cable wires (Holden 1998; 99a). Another concern is the need for large amounts of water[4] for snowmaking and on-slope restaurants and snack bars (May 1995; Draper 1997; EPA 2000; George 2003), and subsequent sediment, nutrient, and pesticide-laden run-off, which affects, among other things, local watersheds and fish-spawning habitats (Rodriguez 1987; NSAA 2000; Pelley 2001; Wemple *et al.* 2003; David *et al.* 2005).

The most obvious impacts on scenic beauty are caused by on-slope structures such as ski lifts, floodlight support structures, restaurants and snack bars (Raemakers 1991; May 1995; Holden 1998; 99a; 2000; NSAA 2000). Of course, structures can affect the scenic beauty of any surrounding environment, but because ski hill structures are sited

[3] "Compaction can reduce the size of macropores, thereby inhibiting root penetration, aeration, and infiltration capacity which can, in turn, lead to reduced seedling growth and accelerated surface erosion" (Wardle & Fahey 1999 pp. 2).

[4] Average water consumption in winter resort destinations can be up to two or three times higher that of others towns and cities (George 2003).

away from other developments, above the tree line, and often on the skyline, they tend to be much more visually intrusive (Raemakers 1991). While these scenic impacts may not heavily impact skiers per se, once the snow melts, these structures, and further visual impacts caused by piste development, are much more apparent (Holden 2000). Solid waste, as a result of on-slope restaurant and snack bar facilities, and littering, as a result of improper disposal by skiers, is also an eyesore[5] (May 1995; Holden 1998; 99a; 2000). This is a serious issue in the French Alps where "litter has been found even at the highest altitudes" (May 1995, pp. 273). Light and air pollution further detract from the beauty of ski hills (McNicol 1997; George 2004). The illumination of on-slope structures and floodlighting for night skiing causes light pollution, and unburned hydrocarbons and nitrogen oxides, released by on-slope transportation, motorized sports activities and maintenance vehicles, can form smog. This smog can reduce visibility and detract from a ski hill's scenic beauty. The next section describes how ski resorts and interest groups are designing solutions to mitigate the environmental impacts of ski hills around the world.

2.3 Environmentally Sustainable Ski Hill Practices

Ski hill managers, as with other outdoor recreational sports operators, are under increasing pressure from governments, environmental agencies, NGOs and the public to undertake environmentally sustainable management (Todd & Williams 1996; Williams & Todd 1997; Hudson 2000a; George 2003; NSAA 2003). This pressure is augmented by increasing evidence that environmentally sustainable initiatives contribute toward a positive image in the market place (Proebstl 2006) - amongst other benefits (Table 2.1) -

[5] Littering is also a problem for the breeding of endemic birds. For example, litter left by skiers in the Cairngorm ski area has encouraged crows and gulls further up the mountain tops. This migration has resulted in these species predating the nests of ptarmigan and dotterel (Holden 1998; 99; 2000).

and that visitors are asking travel companies more questions about environmental policies (Hudson 2000a) and are turning away from resorts they consider to be polluted (Mihalic 2000).

Table 2.1: Potential benefits from implementing environmentally sustainable initiatives

Potential Benefits	
Competitiveness	• Attracts environmentally aware customers • Enhances and strengthens trust with environmental protection authorities and conservation groups • Improves the resort's chances of securing large winter sports events • Results in environmental engagement as a key qualification • Provides access to new markets
Cost reduction	• Reduces the cost of drafting approval documents • Reduces the need for expensive rehabilitation • Lowers insurance premiums and interest rates for bank loans
Risk reduction	• Increases the knowledge of potential surface-covering damage • Reduces the risk of erosion and other associated damage • Increases the traceability of liability in case of damage
Improvement of organization	• Increases the knowledge of slope personnel • Increases the knowledge of the effects tourism has on nature and the landscape • Reduces bureaucratic costs • Increases the knowledge of the contributions of winter visitors

Source: Adapted from Pro Natura (2000)

Most environmentally sustainable ski hill guidelines / procedures have been created for ski resorts by interest groups, tourism associations, and NGOs (NSAA 2000; Pro Natura 2000; BCHSSOA 2003). In an attempt to improve the environmental sustainability of ski hills, the National Ski Area Association (NSAA), the trade association for ski area owners and operators, released a documented entitled 'sustainable slopes - the environmental charter for ski areas'[6] (NSAA 2000). This charter adopts an

[6] In conjunction with this charter, the NSAA also created an online database, called the 'green room'. This site not only lists the environmental projects undertaken by winter resort destinations, but also identifies resorts that have received national environmental excellence awards.

"avoid, minimize, mitigate" approach by offering a set of 21 environmental principles (Table 2.2). These principles provide a framework for the implementation of best practices, the assessment of environmental performance, and the setting of goals for future improvement.

Table 2.2: NSAA's 21 environmental principals

21 Environmental Principles
Air quality
Education and outreach
Energy use for facilities
Energy use for lifts
Energy use for snowmaking
Energy use for vehicle fleets
Fish and wildlife management
Forest & vegetation management
Planning, design and construction
Potentially hazardous wastes
Product re-use
Recycling
Transportation
Visual quality
Wastewater management
Wastewater reduction
Water quality management
Water use for landscaping
Water use for snowmaking
Water use in facilities
Wetlands and riparian areas

In an effort to continue the work of their 2000 document, the NSAA released a supplementary report in 2003 that provided information regarding ski hills' progress in implementing the environmental charter (NSAA 2003). By reporting the most and least implemented principles (Table 2.3), it not only highlighted areas in which ski hills were excelling, but also demonstrated where room for improvement remained.

Table 2.3: NSAA's most and least implemented principles

Overall most implemented principles	Overall least implemented principles
Planning, design and construction	Energy use for lifts
Potentially hazardous waste	Energy use for snowmaking
Visual quality	Energy use for vehicle fleets
Wetlands and riparian areas	Product re-use

Local governments and government ministries (Colorado dept. of public health & environment & Tetra Tech 2002; RMOW 2004; 2005) have also designed environmentally sustainable ski hill guidelines / procedures. In Colorado, the department of public health and the environment, in conjunction with a Californian consultancy firm, produced a handbook that provides detailed environmental improvement strategies for on-slope operations to conserve natural resources and reduce waste (The Colorado department of public health and environment, and Tetra Tech 2002). In 2000, the Resort Municipality of Whistler (RMOW) adopted TNS framework as their 'sustainability compass'. Although not created for ski areas per se, the ski hill in Whistler (Whistler/Blackcomb) was a signatory. This framework has helped both the municipality and the ski hill gain a better understanding of its current environmental unsustainable state, the basic principles that define minimum requirements for environmental sustainability, and an appropriate planning process for moving toward sustainability (RMOW 2005).

Further examples of environmentally sustainable ski hill guidelines / procedures exist throughout North America and Europe. These management processes usually incorporate feedback from a wide variety of stakeholders, but typically do not consider the preferences of the customers (i.e. skiers) per se. This is somewhat surprising as the argument in favour of implementing environmentally sustainable management initiatives

would be greatly strengthened by research showing that demand for such initiatives actually exists amongst the clients. According to Preece and Oosterzee (2000), the need to understand visitor demand is for two reasons. First, knowledge of this demand is necessary in order for ski hill managers to know how these initiatives will affect skier experience, and thus ski hill choice. Second, this knowledge is needed to develop appropriate measures to avoid, or at least minimize, potentially adverse environmental impacts. Hearne and Salinas (2002) support this belief by arguing that in order for ski hill managers to implement initiatives that facilitate nature conservation and income generation most effectively, skier demand must be understood and incorporated. Mercado and Lassoie (2002) agree, when they emphasize the need to better understand skiers' demand in order to:

- Deliver the message of sustainable tourism;
- Provide returns to the environmental resources; and
- Identify key natural features or aspects of the ski hill, which appeal to skiers, without jeopardizing environmental resources.

The next section reviews why it is important that ski hill managers understand skier demand for environmentally sustainable initiatives.

2.4 Skier Demand

Destination managers have long recognised the fundamental importance of environmental quality for ensuring the future existence of their destinations (Culbertson *et al.* 1991; Inskeep 1991; Carter 1995; Priestley *et al.* 1996; Mihalic 2000; Simpson 2001). Others support this view by arguing that environmentally proactive destinations that can demonstrate strong environmental performance will reap long-term economic

gains, while those that do not will be penalized in the market place (TIAA 1992; Hudson 2000a; Mihalic 2000; Proebstl 2006). However, despite these convictions, others argue there is little evidence to suggest visitors are interested in environmentally sustainable management (Holden 1998; Milne 1998; Swarbrooke 1999). They also suggest that certain demographic categories of skiers actually favour potentially unsustainable initiatives, such as ski area expansions, over environmental ones (Fry 1995; Holden 1998).

This choice between whether to implement environmentally sustainable management initiatives is a problem currently being faced by ski hill managers. However, before these managers can begin to implement environmentally sustainable initiatives, they must first understand skier preferences for these initiatives as a component of a ski hill's operations. This understanding is a critical aspect for any manager to establish whether sufficient demand exists for environmentally sustainable management, and the type of initiatives that will be the most popular / least unpopular[7]. Furthermore, it also provides ski hill managers with an opportunity to differentiate their ski hill from others, and thus creating a sustainable competitive advantage (Dalrymple & Parsons 2000; Marxt & Hacklin 2005; Siomkos *et al.* 2005). Since the late 1980s and early 1990s ski resorts has experienced a slowing down and stagnation of market demand (Zimmermann 1991; Harabaugh 1997; Tuppen 2000; Williams & Fidegon 2000). This differentiation, which can be defined as the "degree to which a [ski hill] is meaningfully different and superior when compared by [skiers] to competing [ski hills]" (Best 2000, pp. 370), could help to

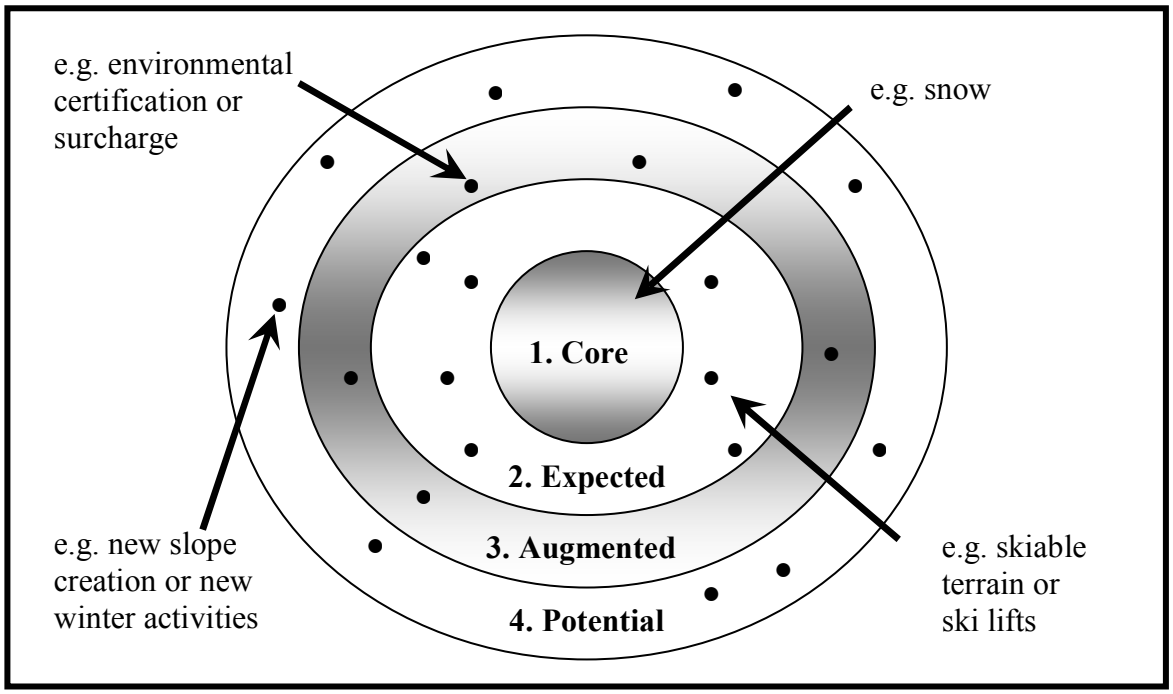
[7] Ultimate the decision to implement environmentally sustainable ski hill initiatives may not be demand driven. Instead, because of environmental impacts of ski hills, managers may be forced to implement these initiatives regardless. Therefore, awareness of skier demand is necessary in order for ski hill managers to implement the most popular (or least unpopular) initiatives.

attract new skiers into the sport. Perceiving the ski hill and its operation as a tourism product in its own right, it is appropriate to introduce Levitt' (1983) product concept to the discussion. He suggests that products consist of four components or rings (Figure 2.2). The innermost of these, referred to as the *core* and *expected* components, represent the generic product and consumers' minimal expectations / purchasing conditions, respectively. Without these, Levitt (1983) argues that products would not only be unsuccessful, but would cease to exist. For a ski hill, the snow and mountain slopes would be the generic components, while skiable terrain and ski lifts would be the expected components. However, while the existence of the first two components will attract some visitation, in order for ski hill managers to ensure the continued success of their hill, they must look beyond these minimal expectations (the first two components) and explore how to *augment* their hill. According to Levitt (1983), augmented components are those that go beyond what consumers think they need or have become accustomed to expect. For a ski hill, these could include environmentally sustainable initiatives, such as environmental certification and innovative on-slope transportation and service options. While many skiers may not expect these components, their existence is not only crucial for product positioning and differentiation, but may also motivate skiers to visit a specific ski hill over others that do not offer such components[8]. Therefore, while providing the generic and expected components is essential, in order for ski hills to be successful, managers must differentiate their hill from others. One way in which to achieve this is to increase and differentiate the number and type of components in the third ring of Levitt's product

[8] The final component of Levitt's (1983) product concept represents the potential attributes of the overall product. These can consist of any new feasible product that could potentially attract and hold potential customers.

concept (McNeill 1999). The next section reviews the challenges of eliciting and measuring skier preferences.

Figure 2.2: Levitt's total product concept



Note: Each dot represents attributes of the component.
Source: Adapted from Levitt (1983).

2.5 Eliciting Skier Demand

Understanding skier preferences for environmentally sustainable management as a component of a ski hill's operations is critical for ski hill managers to establish whether sufficient demand exists for environmentally sustainable management, and the type of initiatives that will be the most popular / least unpopular. Many researchers have suggested processes and techniques for understanding the demand of various local stakeholder groups (Haywood 1988; Murphy 1988; Simmons 1994; Ashworth & Dietvorst 1995; Gill 1997; Jackson & Morpeth 1999; Simpson 2001; Day *et al.* 2003). These have often proven successful for understanding the preferences of employees and

managers, elected decision-makers, year round and seasonal residents, etc. However, due to their transitory nature and the fact that they do not typically reside in, or near, the destination region, these processes and techniques have generally proven unsuccessful for visitors (Haywood 1988; Gill & Williams 1994).

The most efficacious and commonly used technique for quantitatively eliciting the demand of transitory stakeholders, such as skiers, is also the standard for market research; conventional surveys. Over the past few decades, a number of researchers have used these surveys to better understand both consumer and visitor preferences. These attempts have either involved the creation of generic models, which can be used by destination managers to determine visitor demand for a variety of destination attributes, or more specific studies, which have attempted to determine skier demand for specific ski hill and resort attributes. Two generic model examples, which can be used by ski hill managers to better understand skier demand, are the push-pull theory (Dann 1977), developed for tourists per se, and means-end theory (Reynolds & Gutman 1988), which can be used by ski hill managers. However, while these models may provide some useful insights into skier preferences for hill managers, both have been heavily criticised. The push-pull theory has come under attack for not revealing the reasons behind individual preferences, since the importance of particular attributes may be a function of multiple motivational forces (Klenosky 2002), and the means-end theory is viewed as highly susceptible to biases. Other models that can be used to understand skier demand include those based on behavioural decision theory (Sirakaya *et al.* 1996), previous travel experience (Sonmez & Graefe 1998), market access (McKercher 1998), travel horizons (Oppermann 1998) and destination loyalty (Oppermann 2000; McKercher & Wong 2004). These have also been

criticised for not providing enough reliable information for ski hill managers to predict skier demand with confidence.

A multitude of ski specific studies have also been carried out. These range from specifically looking at skier preferences for ski hill and resort attributes, to understanding skier motivations, choice and expectations. In an early study aimed at determining what things, other than snow, attracts skiers to ski areas, Echelberger & Shafer (1970) found that depending on snow accumulation, skiers were either attracted by a resort's advertising program, or by a resort's skiable terrain, groomed area, numbers of instructors employed, and average driving time from metropolitan centres. Greig (1983), Williams & Dossa (1994), Ormiston *et al.* (1998), Riddington *et al.* (2000), Tangian (2002) and Siomkos *et al.* (2005) have also tried to ascertain what ski resort attributes are most important in influencing the quality of skier experience, and thus ski hill choice. While the specific attributes under consideration within each study varied, all five looked at the relatively tangible attributes of ski resorts, such as snow condition, skiable terrain, gondola wait time, grooming, snowmaking capacity, activities, price, level of crowding, accommodation, food services and travel time. In their results, Siomkos *et al.* (2005) concluded that the cost of lift tickets and lunch, resort access and the availability of parking were the most important attributes. Riddington *et al.* (2000) concluded that the critical factors were snow cover, cost and travel time for day visitors, and accommodation for overnight visitors. These results were similar to Tangian (2002), who concluded that cost, travel time and skiable terrain distribution were the most influential variables on ski resort choice, and Williams & Dossa (1994), who concluded that quality of terrain, snow conditions and quality of staff services were the most important factors. Greig (1983) and

Ormiston *et al.* (1998) concluded that skiers most valued snow conditions, skiable terrain, gondola wait times and groomed area. The conclusions of Greig (1983) and Ormiston *et al.* (1998) have also been argued by Morey (1981; 84), Walsh *et al.* (1983), Perdue (2002) and Mulligan (2006), who in their work on skier satisfaction, found that skiable terrain and gondola wait times played an important role in skier experience.

Klenosky *et al.* (1993) and Ferrand & Vecchiatini (2002) have also conducted studies to understand what influences skier experience and thus ski hill choice. However, these studies not only considered the tangible ski resort attributes of snow condition, gondola wait times, skiable terrain, etc, but also included intangible benefits, needs and personal values, such as fun, safety, image and social atmosphere. While Klenosky *et al.* (1993) found that the challenge, social atmosphere, fun and excitement played and equally, if not more, important role in ski hill choice than attributes such as grooming, snow condition and skiable terrain, Ferrand & Vecchiatini (2002) concluded that a good ski resort image is more important than a ski hill's attributes in attracting skiers. In other studies, Sirgy & Su (2000) attempt to predict the relationship between destination environment, destination visitor image, tourists' self-concept, self-congruity, functional congruity, and travel behaviour. While Moeltner and Englin (2004), through the use of a repeated-purchase model, found that purchase history and time-variant site characteristics have a significant and offsetting effect on repurchase decisions. This, the authors concluded, suggests that there are three categories of skiers; habit formers, variety-seekers and the play-it-by-ear type.

Several studies have also investigated different aspects of skier motivations and behaviour. Williams & Dossa (1994), in a study of British Columbian skiers, found that

enjoying the natural setting and experiencing the thrill of skiing were the two most important factors with regards to the decision to ski. Hudson (2000b), in investigating the constraints on skiing participation for potential skiers, found several constraints, including stress, anxiety and perceived self-skill. Williams & Basford (1992) and Williams & Lattey (1994), who focused on understanding what constraints keep people from skiing, and women from skiing, respectively, also conducted similar work. Englin and Moeltner (2004) and Holden (1999b) conducted studies to understand the differences in motivations for skiers and snowboarders. While Englin and Moeltner (2004) found that snow conditions were more important to skiers, Holden (1999b) concluded that the motivation to ski for both skiers and snowboarders was based on skill level. Further studies have also been conducted to increasing the understanding of conflicts between skiers and snowboarders (Vaske *et al.* 2000 & Vaske *et al.* 2004), obligations and self-sanctions amongst skiers (Heywood & Aas 1999), the impacts of snowmobile encounters (Vitterso *et al.* 2004), skier perceptions of service attributes (Pullman & Moore 1999), and the difference between skier groups based on frequency of visit (Vassiliadis *et al.* 2006).

All these studies used user or client focussed preference research to inform a wide range of management and planning questions in a diverse range of tourism and recreation issues. However, only few such skier based studies exist to inform ski hill managers with regards to hill management. Instead, the results of these surveys have generally been used by the marketing administration of companies as an advisory tool to help guide and develop the necessary marketing strategies to increase customer satisfaction, loyalty and retention, and thus strengthening their competitive position. Furthermore, because these

and other attempts to understand skier demand have generally relied on conventional surveys for data collection, they often suffer from a number of additional weaknesses. These include the fact that researchers can influence skier response through the wording of questions, and that it is often difficult to incorporate the multi-attribute reality of trade-offs, as Haider & Rasid (2002) suggested in other resource management applications. Traditional surveys may also ask too much of both the respondent and researcher, because they not only require the evaluation of complex management issues separately, but they also require that an overall utility value be constructed based on these responses (Haider 2002).

Due to the weaknesses of traditional survey techniques, and the fact that understanding of skier preferences for multi-attribute products such as ski hills can provide an empirical foundation for environmentally sustainable ski hill management, more systematic and reliable methods for understanding skier demand is needed. Such methods must overcome the weaknesses of previous attempts, incorporate a behavioural evaluation tool, enable ski hill managers to predict the heterogeneity of demand, and not just aggregated demand, as well as measure the importance of single attributes, such as environmentally sustainable ski hill management initiatives, in relation to others. The next section describes the advantages of one multivariate survey technique in particular, discrete choice surveys, for assessing skiers preferences for ski design and management attributes.

2.6 Discrete Choice Experiments

Although first gaining prominence within marketing and transport economics in the late 1970s and early 1980s (Louviere & Hensher 1982; Louviere & Woodworth

1983), it was not until the 1990s that Discrete Choice Experiments (DCEs) emerged within the tourism literature as a tool to estimate visitor demand. Since then DCEs have often been used in the field of tourism, hospitality and leisure as a market research tool (Finn *et al.* 1992; Dellaert *et al.* 1995; 97; Stemerding *et al.* 1999; Kemperman *et al.* 2000). Additionally, it is sometimes used to determine visitor demand for potential management initiatives (Haider & Ewing 1990; Anderson & Louviere 1993; More *et al.* 1996; Adamowicz *et al.* 1998a; Haider *et al.* 1998; Louviere & Schroeder 1999). With respect to ski hills, by asking skiers to make tradeoffs between entire ski hill alternatives, DCEs enable managers to compare the impacts of management initiatives on skier experience, such as attainment of an environmental certification, and assess the likelihood that these initiatives will receive sufficient support (Morey *et al.* 2002). The results of a DCE can also be used to create a decision support tool. This tool, which enables users to select different combinations of attribute levels and determine the market share for each hypothetical scenario, can be used by ski hill managers to determine which initiatives skiers best supports in a similar way to a multi-criteria analysis (Haider & Rasid 2002).

Typically, DCEs present each respondent with a series of choice tasks. These choice tasks, which consist of two or more alternative scenarios, force the respondent to choose which alternative he/she would prefer (e.g., ski hill A or ski hill B). A base alternative - the status quo or neither option - is also often available in each choice task (e.g., ski hill A, ski hill B, or neither ski hill). Each alternative scenario consists of a fixed number of attributes (e.g., environmental certification, number of terrain parks, gondola wait time, etc) described in terms of several levels. In addition to the DCE, surveys often include several other questions concerning the demographics (e.g., age, gender and

income), trip characteristics (e.g., number of nights, type of accommodation and accommodation location) and attitudes (e.g., reasons for travelling) of the respondent. This information can be used to segment the respondents (both a priori and post hoc) in order to assess for preference heterogeneity.

Grounded in Random Utility Theory, DCEs are more theoretically sound, rigorous and flexible than other preference modelling techniques (Crouch & Louviere 2004), such as conjoint analysis. Contrived in the 1970s as a way of quantifying buyer tradeoffs among multiattributed products and services (Green & Roa 1971; Green & Wind 1975; Louviere 1988), conjoint analysis is seen as inferior to DCEs in several ways. These include level of realism, ability to perform complex statistical modelling, and the number of attributes that can be used. Furthermore, conjoint analysis requires a greater sample size, does not allow respondents to select the base alternative (i.e., 'neither' or the status quo), requires that all alternatives must be characterized by the same attributes, and requires that these attributes have the same levels. The methods used to develop and implement a discrete choice experiment capable of eliciting skier preferences are described in the next chapter.

CHAPTER 3: METHODS

This chapter describes the methods used in this study. It begins with a review of the respondent recruitment procedures and the development of the web-based survey. This is followed by a description of the discrete choice experiment analysis conducted. The designing, programming, pre-testing and delivery of the survey are explained. The chapter concludes with a discussion of the data analysis.

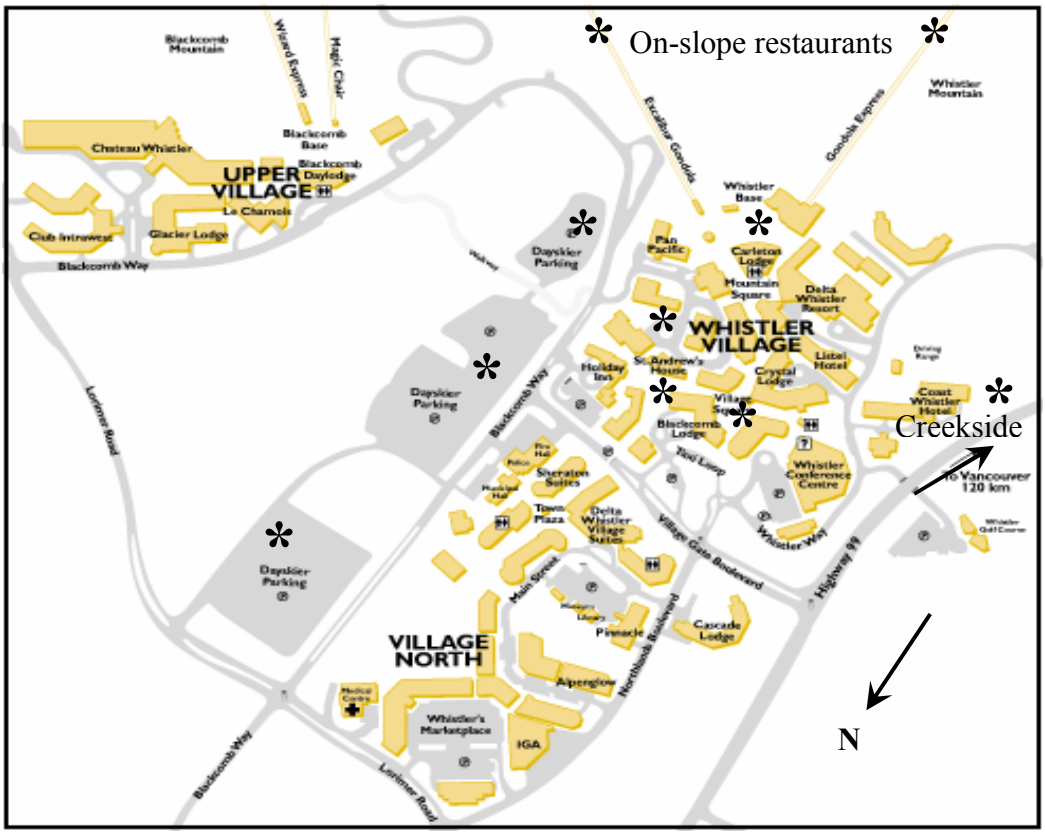
3.1 Recruitment of Survey Respondents

The target population of this research was skiers at Whistler. In order to collect the emails, eight research assistants were employed to conduct short intercept surveys (Appendix 1) at the end of February and throughout March and April of 2005. These intercepts were conducted daily between 8am to 6pm. The purpose behind these surveys was twofold. First, they obtained an email address from those who partook in the intercept surveys so that a link to the survey web-site could be emailed out at a later date, thus increasing the likelihood of a response to the questionnaire. Second, they enabled the separation of full-time Whistler residents and employees from skiers. This was necessary, as the survey was only interested in skier preferences. At the same time, the intercept surveys also provided potential respondents with some background information concerning the study and why it was being undertaken.

The majority of intercept surveys were conducted at the Gondola base, where there was a high concentration of skiers. However, in order to ensure a representative

sample of Whistler skiers, surveys were also conducted in several other locations, such as Whistler Village, the parking lot, the visitor information centre, Creekside, and, when permitted, on the ski hill at the Roundhouse and Rendezvous restaurants (Figure 3.1). At each of these locations, research assistants invited one member from every third party encountered to participate in the survey. Participants were required to be at least 19 years of age and have a working email account. When more than one individual from a party showed an interested in participating, the individual celebrating his or her birthday next was selected. Everyone who completed the intercept survey was presented with a Canadian pin as a token of our gratitude. During the sampling period, a total of 1,643 email addresses were collected.

Figure 3.1: Map of intercept survey locations



* Locations of intercept surveys

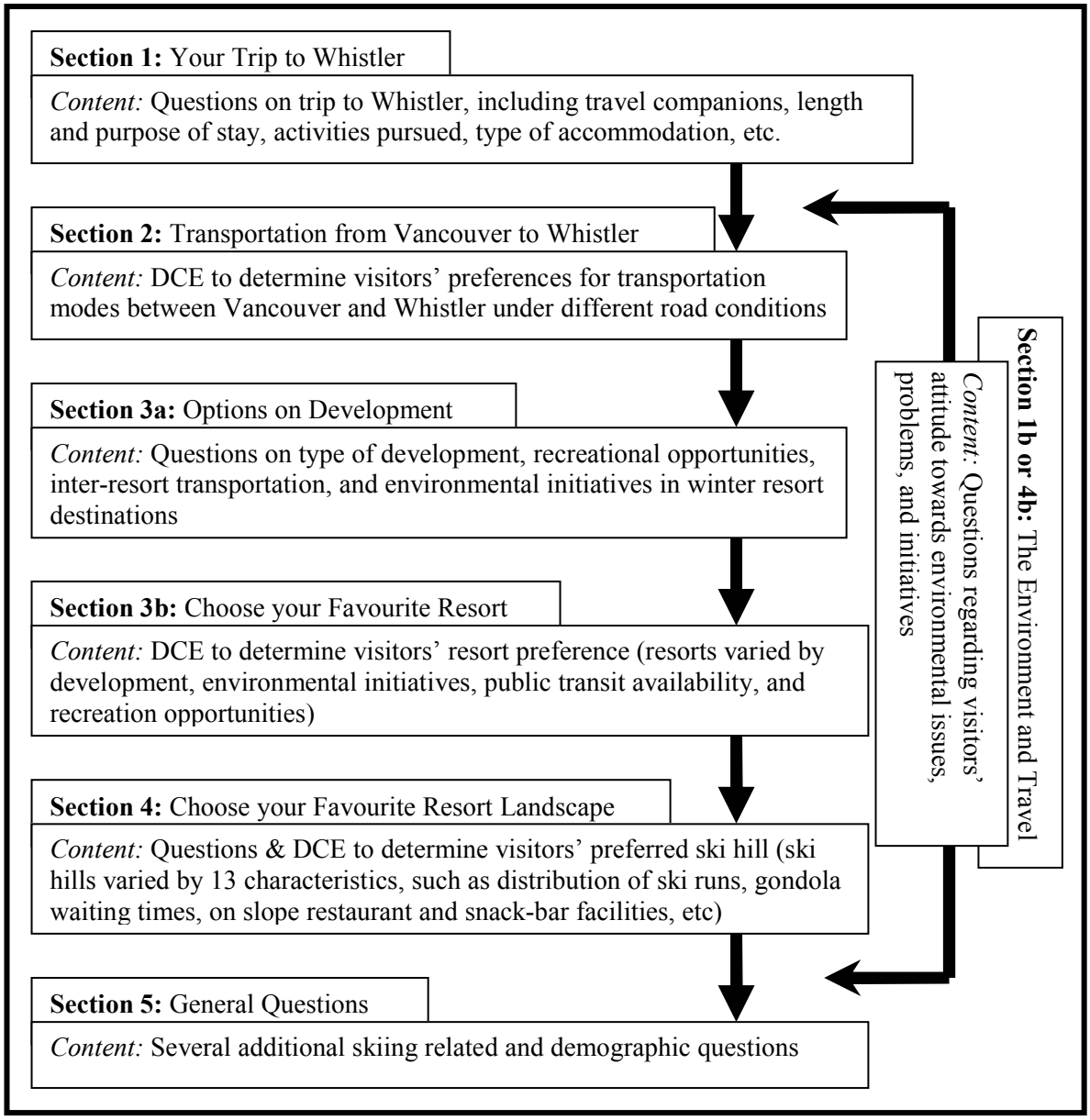
3.2 Development of Web Survey Instrument

The purpose of the web-based winter survey was to examine skier preferences for ski hill design and management attributes. The specific attributes to be tested in the survey were based on a literature review, discussions with skiers, and the academic interests of the researchers involved. In April 2005, the research team drafted a final list of attribute and associated levels to be included in the survey. The ensuing task was to determine a logical order for the survey to follow.

The final survey contained six sections. These were general questions regarding the trip to Whistler - which gave basic insight into respondents' trip and were used in latent class segmentation -, environmental attitude and preference questions[9] - which provided an understanding of respondents' attitude to the environment within which they ski -, visitor demographic questions - used to conduct a priori and latent class segmentations -, and three DCEs accompanied by learning tasks - used to familiarize respondents with the attributes used in each DCE (Figure 3.2). These DCEs assessed preferences for the following: ski hill management and design (the purpose of this report), transportation between Vancouver and Whistler, and general aspects of winter resort destinations.

[9] These questions, which were specifically designed to identify the environmental attitudes and preferences of visitors, included questions on mountain resort environments (adapted from the New Ecological Paradigm Scale (Dunlap *et al.* 2000), destination and travel choice, observed environmental problems, and environmentally sustainable management initiatives.

Figure 3.2: Sections of the web-based survey



3.3 Discrete Choice Model: Theoretical Background

DCEs are a stated preference method whereby respondents are asked to choose between any two or more hypothetical alternatives. Each of these alternatives must consist of the same set of attributes, although attribute levels can vary. These alternatives are constructed using statistical design principles to ensure orthogonality (Raktoe *et al.*

1981, Montgomery 2001). Once a sample of responses have been obtained, the part-worth utilities for various attributes of the alternatives can be calculated. These part-worth utility calculations not only enable the researcher to determine the individual contribution of each attribute to overall preference, but also to predict the probability that a respondent will choose a particular alternative from a set (Louviere & Timmermans 1990). Within ski areas, this refers to the choices made by skiers between various ski hills that differ in on-slope attributes, such as slope grooming, snowmaking, night skiing opportunities, and the number of on-slope restaurants and snack bars.

The theoretical basis for DCEs lies in both Lancasterian consumer theory and Random Utility Theory (RUT) (McFadden 1974; Ben Akiva & Lerman 1985). Lancaster's theory of derived utility proposes that a consumer's, or in this case a skier's, utility is defined over a bundle of attributes or characteristics of a purchased good or service, in this case by visiting a ski hill (Gravelle & Rees 1992). A visit to a ski hill will be influenced some how by a combination of all the attributes, such as backcountry access, on-slope restaurants and terrain parks. A skier will thus derive utility from some attributes, while deriving disutility from others, such as night skiing and a lack of environmental certification.

RUT, on the other hand, is proposed as the basis for explaining dominance judgements among pairs of offerings (McFadden 1974). This theory is based on the assumption that choices are made on the basis of the relative utilities derived from alternative options available in a choice set. This unobservable utility, U, gained by individual n, consists of two components: the deterministic and observable component, V, and the stochastic component, which represents the random unobservable error term, ε,

and captures the effects of omitted or unobserved variables. In the case of random utility theory-based choice models, several assumptions are made regarding the distribution and statistical properties of this random unobservable component (Crouch & Louviere 2000)[10]. Overall, individual *n's* utility of good *i* is

$$U_{in} = V_{in} + \varepsilon_{in} \qquad (1)$$

Some authors take this one step further and expand equation 1 to show that both the deterministic and random error term depends both on the attributes of the alternative, A, as well as on the socio-economic characteristics of the individual decision-maker, C, (Hanley *et al.* 1998). The result of this is

$$U_{in} = V_{in}(A_{in}, C) + \varepsilon_{in}(A_{in}, C) \qquad (2)$$

The econometric justification for this unobserved component is that the analyst may omit variables or commit measurement errors (Adamowicz *et al.* 1998b). However, because of this random component, analysts cannot ascertain all of the information used by decision makers to make their choice, and therefore can only predict the probability that a randomly selected decision maker will chose one alternative over another (Crouch & Louviere 2000). Thus the probability that alternative *i* will be selected over any another alternative is equal to the probability that the utility gained from alternative *i*, U*i*, is greater or equal to the utility of choosing any other alternative in the complete set of all possible alternatives, M,

$$\text{Prob}(i/M) = \text{Prob}\ \{V_{in} + \varepsilon_{in} \geq V_{jn} + \varepsilon_{jn}\ ;\ \forall\ j \in M\ \} \qquad (3)$$

[10] These are that it is not only commonly assumed to be type l Gumbel distributed, but that it is also assumed to be independently and identically distributed (McFadden 1974).

Since the common assumptions for the ε term are known (McFadden 1974), the probability of choosing alternative *i* is equal to the ratio of observed utility index for alternative *i* to the sum of the observed utility indices for all alternatives. This closed-form specification of choice probabilities with the multinomial logit model is expressed below

$$\text{Prob}(i) = \frac{\exp^{\mu v i}}{\sum_{j \in M} \exp^{\mu v j}} \qquad (4)$$

Based on the earlier assumption that all random unobservable error components are independently distributed before the observable component of utility, V, can be expanded to a linear-in-parameters utility function (equation 4), the researcher must also accept the assumption of the independence of irrelevant alternatives (IIA). The IIA simply requires that all alternatives be independent of one another, so that the ratio of the probabilities of choosing one alternative over another is unaffected by the addition or deletion of alternatives (Carson *et al.* 1994; Louviere *et al.* 2000). Therefore β_0 (an intercept) is an alternative-specific constant which is not associated with any observed attribute, but represents all the unobserved utility. β_1 is the coefficient associated with the first attribute, X_1 is the level for the first attribute, and there are a total of k attributes.

$$V_{in} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k \qquad (5)$$

If the socio-economic variables are included (as in Equation 2), then γ_1 is the coefficient for the first socio-economic variable, C_1, and there are p socio-economic variables, thus Equation 5 expands to

$$V_{in} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k + \gamma_1 (C_1 \beta_0) + \ldots + \gamma_p (C_p \beta_0) \qquad (6)$$

For Multi Nomial Logit (MNL) models, the most common technique for estimating the coefficient for each attribute (β_1, β_2, etc) is the Maximum Likelihood Estimation (MLE) (Ben Akiva & Lerman 1985; Louviere *et al.* 2000). This technique involves determining the value of β_k that ensures that responses are most representative of all visitors (Train 1986). The MLE is thus used to find the parameter estimates that best explain the data.

The output of primary importance from MLE procedures are parameter estimates, associated standard errors and t-values, and measures of goodness of fit for the model as a whole. The parameter estimates represent the weight of each attribute in the utility function of a particular alternative (Louviere *et al.* 2000) (i.e. β_1 represents the weight (parameter) associated with the first attribute, X_1, in equation 5). Multiplying each parameter, β, by the level of the corresponding attribute, X, produces a Part Worth Utility (PWU), which is defined as the total utility associated with a given level of an attribute (Adamowicz *et al.* 1998a). Furthermore, by combining all PWU, the relative utility for a particular alternative can be determined using equation 5 (Louviere *et al.* 2000). The t-values associated with the parameter estimates indicate the statistical significance of each estimate. While a t-value above or below + or – 1.96 clearly indicates that the parameter estimate is significant at a 5% level, most modellers generally accept t-values as low as 10% (+ or – 1.6) (Louviere *et al.* 2000). Finally, the goodness of fit provides a likelihood-ratio index that measures the goodness of fit of the MNL model (rho square). If this statistic, once adjusted to account for the degrees of freedom used to estimate the model, is between 0.2 and 0.4, then the model is considered an extremely good fit (Louviere *et al.* 2000).

3.4 Development of Attribute List & Levels for the Ski Hill DCE

During the development of the attribute list, and their associated levels, different descriptive and ski hill management attributes were discussed and considered by the research team. This discussion was based on a literature review of past skier preference research, discussions with skiers, and the academic interests of the researchers involved. It was decided that the final DCE should contain thirteen ski hill attributes, consisting of two, three, or four levels. Of these thirteen attributes, eight were used to describe the ski hill itself, while the remaining five were used to describe management alternatives (Table 3.1). The attributes were then used to construct hypothetical ski hill profiles. Respondents were asked to select their preferred ski hill, or none, if neither was acceptable (Figure 3.3). The attributes and their levels were developed through an iterative process that involved extensive literature review, discussions with stakeholders in Whistler, and the academic interests of the researchers involved.

Table 3.1: Attributes and levels used in the discrete choice experiment

Attribute	Level
Distribution of ski runs	25% green, 45% blue, and 30% black 10% green, 50% blue, and 40% black
Number of terrain parks	Three parks Five parks
Gondola wait time (during peak use)	Under 15 minutes More than 15 minutes†
Significant night skiing opportunity	No† Yes
Environmental certification	No† Yes
Skiable terrain	2700 Ha 3000 Ha† 3300 Ha 3600 Ha
Number of days during peak season that the bottom half of mountain is closed	0 days 3 days† 9 days 27 days
On-slope restaurants	Four fewer Four more
On-slope snack bars	Three fewer Three more
Total area groomed daily	450 Ha 600 Ha 750 Ha† 900 Ha
Snowmaking capacity	160 Ha 190 Ha 230 Ha† 260 Ha
Backcountry access	Not Permitted† Permitted without a lift Permitted with a lift
Environmental surcharge	None† Additional 5% of lift ticket price Additional 10% of lift ticket price Additional 15% of lift ticket price

† The approximate current Whistler situation.

Figure 3.3: Ski hill profiles used in the choice set

		Ski Hill A	Ski Hill B
Ski Hill Description	Distribution of Ski Runs:	10% 50% 40%	10% 50% 40%
	Skiable Terrain:	2700Ha (10% less than Whistler Blackcomb)	3000Ha (Same as Whistler Blackcomb)
	Number of Terrain Parks:	3 terrain parks	3 terrain parks
	Wait Time at Gondola During Peak Use:	Under 15 minutes	Under 15 minutes
	Significant Night Skiing Opportunities:	Yes	Yes
	Days During Peak Season that Bottom Half of Mountain is Closed:	27 days	9 days
	On-Slope Restaurant Facilities: (compared to Whistler Blackcomb)	Restaurants: 4 more (25% more than W/B) Snack Bars: 3 fewer (60% less than W/B)	Restaurants: 4 more (25% more than W/B) Snack Bars: 3 more (60% more than W/B)
Ski Hill Management	Total Area Groomed Daily:	600 Ha (20% less than Whistler Blackcomb)	450 Ha (40% less than Whistler Blackcomb)
	Snowmaking Capacity:	230 Ha (Same as Whistler Blackcomb)	160 Ha (20% less than Whistler Blackcomb)
	Backcountry Access:	Not Permitted	Not Permitted
	Environmental Certification:	No	No
	Environmental Surcharge:	Additional 10% of Lift Ticket Price	None

Which of the following options would you choose for a day on the slopes? Check one.

☐ Ski Hill A ☐ Ski Hill B

☐ Neither ski hill is acceptable

3.4.1 Design Plan

Different levels of the thirteen attributes in Table 3.1 were combined to generate the hypothetical ski hills. To ensure that the influence of each attribute on individual's hill choice could be estimated independently, unique profiles were devised following an orthogonal[11] (independent) fractional factorial design plan, which required a total of 64 choice sets, consisting of 128 profiles. In each choice set, respondents were asked to choose their favoured profile, or neither if both were unacceptable. These choice sets were blocked into sixteen versions, each containing four choice sets. Each respondent was presented with four randomly selected choice sets, one after the other, and asked to select their preferred ski hill.

3.5 Programming, Pre-testing & Delivery of the Web Based Survey

3.5.1 Programming

With the pre-testing recently done for the successfully launched summer web-based survey, it was felt that the winter survey should be conducted in a similar fashion (Englund 2005). This included such decisions as not using Java script, the use of auto fit page widths, and choice of screen resolution. After completion of the programming stage, peers, colleagues, and friends of those associated with the survey tested it during the first week of July of 2005. All recipients were asked to complete the entire survey and provide thoughts, comments or criticisms. Once the issues raised by these evaluators were taken into account, such as the need for additional clarity with regards to certain questions, and

[11] Orthogonal design is an experimental design in which attribute levels across alternatives are uncorrelated thereby providing unconfounded measures of part-worth utility or attribute parameters (Adamowicz *et al.* 1998a).

the necessary modifications were made, the design plans for the discrete choice surveys were finalized and linked to the web survey.

3.5.2 Delivery of the Web Survey

Through Microsoft Mail Merge, the web-based survey was delivered via email to the 1,643 intercept survey respondents. These emails were sent in two batches, on the 16th and 17th of August, 2005. A cover letter introducing the survey (Appendix 2) was personally addressed to each respondent and referred to the month of their visit to Whistler. The cover letter also contained a link to the survey. To enable the matching of respondents with their intercept data, and to allow respondents to leave the site and return at a later date, each recruited respondent was assigned a login ID and password. These login IDs and passwords were embedded directly into the link that was emailed to respondents (e.g., http://www.whistlerstudy.rem.sfu.ca/?SS=yes&pw=«Password»&di=«LoginID»). Thus, upon entering the survey the respondent was automatically logged onto the website and matched with the appropriate record in the database.

After 23 days, a reminder email containing a modified cover letter (Appendix 3) was sent to the first half of the recruited respondents who had not yet proceeded past the introductory webpage. After 37 days this reminder email was sent to the second half of the recruited respondents. This process was repeated for both groups of non-respondents after 41 and 60 days, and 47 and 72 days, respectively. These reminder emails resulted in distinct increase in response rate for a few days immediately following each delivery. Overall 345 (21%) of the emails were undeliverable. Although the exact reason for this is unknown, two possibilities are that spam filters blocked some emails, while other email

addresses may have become obsolete during the three to six month lag time between respondent recruitment and delivery of the web-based survey.

3.6 Data Analysis

While most of the analysis was performed using SPSS, the basic MNL model, upon which much of the discussion in this paper is based, was undertaken in Latent Gold Choice 3.0.6 (Vermund and Magidson 2003). All of the continuous attributes were coded using both linear and quadratic codes. Once the model was run, insignificant estimates were removed, and the model was rerun. All of the categorical attributes were coded using effects coding[12] to allow comparison of the different attributes.

3.6.1 A Priori Segmentation

Segmentation of the population into groupings according to certain characteristics is a simple and effective way to investigate for heterogeneity in preferences within a single sample. It also enables the analysts to gain a better understanding of the differences in response behaviour among certain groups. Demographic characteristics are often cited as a main source of heterogeneity and the reason for differences in respondent's choice behaviour (Barro & Romer 1987; Gupta & Chintagunta 1994; Swait 1994; Cameron & Englin 1997; Gibson 2004; Siomkos *et al.* 2005). However, some theory suggests that other characteristics, such as perceptions, past experiences, and attitudes of individuals may also be of importance (Boxall & Adamowicz 2002).

In order to test for heterogeneity, and to gain a better understanding of skier preferences, the sample was segmented by many demographic and attitudinal variables,

[12] Effects coding shows the differences between all attribute levels, while dummy coding shows the difference of one attribute level to all other attribute levels.

and separate models were estimated for each segment. The estimates derived from each model were then compared using the t test in equation 7, to determine if they were statistically significant:

$$t = \frac{\beta_1 - \beta_2}{\sqrt{(SE_1)^2 + (SE_2)^2}} \quad (7)$$

In this model β_1 and β_2 are the parameter estimates for the same attribute for the two different segments, and SE_1 and SE_2 are the standard error terms associated with the respective parameter estimates. A t-statistic of 1.96 or greater indicates that the parameter estimates for the two segments are significantly different at $p<0.05$ (Ben Akiva & Lerman 1985).

Despite the expectation that skier preferences would vary depending upon several respondent characteristics (such as age, sex, income, number of visits, number of ski days, travel motivations and attitudinal questions), most segmentation outcomes showed little variance. Therefore, the only segmentations that have been incorporated into this study are the estimates for day versus overnight skiers[13], local versus out of province skiers[14].

3.6.2 Latent Class Modelling

Knowledge of the differences or similarities in preferences of diverse groups within the overall sample can be informative for ski hill managers. However, while winter destination literature may provide insight into possible sources of heterogeneity, as long as groups are defined a priori by researchers it is likely that not all sources of

[13] Skiers who spent at least one night in Whistler were classed as overnight skiers, while those who didn't were classed as day skiers.
[14] Skiers who live in British Columbia were classed as local skiers, while those who didn't were classed as out of province skiers.

heterogeneity will be observed. One way of overcoming this problem is to use attribute data as well as individual's characteristics and attitudinal data[15] to simultaneously explain choice behaviour through the use of latent class modelling.

At the core of the latent class modelling is the assumption that there are groups of people within the data set with similar tastes or utility functions. Specifically, it is assumed that skiers can be divided into *S* unobservable segments. Within each segment skiers are similar to each other in their own characteristics and their responses when they evaluate ski hills, while skiers across segments are different from each other. By endogenously assigning individuals to classes with most similar preferences and estimating the probability of membership to each class, along with their respective preference weights, researchers can identify and characterize various preference groups[16]. Latent class methods involve characterizing segments from a set of discrete observed measures such as attitudinal scales or socio-economic characteristics. The standard latent class model for nominal and ordinal categorical variables is as follows

$$f(y_i) = \sum_{x=1}^{K} P(x) \prod_{t=1}^{T} f(y_{it} / x) \qquad (8)$$

In this model, *i* is the number of cases, y_i is the entire set of responses, *T* is the number of indicators, *t* is the indicator index, *x* is the latent variable, and *K* is the number of latent classes (Vermunt & Magidson 2005). An important extension of the standard latent class model described above (equation 8) comes through the inclusion of exogenous variables,

[15] While attitudinal questions are often viewed as simply a 'warm-up' exercise, this data can provide significant information about the existence and composition of different preference groups.
[16] However, latent class does not forcibly create subgroups. If no subgroups exist (i.e. there are no latent variables), the best-fit model will be a one-cluster model. If, however, there are subgroups within the dataset, multiple-cluster models will better fit the data.

such as covariates (McCutcheon 1988; Van der Heijden *et al.* 1996; Vermunt 1997). Covariates vary between cases and can be included to predict class membership. In other words, covariates affect the latent variable (the clusters) but have no direct effect on the indicators. Inclusion of covariates to predict class membership is straightforward within the general framework of the model defined in equation (8)

$$f(y_i / z_i^{\text{cov}}) = \sum_{x=1}^{K} P(x / z_i^{\text{cov}}) \prod_{t=1}^{T} f(y_{it} / x) \qquad (9)$$

In this model z_i^{cov} represents the covariates (exogenous variable). Due to these advantages, latent class analysis, with the inclusion of significant covariates, was used to simultaneously assess the influence of individual characteristics, motivational aspects, and the influences of ski hill attributes in the estimation of latent segments. However, because there are no hard and fast rules for selecting the number of segmentations, as the model fit is 'penalized' as these increase, statistical criteria were established to determine the most appropriate number. Following Kamakura and Russell (1989), Gupta and Chintagupta (1994), Swait (1994), and Boxall and Adamowicz (2002), two criteria were chosen to determine the number of segments: the minimum Akaike Information Criterion (AIC), and the minimum Bayesian Information Criterion (BIC). The AIC, which measures the goodness of fit of an estimated statistical model, is an operational way of trading off the complexity of an estimated model against how well the model fits the data. The BIC is a statistical information criterion that also measures goodness of fit. However, the BIC penalizes free parameters more strongly than the AIC.

3.7 Computerized Decision Support Systems

To create the computerized ski hill Decision Support Tool (DST) in Microsoft Excel®[17] the Part-Worth Utility (PWU) estimates for the latent class model (Table 4.12) and day visitors (Table 4.8) were used. This DST allows the user to compare overall preference for two different ski hills by adjusting the levels of each design and management attribute for both scenarios. For the categorical attributes, such as ski run distribution and gondola wait time, the user must select one of the levels used in the DCE. For all linear and quadratic coded attributes, such as groomed area and skiable terrain, the user can select any value between the minimum and maximum values used in the DCE. Whenever users select a new attribute level, the DST calculates the probability that skiers will choose either ski hill A, B or neither by utilizing equation 4. This probability, which essentially represents a market share, or level of support, for each ski hill, is then displayed in a text box below each ski hill. Therefore, the DST is an easy to use and practical tool for ski hill managers to predict the likely level of support for proposed changes, such as environmentally sustainable initiatives.

In this Chapter, the methodology of discrete choice and latent class experiments have been explained along with details of how these methods were applied to this project. Physical characteristics of ski hills, such as skiable terrain, gondola wait times, number of on-slope restaurants and snack bars, groomed area and environmental certification were converted into design and management attributes, and respondents to the web-based survey evaluated these. The following chapter presents and summarizes the results of survey, discrete choice experiments and DST applications.

[17] Microsoft, Encarta, MSN and Windows are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

CHAPTER 4: RESULTS & ANALYSIS

This Chapter presents the results of the web-based survey and the DCE in detail. It begins with a summary of the demographic, trip characteristic, motivational and attitudinal results of the respondents. The results of the DCEs are presented next. These are the full MNL model, the a priori segmentations by length of stay and place of residence, and a latent class segmentation. As described in Chapter 3, the DCE consisted of ski hill design and management attributes. The final section contains an example application of a ski hill Decision Support Tool (DST).

4.1 Visitor Characteristics

4.1.1 Demographics

The following section presents the results (Table 4.1) of the demographic questions for both the intercept and web-based surveys. Two-fifths (39%) of skiers lived in Canada, with two-thirds (69%) of these residing in British Columbia. Of the remaining skiers, one-quarter (23%) lived in the USA, one-quarter (22%) in the UK and one-sixth elsewhere. Of the Canadian skiers living outside of British Columbia, the majority (63%) came from Ontario. The most common state of residence for US skiers was Washington (23%). Two-thirds (67%) of all skiers were male, while over half (56%) of all skiers were between the ages of twenty six and forty five. About one-quarter (27%) were over the age of forty six. Most skiers were highly educated, with three-quarters (73%) attaining at least a university education. Furthermore, most skiers lived in households with high annual

incomes. About one-third (32%) earned between $50,000 and $100,000 per year, and half (48%) more than $100,000.

The demographic profile of overnight and day skiers in terms of gender, education, and, to a slightly lesser degree, age, were similar. Place of residence and household income, however, were statistically different. A much lower proportion of overnight (34%) than day skiers (77%) lived in Canada, while a much higher proportion of overnight (53%) than day skiers (17%) had annual household incomes above $100,000.

Table 4.1: Demographic profile of skiers[†]

	Total Sample		Overnight Skiers		Day Skiers		Chi square (p-value)
	Freq.	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**	
Place of Residence							
Canada	156	38.6 %	118	33.8 %	37	77.1 %	34.196 (0.000)
British Columbia	*107*	*68.6 %*	*74*	*62.7 %*	*32*	*86.5 %*	
USA	92	22.7 %	90	25.8 %	2	4.2 %	
UK	90	22.2 %	88	25.2 %	2	4.2 %	
Other International	67	16.5 %	53	15.2 %	7	14.5 %	
Gender							
Male	269	66.6 %	230	65.9 %	36	75.0 %	1.580 (0.209)
Female	135	33.4 %	119	34.1 %	12	25.0 %	
Age							
Under 25 Years	70	17.3 %	53	15.1 %	14	29.2 %	10.318 (0.067)
26 - 35 Years	124	30.7 %	107	30.6 %	15	31.2 %	
36 - 45 Years	101	24.9 %	90	25.7 %	10	20.8 %	
46 - 55 Years	82	20.2 %	76	21.7 %	6	12.5 %	
56 Years +	28	6.9 %	24	6.9 %	3	6.3 %	

[†] Due to missing data total sample sizes differs for each characteristic.

Table 4.1: Demographic profile of skiers (continued)[†]

	Total Sample		Overnight Skiers		Day Skiers		Chi square (p-value)
	Freq.	Percent	Freq.	Percent	Freq.	Percent	
Education							
Elementary school	3	0.7 %	3	0.8 %	0	0 %	1.669 (0.796)
High school	40	9.9 %	37	10.6 %	3	6.3 %	
Technical college	66	16.3 %	57	16.3 %	8	16.7 %	
Uni undergraduate	155	38.3 %	131	37.4 %	21	43.7 %	
Uni postgraduate	141	34.8 %	122	34.9 %	16	33.3 %	
Income (before taxes C$)							
Under $24,999	35	8.9 %	27	7.9 %	6	13.0 %	22.176 (0.001)
$25k–$49,999	45	11.5 %	34	10.0 %	8	17.4 %	
$50k–$74,999	72	18.3 %	55	16.2 %	16	34.8 %	
$75k–$99,999	52	13.2 %	44	12.9 %	8	17.4 %	
$100k–$149,999	92	23.4 %	89	26.2 %	3	6.5 %	
$150k–$199,999	40	10.2 %	38	11.2 %	2	4.3 %	
Over $200k	57	14.5 %	53	15.6 %	3	6.6 %	

[†] Due to missing data total sample sizes differ for each characteristic.

4.2 Trip Characteristics

The intercept survey asked skiers various questions about their past trip (Table 4.2). Almost two-thirds (62%) of all skiers had previously visited Whistler, and the vast majority (96%) of visits were for leisure purposes. Over three-fifths (61%) of all skiers travelled with friends, family or colleagues. Two-thirds (43%) travelled with a spouse or equivalent. No travel party size was more prominent than another. Groups of one-two (32%), three-four (35%), and five plus (31%) skiers each accounted for one-third of all skier groups. Three-quarters (71%) of all overnight skiers stayed for seven nights or less. Four-fifths (80%) stayed in some form of paid accommodation. Three-fifths (64%) of this accommodation was located in Whistler Village or Whistler North.

The results regarding frequency and purpose of visit, travel party composition and travel party size revealed differences between overnight and day skiers. A much lower proportion of overnight (58%) than day skiers (92%) had previously visited Whistler. Fewer overnight (4%) than day skiers (11%) were visiting for business purposes. Conversely, more overnight (45%) than day skiers (29%) travelled with a spouse or equivalent. More overnight (57%) than day skiers (35%) travelled in groups of four or more people. Despite these differences, only frequency of visit and purpose of visit were statistically significant.

Table 4.2: Trip characteristics[†]

	Total Sample		Overnight Skiers		Day Skiers		Chi square (p-value)
	Freq.	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**	
Frequency of Visit							
First visit	149	37.8 %	144	41.9 %	4	8.3 %	**20.148 (0.000)**
Second visit +	245	62.2 %	200	58.1 %	44	91.7 %	
Purpose of Visit							
Business	18	4.5 %	13	3.7 %	5	10.6 %	4.563 (0.033)
Leisure	380	95.5 %	336	96.3 %	42	89.4 %	
Travel Party Composition[††]							
Alone	32	7.9 %	22	6.3 %	6	12.5 %	6.909 (0.141)
With spouse or equivalent	173	42.7 %	157	44.9 %	14	29.2 %	
With dependents	75	18.5 %	70	20.0 %	5	10.4 %	
With friends, family or colleges	247	61.0 %	212	60.6 %	33	68,8 %	
With only family	*64*	*12.9%*	*61*	*13.9%*	*3*	*5.8 %*	
With tour group	10	2.5 %	10	2.9 %	0	0 %	

[†] Due to missing data sample sizes differ for each characteristic.
[††] The sum of column percentages is greater than 100% because respondents could select more than one.

Table 4.2: Trip characteristics (continued)†

	Total Sample		Overnight Skiers		Day Skiers		Chi square (p-value)
	Freq.	Percent	Freq.	Percent	Freq.	Percent	
Travel Party Size							
One	27	6.8 %	18	5.2 %	5	10.4 %	10.592 (0.060)
Two	99	24.9 %	83	24.2 %	14	29.2 %	
Three	60	15.1 %	48	14.0 %	12	25.0 %	
Four	80	20.1 %	71	20.8 %	9	18.8 %	
Five	36	9.0 %	33	9.6 %	3	6.3 %	
Six or more	96	24.1 %	90	26.2 %	5	10.3 %	
Number of Nights							
One	---	---	30	8.6 %	---	---	
Two	---	---	42	12.0 %	---	---	
Three	---	---	38	10.9 %	---	---	
Four	---	---	25	7.2 %	---	---	
Five	---	---	29	8.3 %	---	---	
Six	---	---	23	6.6 %	---	---	
Seven	---	---	59	16.9 %	---	---	
Eight +	---	---	103	29.5 %	---	---	
Accommodation Type							
Paid accommodation	---	---	279	79.9 %	---	---	
Hotel, condo, or chalet	---	---	243	87.1 %	---	---	
Timeshare	---	---	19	6.8 %	---	---	
B&B or pension	---	---	2	0.7 %	---	---	
Hostel or club cabin	---	---	15	5.4 %	---	---	
Home of friends or family	---	---	45	12.9 %	---	---	
Second home	---	---	19	5.5 %	---	---	
Other	---	---	6	1.7 %	---	---	
Accommodation Location							
Whistler Village / Village North	---	---	219	63.5 %	---	---	
Within 2km of Whistler Village	---	---	61	17.7 %	---	---	
2km+ from Whistler Village	---	---	65	18.8 %	---	---	

† Due to missing data sample sizes differ for each characteristic.

4.3 Travel Motivations

To understand what motivated travel to Whistler, skiers were asked to rate the importance of sixteen motivational items on a scale ranging from 1, representing "not at all important", to 5, representing "very important" (Table 4.3). Overall, scores were high, with most items being rated by skiers as at least 'somewhat important' (mean >3). Of interest is that two of the five most important items for all skiers segments were "experiencing and seeing a mountain area" (mean = 4.1) and "visiting a place that takes good care of its environment" (mean = 4.0)[18]. These results corroborate previous research that one of the driving forces behind the desire to ski is to experience the natural beauty of mountains (Culbertson *et al.* 1991; Williams and Dossa 1994; Fry 1995).

Between overnight and day skiers, the motivations were significantly different for three motivational items, all of which overnight skiers rated more highly than day skiers. These were "visiting a place with unique and interesting restaurants", "having opportunities to shop" and "indulging in luxury, staying at first class hotels".

[18] Mean scores of four or above indicate that, on average, skiers found these statements to be important.

Table 4.3: Travel motivations[†]

	Total Sample	Overnight Skiers	Day Skiers	T-value	Sig. Level
	Mean[††]	Mean[††]	Mean[††]		
Getting value for the cost of the trip	4.4	4.4	4.3	0.185	.854
Being physically active	4.3	4.3	4.3	0.481	.632
Experiencing and seeing a mountain area	4.1	4.2	4.1	0.352	.726
Participating in outdoor activities	4.0	4.0	4.1	-0.543	.589
Visiting a place that takes good care of its environment	4.0	4.0	3.9	0.127	.899
Resting and relaxing	3.9	3.9	3.8	0.787	.434
Learning new things, increasing my knowledge	3.5	3.4	3.5	-0.462	.646
Visiting a place with unique and interesting restaurants	3.5	3.5	3.0	3.032	**.004**
Visiting wilderness and undisturbed areas	3.2	3.2	3.2	-0.171	.865
Enjoying nightlife and entertainment	3.2	3.2	2.9	1.652	.104
Viewing wildlife and birds	3.1	3.0	3.1	-0.380	.705
Having opportunities to shop	3.0	3.1	2.4	3.746	**.000**
Going to a place that is family orientated	2.9	3.0	2.7	1.392	.169
Enjoying cultural or historic sites/attractions	2.8	2.8	2.8	-0.095	.925
Attending a festival or event	2.6	2.6	2.7	-0.612	.543
Indulging in luxury, staying in first class hotels	2.3	2.4	1.9	2.499	**.015**

[†] Due to missing data total sample sizes differ for each characteristic.

[††] Scale of 1 to 5, with 1 being the least important and 5 being the most important.

4.4 Environmental Influences

To understand the impact that environmentally sustainable management strategies might have on destination choice and reputation, skiers were asked to rate the importance of fifteen factors (eight for destination choice and seven for environmental reputation) on a scale of 1 to 5, with 1 indicating "not at all important" and 5 indicating "very important" (Table 4.4). Again scores were generally high, with all factors being rated by skiers as at

least 'somewhat important' (mean >3). The most important factors with regards to destination choice were public transit access (mean = 3.9), on-site energy efficient buildings (mean = 3.8), wildlife (mean = 3.8) and vegetation (mean = 3.7) sensitive ski trail maintenance systems. The most important factors regarding environmental reputation were minimizing the environmental effects of transportation (mean = 3.9), mitigating (mean = 3.8) and minimizing (mean = 3.8) the effects of ski run construction on vegetation, and minimizing energy and water consumption for snowmaking (mean = 3.7) and food services on the mountain (mean = 3.7)[19]. These results collaborate with previous research (TIAA 1992; Hudson 2000a; Mihalic 2000; Proebstl 2006) and indicate not only that skiers are more interested in visiting ski resorts that implement environmentally sustainable management strategies, but also that these strategies can heavily influence a ski resort's reputation.

While the results for ski resort choice and environmental reputation vary slightly between overnight and day skiers, all factors for both groups are still considered important (mean >3), and these differences are not statistically different. This homogeneity is surprising and contradicts previous research by Riddington *et al.* (2000) who found that the day and overnight skier preferences were very distinct.

[19] Mean scores between three and four indicate that on average, skiers found these factors to be somewhat important.

Table 4.4: Environmental influences[†]

	Total Sample	Overnight Skiers	Day Skiers	T-value	Sig. Level
	Mean[††]	Mean[††]	Mean[††]		
Important Factors in Destination Choice					
Public transit access to the destination	3.9	3.9	3.8	0.462	.646
On-site energy efficient buildings	3.8	3.8	3.9	-0.809	.422
Wildlife sensitive ski trail maintenance system	3.8	3.8	3.7	0.832	.409
Vegetation sensitive ski trail maintenance Systems	3.7	3.7	3.7	0.076	.946
On-site solid waste recycling systems	3.5	3.5	3.8	-1.661	.102
On-site water conservation systems	3.3	3.3	3.4	-1.093	.279
Low-density visitor accommodation facilities	3.3	3.3	3.0	1.308	.196
Pre-trip info on destinations environmental Initiatives	3.1	3.2	3.0	0.577	.566
Important Factors in Environmental Reputation					
Minimize environmental effects of transportation to and from the ski hill	3.9	3.9	4.1	-1.417	.162
Mitigating effects of ski run construction on Vegetation	3.8	3.8	3.7	0.890	.377
Minimizing environmental effects of ski run Construction	3.8	3.8	3.8	-0.173	.863
Minimize energy and water consumption for snowmaking	3.7	3.7	3.8	-0.875	.385
Min energy & water consumption of food Services on mountain	3.7	3.7	3.6	0.379	.706
Minimizing energy consumption for lifts	3.6	3.6	3.7	-0.139	.890
Reduce energy consumption by not providing night skiing	3.2	3.3	3.0	1.937	.058

[†] Due to missing data total sample sizes differ for each characteristic.

[††] Scale of 1 to 5, with 1 being the least important and 5 being the most important.

4.5 Multinomial Logit Model

4.5.1 Full Model

Thirteen attributes were used to describe hypothetical ski hills. Table 4.5 and Figures 4.1 and 4.2 display these attributes in two sections: those related to ski hill design (the first eight attributes); and those related to ski hill management (the last five attributes). The last row of the table shows the diagnostic statistics for the model. The intercept indicates if respondents were more likely to choose a skiing alternative over selecting not to ski. All categorical attributes were coded using effects coding and all continuous attributes using linear and quadratic codes. Any quadratic terms that were not significant at the 10% level were removed and the model was rerun. Overall, the majority of attributes were significant (nine of the thirteen). However, a smaller proportion of design (five of the eight) than management attributes (four of the five) were significant. All attribute signs seem intuitively correct, and most attributes were deemed to be relatively important by skiers (as indicated by the magnitude of the coefficients). On average the design attributes were generally deemed to have a smaller impact on skier experience than the management attributes (as indicated by smaller coefficients).

Concerning the ski hill itself, skiers demonstrated a statistically significant preference for greater amounts of skiable terrain, shorter gondola wait times, limited night skiing, fewer number of days during which the bottom half of the mountain was closed, and more on-slope restaurants. These findings are consistent with previous research concerning skier preferences for more skiable terrain (Walsh *et al.* 1983; Morey 1981; 84; Williams & Dossa 1994; Ormiston *et al.* 1998; Perdue 2002; Mulligan 2006) and shorter gondola wait times (Greig 1983; Walsh *et al.* 1983; Williams & Dossa 1994; Orminston

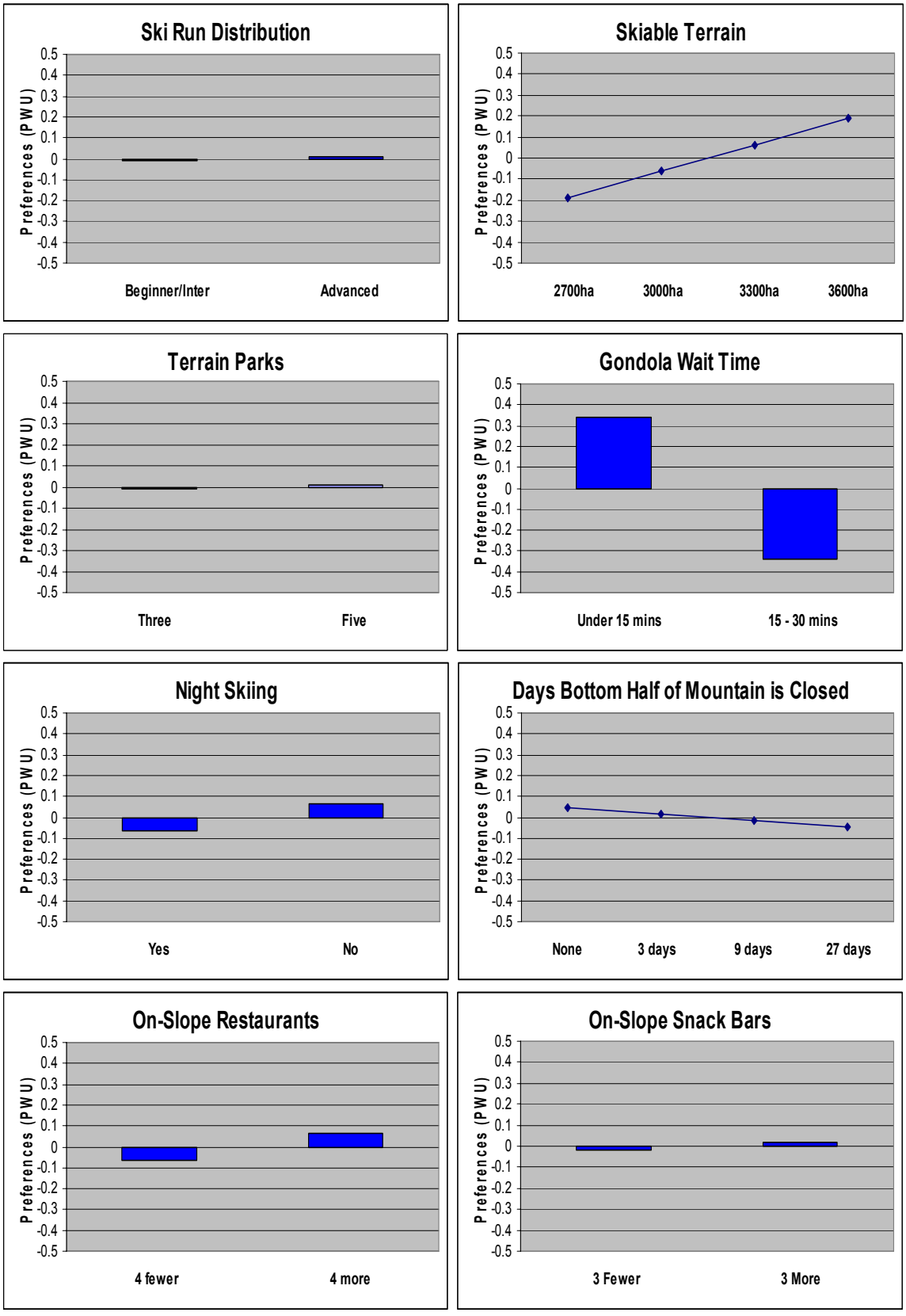
et al. 1998; Perdue 2002; Mulligan 2006). Preferences for the remaining ski hill design attributes were also predictable, although not statistically significant. While the overall sample was indifferent to ski run distribution and number of terrain parks, they showed a slightly stronger preference for a greater number of on-slope snack bars.

Table 4.5: **Parameter estimates and model fit for the full and restricted DCE (n = 405)**

Attributes		Full Model		Restricted Model	
		Coeff.	**Std. Err**	**Coeff.**	**Std. Err**
Ski Hill Design					
Ski run distribution	Beginner/Inter	-0.010	0.039	-0.009	0.039
	Advanced	0.010	0.039	0.009	0.039
Skiable terrain	Liner term	0.126***	0.031	0.127***	0.031
	Quadratic term	-0.003	0.034	N.E	N.E
Terrain parks	Three	-0.002	0.039	-0.002	0.039
	Five	0.002	0.039	0.002	0.039
Gondola wait time	Under 15 mins	0.341***	0.039	0.341***	0.039
	15-30 mins	-0.341***	0.039	-0.341***	0.039
Significant night skiing	No	0.067*	0.039	0.067*	0.039
	Yes	-0.067*	0.039	-0.067*	0.039
Days bottom ½ of mountain closed	Linear term	-0.033***	0.006	-0.029***	0.004
	Quadratic term	0.042	0.057	N.E	N.E
On-slope restaurants	Four fewer	-0.062*	0.038	-0.062*	0.038
	Four more	0.062*	0.038	0.062*	0.038
On-slope snack bars	Three fewer	-0.017	0.040	-0.017	0.040
	Three more	0.017	0.040	0.017	0.040
Ski Hill Management					
Groomed area	Linear term	0.125***	0.035	0.125***	0.035
	Quadratic term	-0.086**	0.038	-0.086**	0.038
Snowmaking	Linear term	0.023	0.034	0.023	0.034
	Quadratic term	-0.007	0.038	N.E	N.E
Backcountry access	No	-0.232***	0.052	-0.233***	0.052
	Yes (no lift)	0.195***	0.060	0.195***	0.060
	Yes (lift)	0.037	0.059	-0.038	0.058
Environmental certification	No	-0.227***	0.038	-0.226***	0.038
	Yes	0.227***	0.038	0.226***	0.038
Environmental surcharge	Linear term	-0.333***	0.036	-0.332***	0.036
	Quadratic term	-0.024	0.038	N.E	N.E
Intercept	Neither ski hill	-0.466***		-0.466***	
	Ski hill A or B	0.466***		0.466***	
R2		0.1141		0.1135	
R2(0)		0.1691		0.1685	
L2		2960.4		2961.7	
AIC		3056.1		3055.2	
BIC		3140.2		3139.7	

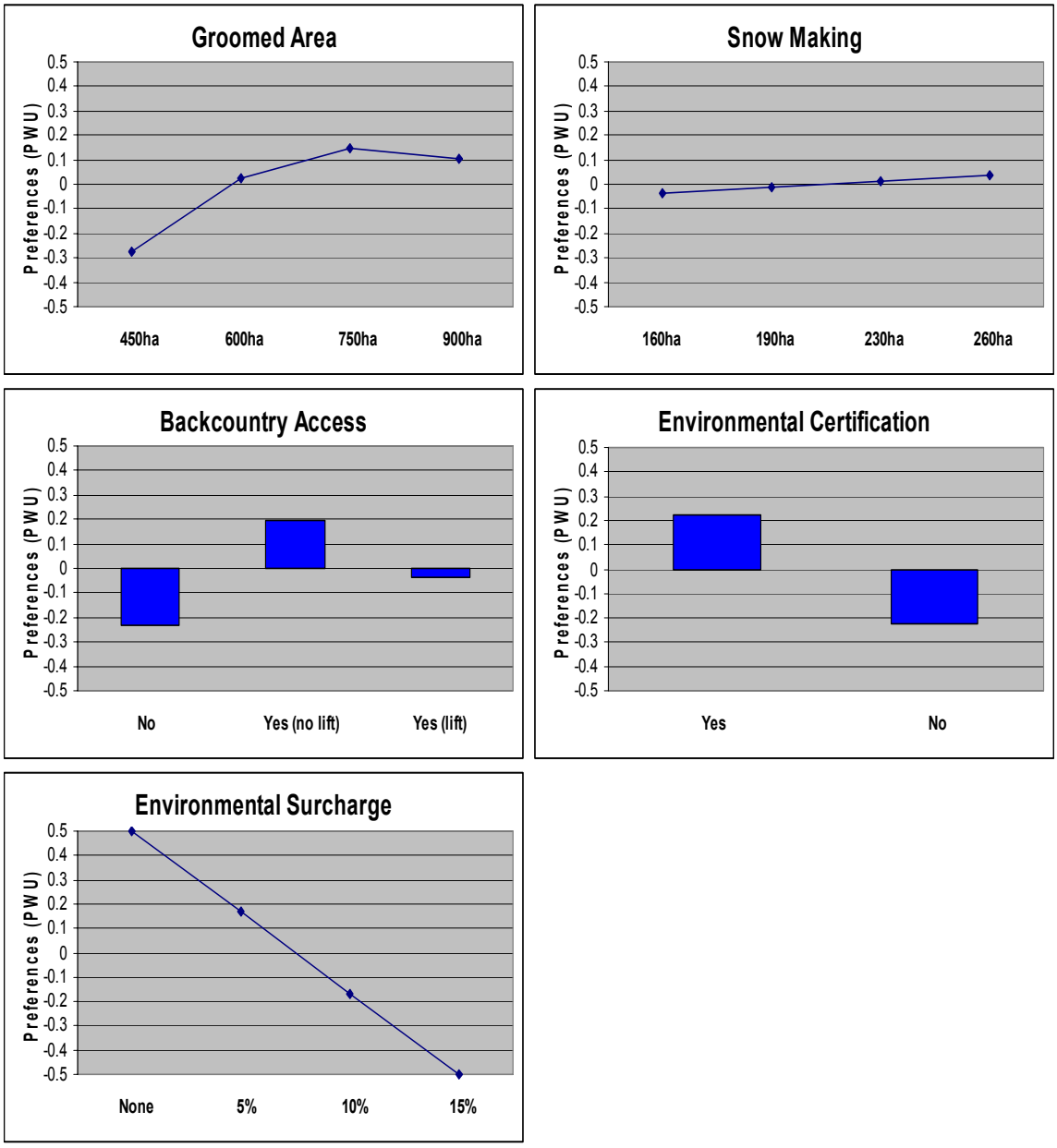
NE = not estimated * $0.10 > p \geq 0.05$ ** $0.05 > p \geq 0.01$ *** $p < 0.01$

Figure 4.1: Part worth utilities (PWU) for ski hill design attributes



Four of the five ski hill management attributes were statistically significant (Table 4.5; Figure 4.2). As with skiable terrain, skiers demonstrated a preference for greater amounts of groomed area. Again, this finding is consistent with previous research concerning skier's preference for greater amounts of groomed area (Echelberger *et al.* 1970; Ormiston *et al.* 1998). However, preference levelled off as the amount of groomed area approached 750ha, and actually fell as it approached 900ha. Skiers also showed a preference for backcountry access without a lift. In regards to environmentally sustainable management strategies, skiers clearly preferred environmentally certified ski hills. Furthermore, skiers considered a 0% and 5% environmental surcharge to be acceptable, but higher than 5% to be undesirable. These findings lend support to previous research regarding skier's environmental consciousness (Hudson 2000a; Jesitus 2000; Mihalic 2000; The Colorado Department of Public Health and Environment & Tetra Tech 2002; NSAA 2003), and highlight the fact that environmentally sustainable initiatives have a strong influence on skier experience, and thus ski hill choice. The only management attribute that was not statistically significant was snowmaking capacity.

Figure 4.2: Part worth utilities (PWU) for ski hill management attributes



4.5.2 A Priori Segmentation

Understanding preferences of the entire sample provides only partial insights for ski hill managers. What is more revealing is to investigate the preferences of specific segments of the sample, especially when the sample contains diverse groups. The

segmentations below examines for differences in preferences between day and overnight skiers (Table 4.6; Figure 4.3), and local and non-local skiers (Table 4.7; Figure 4.4). Although these segmentations were expected to highlight several differences, few were significant.

4.5.2.1 Day vs. Overnight Skiers

As with the previous table and figures, Table 4.6 and Figures 4.3 and 4.4 have been organized into two sections. In addition, the t-values in the right most column indicate if preferences were different between the two skier groups and if these differences were significant. The intercept shows that although both groups were more likely to choose a hypothetical ski hill than selecting not to ski, overnight skiers were more likely to choose a skiing alternative than day skiers, and thus are more likely to visit a ski hill. However, this difference is not statistically significant. All attribute signs for both skier groups seem to be intuitively correct, and almost all attributes were deemed relatively important by both groups (as indicated by the relative magnitude of the coefficients for each skier group).

Concerning the ski hill design attributes, overnight and day skiers had similar preferences for ski run distribution, skiable terrain, gondola wait times, night skiing opportunities, and number of on-slope restaurants. Overnight and day skier preferences were different for the number of terrain parks, on-slope snack bars and number of days during which the bottom half of the mountain was closed (overnight skiers preferred less days, while day skiers preferred none then 9 and 27 days). Although the pattern of signs for these variables differed between the two segments, in the end the only statistically

significant differences were for the number of on-slope snack bars and number of days during which the bottom half of the mountain was closed.

For the ski hill management attributes, overnight and day skiers had similar preferences for snowmaking capacity, environmental certification and environmental surcharge. Overnight and day skier preferences were different for groomed area (overnight skier preferences fell once groomed area reached 750ha, while day skier preferences were highest for 900ha) and backcountry access (overnight skiers preferred access without a lift, while day skiers preferred access with a lift). Despite this contrariety, no differences were significantly significant.

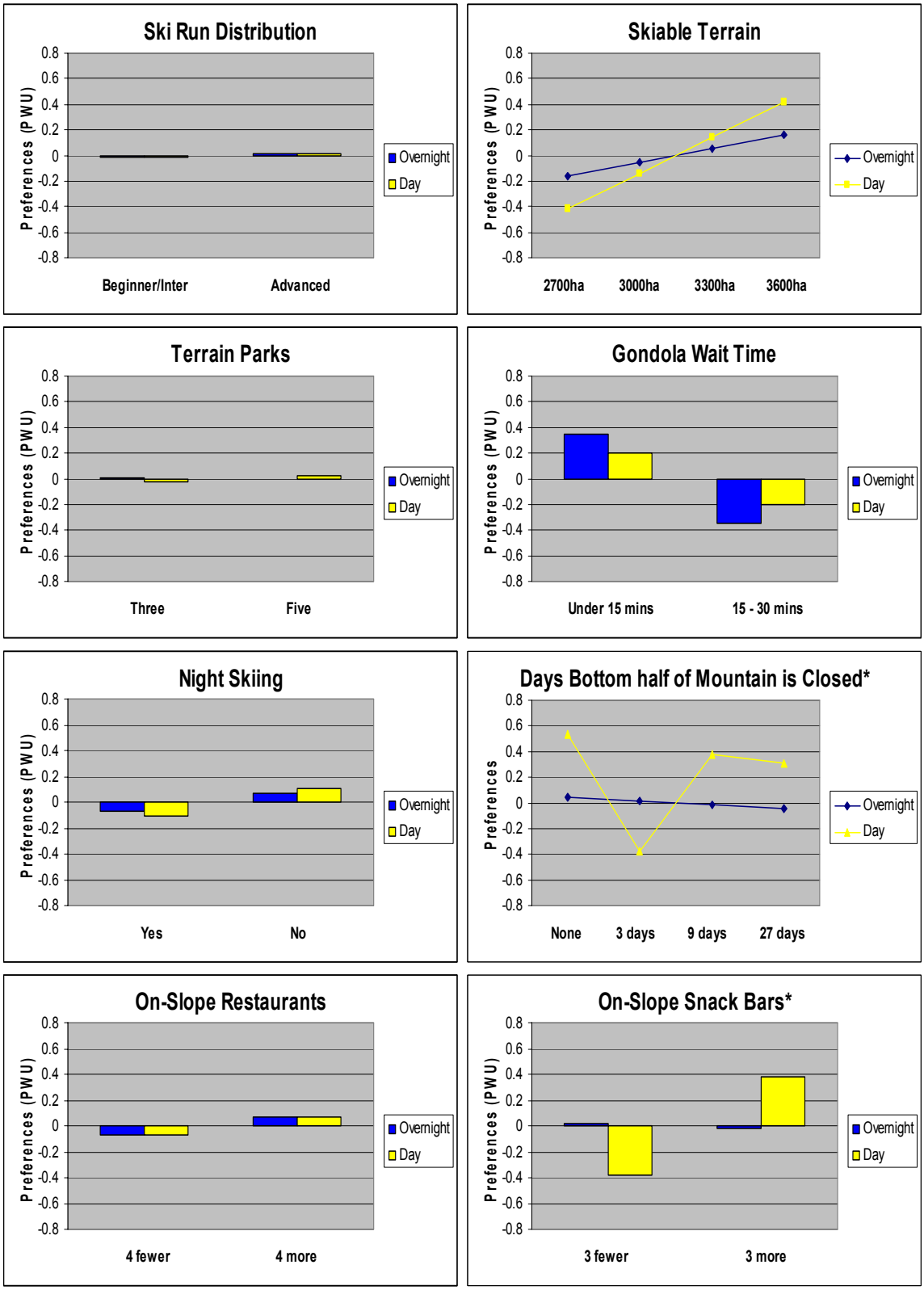
Overall, this segmentation shows that despite differences in preferences for a few ski hill attributes, overnight and day skier preferences are generally similar. While this is perhaps a little surprising and in contradiction to previous research by Riddington *et al.* (2000), who found that in Scotland day and overnight skier preferences were very distinct, it is in keeping with the results from Table 4.4, where both overnight and day visitor preferences were homogenous. The segmentation also shows that certain environmentally sustainable management initiatives, such as environmental certification, is popular with both skier groups, while other initiatives, such as a 5% environmental surcharge, is seen as acceptable by both skier groups.

Table 4.6: Segmentation for overnight (n=350) and day (n=48) skiers

Attributes		Overnight Skiers		Day Skiers		Differ-Ence
		Coeff.	Std. Err	Coeff.	Std. Err	
Ski Hill Design						
Ski run Distribution	Beginner/Inter	-0.012	0.042	-0.015	0.120	0.026
	Advanced	0.012	0.042	0.015	0.120	-0.026
Skiable terrain	Liner term	0.110***	0.033	0.279***	0.100	-1.608
Terrain parks	Three	0.005	0.042	-0.024	0.117	0.230
	Five	-0.005	0.042	0.024	0.117	-0.230
Gondola wait time	Under 15 mins	0.349***	0.042	0.206*	0.120	1.128
	15-30 mins	-0.349***	0.042	-0.206*	0.120	-1.128
Significant night skiing	No	0.067	0.042	0.109	0.121	-0.332
	Yes	-0.067	0.042	-0.109	0.121	0.332
Days bottom ½ of mountain closed	Linear term	-0.028***	0.007	-0.077***	0.021	2.218***
	Quadratic term	-0.002	0.061	0.420**	0.200	-1.999***
On-slope restaurants	Four fewer	-0.064	0.041	-0.071	0.122	0.053
	Four more	0.064	0.041	0.071	0.122	-0.053
On-slope snack bars	Three fewer	0.016	0.043	-0.376***	0.127	2.915***
	Three more	-0.016	0.043	0.376***	0.127	-2.915***
Ski Hill Management						
Groomed area	Linear term	0.126***	0.037	0.040	0.110	0.743
	Quadratic term	-0.087**	0.041	-0.120	0.121	0.262
Snowmaking	Linear term	0.023	0.036	0.043	0.109	-0.176
Backcountry access	No	-0.257***	0.056	-0.092	0.158	-0.946
	Yes (no lift)	0.237***	0.064	-0.032	0.206	1.250
	Yes (lift)	0.020	0.063	0.130	0.191	-0.550
Environmental certification	No	-0.214***	0.041	-0.383***	0.123	1.310
	Yes	0.214***	0.041	0.383***	0.123	-1.310
Environmental Surcharge	Linear term	-0.320***	0.038	-0.424***	0.109	0.910
Intercept	Neither	-0.510***	0.047	-0.167**	0.091	-0.025
	Ski Hill A or B	0.510***	0.047	0.167**	0.091	0.025
R2		0.1111		0.176		
R2(0)		0.1734		0.187		
L2		2559.7		352.2		
AIC		2627.9		386.2		
BIC		2693.6		418.0		

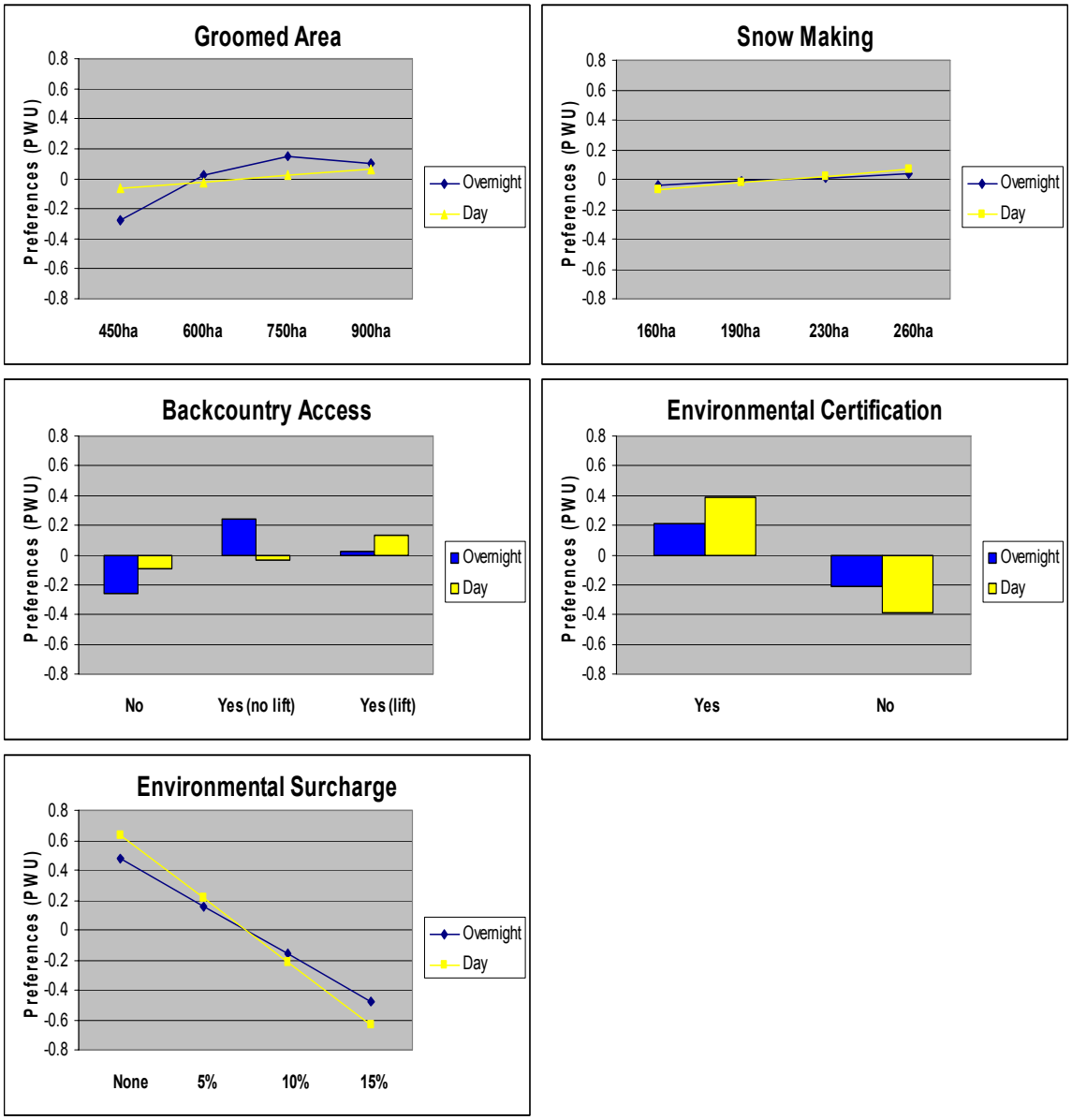
* $0.10 > p \geq 0.05$ ** $0.05 > p \geq 0.01$ *** $p < 0.01$

Figure 4.3: PWU of overnight and day skiers for ski hill design attributes



* Significantly different.

Figure 4.4: PWU of overnight and day skiers for ski hill management attributes



4.5.2.2 Place of Residence

As with the previous tables and figures, Table 4.7 and Figures 4.5 and 4.6 have been organized into two sections and show how preferences differ between the two skier groups (far right column). The intercept shows that although both groups were more likely to choose a hypothetical ski hill than selecting not to ski, BC skiers were less likely

to choose a skiing alternative than out of province skiers, and thus are less likely to visit a ski hill. This difference is statistically significant. All attribute signs for both skier groups seem to be intuitively correct, and almost all attributes were deemed relatively important by both groups (as indicated by the relative magnitude of the coefficients for each skier group).

Concerning the ski hill design attributes, BC and out of province skiers had similar preferences for ski run distribution, gondola wait times, night skiing opportunities and the number of days during which the bottom half of the mountain was closed. BC and out of province skier preferences were different for skiable terrain, and the number of terrain parks, on-slope restaurants and snack bars. Although the pattern of signs for three of these variables differed between the two segments, these differences were not statistically significant. The only statistically significant difference was for skiable terrain.

For the ski hill management attributes, BC and out of province skiers had similar preferences for snowmaking capacity, backcountry access, environmental certification and environmental surcharge. BC and out of province skier preferences were different for groomed area (BC skier preferences were highest for 900ha, while out of province skier preferences fell once groomed area reached 750ha). This difference was significantly significant.

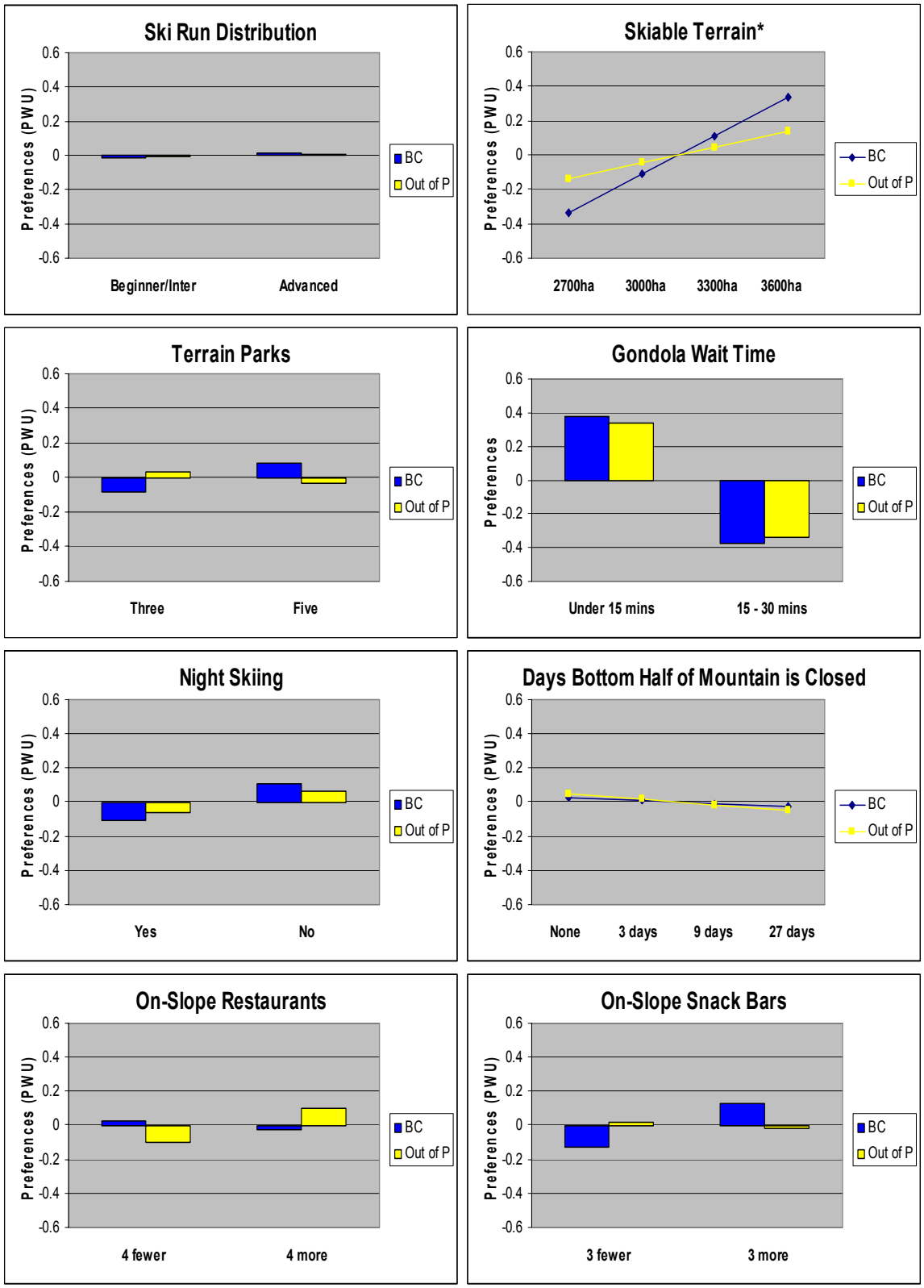
Overall, this segmentation shows that despite differences in preferences for a few ski hill attributes, BC and out of province skier preferences are generally similar. The segmentation also shows that certain environmentally sustainable management initiatives, such as environmental certification, are popular with both skier groups, while other initiatives, such as a 5% environmental surcharge, is acceptable with both skier groups.

Table 4.7: Segmentation for B.C (n=107) and out of province (n=298) skiers

Attributes		B.C Skiers		Out of P Skiers		Differ-Ence
		Coeff.	Std. Err	Coeff.	Std. Err	
Ski Hill Design						
Ski run Distribution	Beginner/Inter	-0.014	0.078	-0.005	0.046	0.093
	Advanced	0.014	0.078	0.005	0.046	0.093
Skiable terrain	Linear term	0.222***	0.063	0.094***	0.036	1.765**
Terrain parks	Three	-0.084	0.078	0.032	0.046	-1.285
	Five	0.084	0.078	-0.032	0.046	1.285
Gondola wait time	Under 15 mins	0.375***	0.079	0.336***	0.046	0.419
	15-30 mins	-0.375***	0.079	-0.336***	0.046	-0.419
Significant night skiing	No	0.105	0.080	0.059	0.045	0.505
	Yes	-0.105	0.080	-0.059	0.045	-0.505
Days bottom ½ of mountain closed	Linear term	-0.019***	0.007	-0.034***	0.005	1.579
On-slope restaurants	Four fewer	0.028	0.077	-0.097**	0.044	1.404
	Four more	-0.028	0.077	0.097**	0.044	-1.404
On-slope snack bars	Three fewer	-0.128	0.081	0.016	0.046	-1.545
	Three more	0.128	0.081	-0.016	0.046	1.545
Ski Hill Management						
Groomed area	Linear term	0.013	0.070	0.164***	0.041	-1.878**
	Quadratic term	-0.070	0.075	-0.095**	0.044	0.295
Snowmaking	Linear term	0.048	0.069	0.018	0.039	0.380
Backcountry access	No	-0.254***	0.103	-0.230***	0.061	-0.204
	Yes (no lift)	0.295***	0.124	0.171***	0.069	0.878
	Yes (lift)	-0.041	0.120	0.059	0.068	-0.728
Environmental certification	No	-0.321***	0.076	-0.205***	0.044	-1.317
	Yes	0.321***	0.076	0.205***	0.044	1.317
Environmental Surcharge	Linear term	-0.386***	0.070	-0.309***	0.042	-0.953
Intercept	Neither ski hill	-0.295***	0.062	-0.538***	0.042	3.260***
	Ski hill A or B	0.295***	0.062	0.538***	0.042	-3.260***
R2		0.125		0.1189		
R2(0)		0.152		0.1862		
L2		810.4		2147.1		
AIC		845.2		2207.9		
BIC		887.9		2267.0		

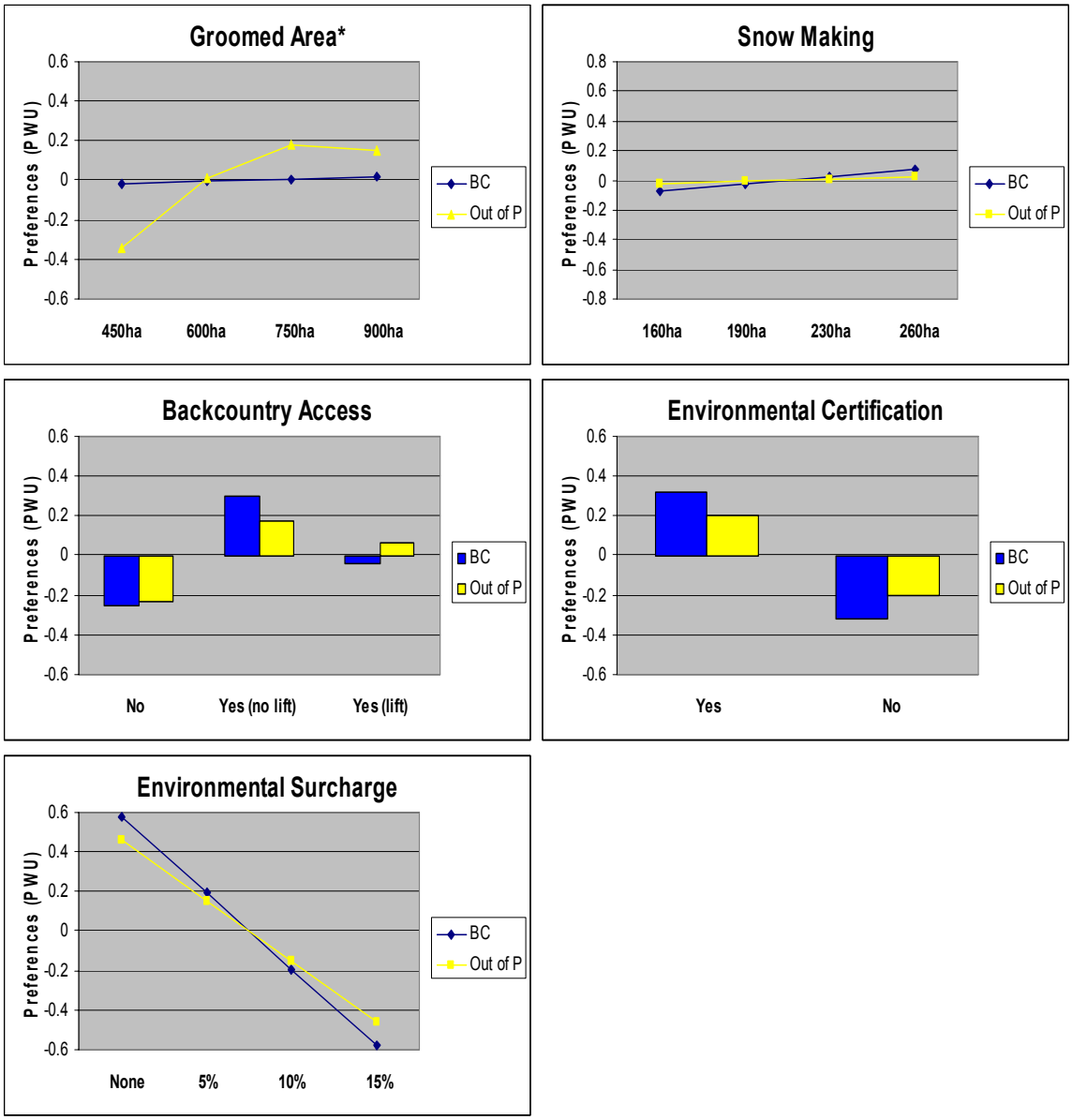
* $0.10 > p \geq 0.05$ ** $0.05 > p \geq 0.01$ *** $p < 0.01$

Figure 4.5: PWU of B.C. and out of province skiers for ski hill design attributes



* Significantly different

Figure 4.6: PWU of B.C. and out of province skiers for ski hill management attributes



* Significantly different.

4.5.3 Latent Class Segmentation

Additional segmentations, based on demographic characteristics, frequency of visits, and activities undertaken in Whistler, only resulted in one or two significant differences, and thus are not discussed below. Regardless of segmentations, all groups showed a consistently positive and statistically significant preference for environmentally

certified ski hills, and considered a 5% environmental surcharge to be acceptable. These findings contribute further to previous research regarding skier's environmental consciousness (Hudson 2000a; Jesitus 2000; Mihalic 2000; The Colorado Department of Public Health and Environment & Tetra Tech 2002; NSAA 2003). Furthermore, these result highlights the fact that environmentally sustainable initiatives have a strong influence (either positive or negative) on skier experience and thus ski hill choice.

Preference heterogeneity was explored further in a latent class analysis. For the overall model, the two, three, and four class segmentations showed few differences between the clusters. Next, a latent class segmentation was performed on overnight visitors only, who are assumed to be more homogenous. In this model, the three class segmentation resulted in one small cluster, representing roughly five percent of overnight visitors, with very inconsistent preferences. For example, skiers in this cluster demonstrated a significant preference for less skiable terrain and groomed area, higher levels of environmental surcharge and longer gondola wait times. While this cluster shared no similar characteristics, these results even contradicted the same respondents' preferences recorded during the ski hill learning task. During this task, over four-fifths of the cluster members indicated preferences for at least 3,000ha of skiable terrain (95%), at least 750ha of groomed area (82%), and an environmental surcharge of 5 percent or under (82%). Furthermore, two-thirds of the cluster members (65%) indicated a preference for shorter gondola wait times. When members of this cluster were removed, and the latent class segmentation was re-run, much more plausible results emerged for the overnight sample. The summary statistics for these segmentations (Table 4.8) show that both the two and three class segmentation are equally plausible segmentations to understand skier

preferences (while the BIC identifies the two class segmentation as the most parsimonious model form, the AIC identifies the three class segmentation). The following analysis is based on the three class segmentation, as this was seen to provide the most interesting insights into skier preferences.

Table 4.8: Latent class segmentations

Model	Segments	LL	BIC(LL)†	AIC(LL)†	Npar	L^2	Df	p-value	C. Err.
1	1 segment	-1507.1	3140.2	3077.1	21	2960.4	384	0.0	0.000
2	2 segments	-972.51	**2194.8**	2033.0	44	1945.0	248	0.0	0.348
3	3 segments	-942.56	2282.5	**2025.1**	70	1885.1	222	0.0	0.429
4	4 segments	-911.78	2368.5	2015.6	96	1823.6	196	0.0	0.437

† Information criteria used to evaluate the quality of the latent class models.

4.5.3.1 Segment Characteristics

Cluster I comprised the largest portion (65%) of the sample. Skiers within this cluster viewed on-site solid waste recycling (3.5)[20], water conservation (3.3) and pre-trip information (3.2) as somewhat important factors in their choice of ski resort. Skiers in this cluster also viewed minimization of energy and water consumption for snowmaking (3.7) and on-slope food services (3.8), as well as a reduction in energy consumption for lifts (3.7) and by not providing night skiing (3.3) as somewhat important initiatives for ski hills to create a more environmentally sound reputation. With respect to travel motivations, skiers in this cluster only saw the opportunity to rest (3.8) and enjoy unique restaurants (3.5) as being important (Table 4.9). For the subsequent analysis, this cluster will be referred to as the 'Environmentally Inclined Skiers' (EIS).

[20] A mean score between 2 - 3 indicates that, on average, skiers found these factors to be somewhat unimportant. A mean score of 3 indicates that, on average, skiers were indifferent about these factors. A mean score between 3 -4 indicates that, on average, skiers found these factors to be somewhat important. A mean score >4 indicates that skiers, on average, found these factors to be important.

Cluster II comprised the second largest portion (20%) of the sample. Skiers within this cluster viewed on-site solid waste recycling (3.1) as a somewhat important factor in their choice of ski resort, while water conservation (2.8) and pre-trip information (2.8) were seen as somewhat unimportant. Skiers in this cluster viewed minimization of energy and water consumption for snowmaking (3.4) and on-slope food services (3.4), and a reduction in energy consumption for lifts (3.4) as somewhat important initiatives for ski hills to create a more environmentally sound reputation. However, skiers were indifferent towards a reduction in energy consumption for lifts (3.0). The importance of these environmental factors and initiatives are lower than for the EIS. With respect to travel motivations, skiers in this cluster only viewed the opportunity to rest (4.1) and enjoy unique restaurants (3.8) as being important (Table 4.9). For the subsequent analysis, and due to the high level of importance placed on resting and visiting unique restaurants when compared to other motivational factors, this cluster will be referred to as the 'Pleasure Seeking Skiers' (PSS).

The final cluster, cluster III, comprised the smallest portion (15%) of the sample. Skiers within this cluster viewed on-site solid waste recycling (3.9), water conservation (3.5) and pre-trip information (3.4) as somewhat important factors in their choice of ski resort. Skiers in this cluster also viewed minimization of energy and water consumption for snowmaking (3.7) and on-slope food services (3.6), as well as a reduction in energy consumption for lifts (3.8) and by not providing night skiing (3.4) as somewhat important initiatives for ski hills to create a more environmentally sound reputation. The importance of these environmental factors and initiatives are slightly higher than for the EIS. With respect to travel motivations, skiers in this cluster were unlike EIS and PSS, as they saw

the opportunity to visit a place that is family orientated (3.6), rest (4.2), enjoy unique restaurants (3.5) and view wildlife (3.5) as being important (Table 4.9). For the subsequent analysis, and due to the high level of importance placed on all but one of the motivational factors when compared to the other two clusters, this cluster will be referred to as the 'Multi-Activity Orientated Skiers' (MAOS).

Table 4.9: Characteristics of clusters[†]

Characteristics	Environ Inclined (EIS)	Pleasure Seekers (PSS)	Multi-Act Orientated (MAOS)	ANOVA	Bonferroni		
					1-2	1-3	2-3
Environmental actions							
On-site solid waste recycling	3.5	3.1	3.9	.003	.087	.095	**.002**
On-site water conservation	3.3	2.8	3.5	.011	**.038**	.751	**.014**
Pre-trip info on environ initiatives	3.2	2.8	3.4	.028	.107	.691	**.030**
Environmental Factors							
Min energy & water use for food services	3.8	3.4	3.6	.061	.067	1.00	.837
Min energy & water use for snowmaking	3.7	3.4	3.7	.139	.166	1.00	.375
Min energy use for lifts	3.7	3.4	3.8	.077	.171	1.00	.107
Reduce energy use by not providing night skiing	3.3	3.0	3.4	.053	.109	1.00	.083
Travel motivations:							
Events	2.5	2.5	3.0	.014	1.00	**.013**	**.058**
Family oriented	2.7	3.0	3.6	.002	.504	**.001**	.175
Resting	3.8	4.1	4.2	.003	.065	**.010**	1.00
Unique restaurants	3.5	3.8	3.5	.050	**.046**	1.00	.287
Wildlife viewing	3.0	2.8	3.5	.004	1.00	**.007**	**.008**

[†] Scale of 1 to 5, with 1 being the least important and 5 being the most important.

4.5.3.2 Preferences of Segmentations

As with the previous segmentations, Table 4.10 and Figures 4.7; 4.8 have been organized into sections and show how preferences differ between the groups (far right column). Unlike the previous tables, the coefficients have been dummy coded. This type of coding, because it compares one attribute level to all other attribute levels, was used to

break out the environmental surcharge attribute, and allowed for a greater understanding of skier preferences for different levels of this attribute[21]. The covariates and parameter estimates associated with these covariates are also shown in Table 4.10. While only two of the covariates are statistically significant (the importance of visiting a ski resort that is family oriented / provides nightlife and entertainment, and that has unique and interesting restaurants / shopping opportunities / first class hotels / and facilitates resting and relaxing), it was found that inclusion of the other covariates created a more revealing model, and thus are kept in the model. The intercept shows that EIS were more likely to choose a skiing alternative than PSS and MAOS, and thus are more likely to visit a ski hill. This difference is not statistically significant. Most attribute signs for the skier groups seem to be intuitively correct, and almost all attributes were deemed relatively important by all three groups (as indicated by the relative magnitude of the coefficients for each skier group).

Concerning the ski hill design attributes, EIS and MAOS had similar preferences for ski run distribution, skiable terrain, number of terrain parks, gondola wait times, number of days during which the bottom half of the mountain was closed, and number of on-slope restaurants and snack bars. The only difference between EIS and MAOS preferences was for night skiing opportunities. PSS preferences were less consistent and differed from EIS and MAOS for ski run distribution, skiable terrain, number of terrain parks, and number of on-slope snack bars. For night skiing opportunities, PSS preferences were the same as MAOS. Although the pattern of signs for these variables differed between the three segments, in the end the only statistically significant differences were

[21] For example, dummy coding allows the specific comparison of a 5% environmental surcharge to no environmental surcharge.

for ski run distribution and the number of days during which the bottom half of the mountain was closed.

For the ski hill management attributes, EIS and MAOS had similar preferences for all attributes (groomed area, snowmaking capacity, backcountry access, environmental certification and surcharge). PSS preferences were less consistent and differed from EIS and MAOS for groomed area (PSS preferred 600ha and 750ha, while EIS and MAOS preferred 900ha), snowmaking capacity, backcountry access (PSS preferred access with a lift, while EIS and MAOS preferred access without a lift), and environmental certification (PSS preferred no certification, while EIS and MAOS preferred certification). For environmental surcharge, PSS preferences were the same as both EIS and MAOS. These differences were statistically significantly different for snowmaking, backcountry access, environmental certification and environmental surcharge.

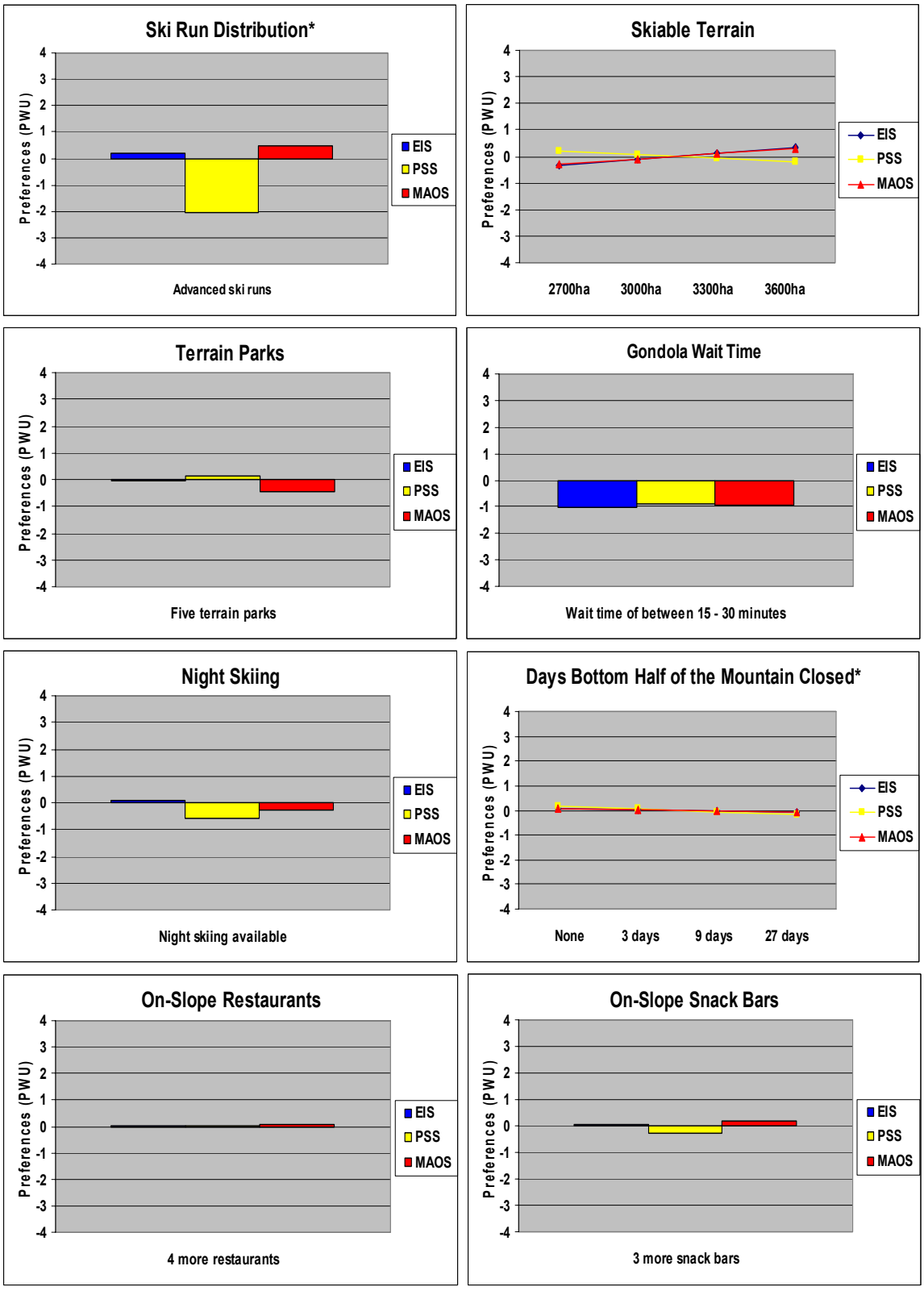
Overall, this segmentation shows that while EIS and MAOS preferences are generally similar, the majority of PSS preferences are different (eight of the thirteen attributes). The segmentation also shows that certain environmentally sustainable management initiatives, such as environmental certification, are popular with most skier groups, while other initiatives, such as a 5% environmental surcharge are considered acceptable. These results will be more clearly explained in the coming DST (Chapter 4.6).

Table 4.10: Segmentation for 'environmentally inclined' (n=191) 'pleasure seeking' (n=57) and 'multi-activity orientated' (n=44) skiers

Attributes		EIS		PSS		MAOS		Difference
		Coeff.	St. Er	Coeff.	St. Er	Coeff.	St. Er	
Ski Hill Design								
Ski run Distribution	Beginner/Inter	0.00	.	0.00***	.	0.00	.	0.00***
	Advanced	0.211	0.135	-2.035***	0.546	0.468	0.398	
Skiable terrain	Liner term	0.219***	0.051	-0.143	0.169	0.183	0.178	0.13
Terrain parks	Three	0.00	.	0.00	.	0.00	.	0.70
	Five	-0.023	0.133	0.137	0.461	-0.443	0.487	
Gondola wait time	Under 15 mins	0.00***	.	0.00***	.	0.00***	.	0.94
	15-30 mins	-1.019***	0.136	-0.890***	0.375	-0.953***	0.449	
Significant night skiing	No	0.00	.	0.00	.	0.00	.	0.18
	Yes	0.104	0.133	-0.564	0.352	-0.259	0.399	
Days bottom ½ of mountain closed	Linear term	-0.033***	0.007	-0.102***	0.028	-0.057	0.032	0.06*
On-slope Restaurants more	Four fewer	0.00	.	0.00	.	0.00	.	0.96
	Four more	0.001	0.064	0.024	0.191	0.058	0.215	
On-slope snack bars	Three fewer	0.00	.	0.00	.	0.00	.	0.28
	Three more	0.026	0.068	-0.272	0.199	0.165	0.204	
Ski Hill Management								
Groomed area	Linear term	0.155***	0.060	0.026	0.158	0.125	0.223	0.75
	Quadratic term	0.001	0.064	-0.578***	0.214	-0.185	0.195	
Snowmaking	Linear term	0.070	0.060	-0.308	0.159	0.500***	0.188	0.03**
Backcountry access	No	0.00	.	0.00	.	0.00	.	0.00***
	Yes (no lift)	0.802***	0.163	-2.210***	0.766	1.039***	0.463	
	Yes (lift)	0.248	0.171	0.898***	0.418	0.186	0.573	
Environmental Certification	No	0.00***	.	0.00	.	0.00	.	0.07*
	Yes	0.556***	0.126	-0.350	0.364	0.384	0.396	
Environmental surcharge	None	0.00	.	0.00	.	0.00	.	0.00***
	Five percent	-0.012	0.181	-0.922	0.539	-0.416	0.466	
	Ten percent	-0.414***	0.192	-3.974***	0.805	-1.306***	0.532	
	Fifteen percent	-0.797***	0.198	-2.913***	0.604	-3.625	1.866	
Covariates:								
Environmental actions		0.00	.	-0.098	0.252	-0.191	0.271	0.25
Environmental factors		0.00	.	-0.297	0.228	0.224	0.285	1.43
Wilderness/Env/Learn		0.00	.	0.012	0.226	0.367	0.241	1.08
Restaur/Shop/Indulge/Rest		0.00	.	0.588***	0.211	0.409	0.232	0.57
Festival/Event		0.00	.	-0.054	0.210	0.433	0.236	1.54
Activities/Value		0.00	.	0.268	0.226	0.105	0.260	0.47
Family/Entertainment		0.00	.	0.170	0.203	0.604***	0.232	1.52
Intercept		0.00	.	-1.310***	0.262	-1.624	0.291	0.80
R2		0.224		0.423		0.225		
R2(0)		0.384		0.437		0.356		
L2		0.644		0.198		0.158		

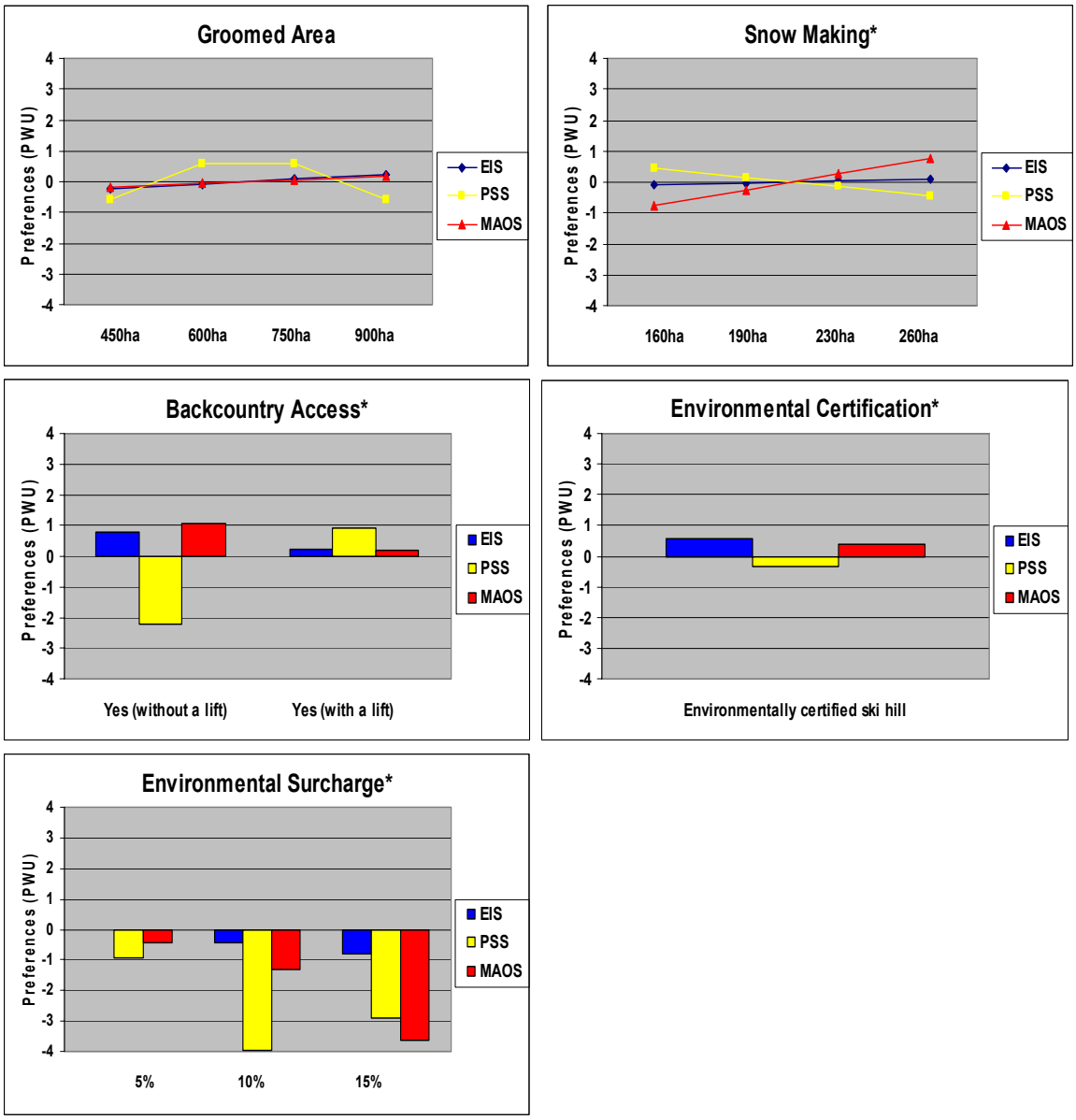
* $0.10 > p \geq 0.05$ ** $0.05 > p \geq 0.01$ *** $p < 0.01$

Figure 4.7: PWU of 'environmentally inclined', 'pleasure seeking' and 'multi-activity orientated' skiers for ski hill design attributes



* Significantly different

Figure 4.8: PWU of 'environmentally inclined', 'pleasure seeking' and 'multi-activity orientated' skiers for ski hill management attributes



* Significantly different

4.6 Decision Support: Measuring Tradeoffs with a DST

Decision Support Tools (DST) were created in Microsoft Excel®[22] based on the latent class model for overnight visitors (Table 4.10) and the Day Skiers (DS) from Table

[22] Microsoft, Encarta, MSN and Windows are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

4.6. This ski hill DST enables the user to select any combination of design and management attribute levels used in the DCE for two different ski hills, which are then displayed side by side. Based on the levels selected, the DST calculates and displays the percentage of skiers that would select the specified alternatives. This probability essentially represents a market share, or level of support, for each ski hill. For the purpose of this study, the DST will be used to determine which of the ski hill attributes most influence market share, and how the introduction of environmentally sustainable ski hill initiatives, namely environmental certification and an environmental surcharge of 5%, will impact this share.

To illustrate how the ski hill DST functions, two random ski hill scenarios were compared (Table 4.11). The first ski hill represents a highly desirable hill for each of the segments, the EIS, MAOS and Day Skiers (DS) separately in which most attributes have been set to the most preferred levels for these groups. The second ski hill represents a highly desirable hill for PSS in which most attributes have been set to the most preferred levels for this group. Given these two ski hills, the DST predicts that 90% of EIS, 0% of PSS, 98% of MAOS and 91% of DS would have chosen the first ski hill, while 7% of EIS, 98% of PSS, 1% of MAOS and 7% of DS would have chosen the second ski hill.

Table 4.11: Market shares for a desirable and undesirable ski hill

Attribute	Desirable Ski Hill for EI, MAO & D Skiers				Desirable Ski Hill for PS Skiers				Neither Ski Hill			
Ski Hill Design												
Ski run distribution	Advanced				Beginner/Inter				--			
Skiable terrain	3600ha				2700ha				--			
Terrain parks	Three				Five				--			
Gondola wait times	Under 15 mins				Under 15 mins				--			
Night skiing	No				No				--			
Days bottom closed	None				None				--			
On-slope restaurant	4 more				4 fewer				--			
On-slope snack bar	3 more				3 fewer				--			
Ski Hill Management												
Groomed area	900ha				450ha				--			
Snowmaking	260ha				160ha				--			
Backcountry access	Permitted (no lift)				Permitted (with lift)				--			
Environmental cert	Yes				No				--			
Environmental sur	0%				0%				--			
Market Share	EI	PS	MAO	D	EI	PS	MAO	D	EI	PS	MAO	D
Percentage	90	0	98	91	7	98	1	7	3	2	1	2

To determine how environmentally sustainable management initiatives will affect the popularity of ski hills (their market share), four hypothetical ski hill scenarios were compared to a hypothetical base scenario. This base scenario was designed to be the most potentially unsustainable ski hill possible, thus all attributes were set to their maximum level so that resource consumption would be at its greatest (e.g., maximum skiable terrain, number of lifts, groomed area, snowmaking, etc) (Table 4.12). The first scenario represents a situation in which the ski hill uses the minimal amount of resources and thus is potentially the most environmentally sustainable ski hill possible. When compared to the base scenario, scenario 1 is much less popular with EIS, MAOS and DS, receiving only 6%, 3% and 3% of the market share, respectively. These results clearly show that skiers in these groups value higher levels for some of the ski hill attributes, and are unwilling to sacrifice them in the name of environmental sustainability. For PSS, scenario

1 is more popular than the base scenario, receiving nine times the market share (37% as opposed to 4%). However, the market share for scenario 1 is still very low, and these results imply that skiers in this group value specific attribute levels that are not provided by either ski hill.

The second scenario represents a situation in which the ski hill has increased its consumption of resources to provide higher levels for certain attributes, such as shorter gondola wait times, more skiable terrain and groomed area. However, while some levels are equivalent to the base scenario, overall resource consumption is still lower, and thus the ski hill in scenario 2 is still more environmentally sustainable than the base scenario. When compared to the base scenario, scenario 2 is equally popular with EIS, and more popular with MAOS, receiving 48% and 69% of the market share, respectively (the base scenario received 47% and 40%, respectively). This sizeable increase in market share for EIS is mainly driven by more skiable terrain (market share falls to 36% if this is 2700ha), shorter gondola wait times (market share falls to 24% if wait times exceed 15 minutes) and backcountry access (market share falls to 28% if this is not permitted). For MAOS, this increase in market share is driven by shorter gondola wait times (market share falls to 33% if wait times exceed 15 minutes), greater snowmaking capacity (market share falls to 36% if this is 160ha) and backcountry access (market share falls to 31% if this is not permitted). From these results, it is clear which ski attributes both EIS and MAOS value, and which they are indifferent towards. For PSS and DS, scenario 2 is not the most popular ski hill. While PSS are still more likely to choose not to ski, DS are still more likely to choose the base scenario. However, despite being unpopular with DS, scenario 2 is much more popular than scenario 1, receiving 28% as opposed to 3% of the market

share. This increase in market share is driven by more skiable terrain (market share falls to 18% if this is 2700ha), fewer number of days during which the bottom half of the mountain is closed (market share falls to 14% if this is 27 days) and more on-slope snack bars (market share falls to 16% if this is three less). These results suggest that at least some of the attributes that DS value are represented in scenario 2, while for PSS, whichever ski hill attributes motivate them to ski are still not present.

In the third scenario, the hypothetical ski hill has the same attribute levels and thus resource consumption as in scenario 2. However, in addition, scenario 3 has also implemented an environmentally sustainable management initiative (the environmental certification of the ski hill). When compared to scenario 2, scenario 3 is more popular with EIS, MAOS and DS, receiving 60%, 66% and 46% of the market shares, respectively (scenario 2 received 47%, 56% and 28%, respectively). This increase in market share is obviously due to the attainment of an environmental certification. For PSS, scenario 3 is very slightly less popular than scenario 2, receiving only 2% as opposed to 3% of the market share. However, due to the low market shares for both of these scenarios, it is difficult to ascertain the preferences of PSS for environmental certification. Therefore, two hypothetical ski hills, based on the desirable ski hill for PSS (Table 4.11), were compared. The first of these ski hills was identical to that in Table 4.13, while the second varied only in that it had an environmental certification. Results from these ski hills show that environmental certification is slightly unpopular with PSS, as market share falls by 8% when the certification is introduced.

In the fourth and final scenario, the hypothetical ski hill has the same attribute levels and thus resource consumption as in scenario 3. However, due to the popularity of

the environmental certification, another environmentally sustainable management initiative has been implemented (a 5% environmental surcharge). When compared to scenario 3, scenario 4 is equally acceptable with EIS, and still receives 60% of the market share. This identical market share clearly shows that a 5% environmental surcharge will not affect the skiing experience for EIS. For MAOS and DS, scenario 4 is less popular than scenario 3, loosing 10% market share from both skier groups (56% and 36% as opposed to 66% and 46%, respectively). This decrease in market share is obviously due to the implementation of an environmental surcharge and occurs at the ration of 1:2 (for every 1% increase in environmental surcharge, market share decreases by 2%). For PSS, scenario 4 is very slightly less popular than scenario 3, but due to the low market share for this segment to start with, the effect of the surcharge would not really matter for the overall demand.

Therefore, two hypothetical ski hills, based on the desirable ski hill for PSS (Table 4.11), were once again compared. The first of these ski hills was identical to that in Table 4.11, while the second varied only in that it had a 5% environmental surcharge. Results from these ski hills clearly show that a 5% environmental surcharge is very unpopular with PSS, as market share falls by 22% when the certification is introduced.

Table 4.12: Market shares for hypothetical ski hills (brackets denote changes in market share)

Attribute	Base	Scenario 1			Scenario 2		
Ski Hill Design							
Ski run distribution	Advanced	Advanced			Advanced		
Skiable terrain	3600ha	2700ha			3300ha		
Terrain parks	Five	Three			Three		
Gondola wait times	Under 15 mins	15 – 30 mins			Under 15 mins		
Night skiing	Yes	No			No		
Days bottom closed	None	27			9		
Restaurants	4 more	4 fewer			4 fewer		
Snack bars	3 more	3 fewer			3 more		
Ski Hill Management							
Groomed area	900ha	450ha			650ha		
Snowmaking	260ha	160ha			210ha		
Backcountry access	Yes (lift)	No			Yes (without lift)		
Environ certification	No	No			No		
Environ surcharge	None	None			None		
Market Share		Base	Sc1	None	Base	Sc2	None
Environmentally Inclined Skiers		85%	6%	9%	48% (-37%)	47% (+41%)	5% (-4%)
Pleasure Seeking Skiers		4%	37%	59%	6% (+2%)	3% (-34%)	91% (+32%)
Multi-Activity Orientated Skiers		89%	3%	8%	40% (-49%)	56% (+53%)	4% (-4%)
Day Skiers		93%	3%	4%	69% (-24%)	28% (+25%)	3% (-1%)

Attribute	Base	Scenario 3			Scenario 4		
Ski Hill Design							
Ski run distribution	Advanced	Advanced			Advanced		
Skiable terrain	3600ha	3300ha			3300ha		
Terrain parks	Five	Three			Three		
Gondola wait times	Under 15 mins	Under 15 mins			Under 15 mins		
Night skiing	Yes	No			No		
Days bottom closed	None	9			9		
Restaurants	4 more	4 fewer			4 fewer		
Snack bars	3 more	3 more			3 more		
Ski Hill Management							
Groomed area	900ha	650ha			650ha		
Snowmaking	260ha	210ha			210ha		
Backcountry access	Yes (lift)	Yes (without lift)			Yes (without lift)		
Environ certification	No	Yes			Yes		
Environ surcharge	None	None			5%		
Market Share		Base	Sc3	None	Base	Sc4	None
Environmentally Inclined Skiers		36% (-12%)	60% (+13%)	4% (-1%)	36% (0%)	60% (0%)	4% (0%)
Pleasure Seeking Skiers		6% (0%)	2% (-1%)	92% (+1%)	6% (0%)	1% (-1%)	93% (+1%)
Multi-Activity Orientated Skiers		32% (-8%)	66% (+10%)	2% (-2%)	41% (+9%)	56% (-10%)	3% (+1%)
Day Skiers		52% (-17%)	46% (+18%)	2% (-1%)	61% (+9%)	36% (-10%)	3% (+1%)

CHAPTER 5:
IMPLICATIONS & RECOMMENDATIONS

Due to the ecological sensitivity of the areas within which they operate, and because they attract large numbers of visitors to small areas, ski hills need to be carefully planned, developed, and managed in order to minimize their impacts on the surrounding natural environment and to stop them from becoming self-destructive enterprises. While the most immediate and apparent impacts occur during construction and expansion stages, the day-to-day use and operations of on-hill facilities also adversely impact the surrounding natural environment. These include the disturbance and alteration of vegetation and wildlife, as well as impacts on scenic beauty (Todd 1994; Price *et al.* 1997; Wilde 1998; Wardle & Fahey 1999; Holden 2000; NSAA 2000; Simpson & Terry 2000; Pelley 2001; Waldron and Williams 2002; Wipf *et al.* 2005). Increased awareness of the impacts of ski hills, and their inseparability with the surrounding environment, has resulted in demands for environmentally sustainable management initiatives. This demand is augmented by several factors, as documented by several earlier research projects. One of the driving forces behind the desire to ski is to experience the natural beauty of mountains (Culbertson *et al.* 1991; Williams and Dossa 1994; Fry 1995), a result that was echoed in Table 4.3[23], and that environmentally sustainable initiatives result in additional benefits for ski resort, such as increased skier visitation (TIAA 1992; Hudson 2000a; Mihalic 2000; Proebstl 2006), a result that was again echoed in Table

[23] One of the most important travel motivations was "experiencing and seeing a mountain area".

4.3[24]. While a few ski areas have developed their own environmentally sustainable ski hill guidelines / procedures, most have been created for ski resorts by interest groups, tourism associations, and NGOs (NSAA 2000; Pro Natura 2000; Colorado Department of Public Health and Environment & Tetra Tech 2002; BCHSSOA 2003).

Despite the many convictions regarding the importance of environmentally sustainable management, and the existence of environmentally sustainable management initiatives, others still argue that there is little evidence to suggest skiers are interested in this type of management (Fry 1995; Holden 1998; Milne 1998; Swarbrooke 1999). This argument is strengthened somewhat by the fact that there has been little research into understanding the demands of skiers for environmentally sustainable ski hill management as a component of a ski hill's operations. Lack of understanding is somewhat surprising, as maintaining positive skier experiences requires understanding of how ski hill changes will affect skier preferences. Therefore, before ski hill managers can decide whether or not to implement environmentally sustainable initiatives, they must first understand skier preferences. Understanding ski preferences will enable managers to establish whether sufficient demand exists for environmentally sustainable management, and the type of initiatives that will be well received. Furthermore, it will also provides ski hill managers opportunity to differentiate their ski hill from others[25], and thus potentially gain a competitive advantage (Dalrymple & Parsons 2000; Marxt & Hacklin 2005; Siomkos *et al.* 2005).

[24] Another important travel motivation was to "visit a place that takes good care of its environment".
[25] Due to the slowing down and stagnation of market demand for skiing over the past few decades (Zimmermann 1991; Harabaugh 1997; Tuppen 2000; Williams & Fidegon 2000), this differentiation could prove invaluable for attracting new skiers into the sport.

Many researchers have suggested processes and techniques for determining the demand of various local stakeholder groups (Haywood 1988; Murphy 1988; Simmons 1994; Ashworth & Dietvorst 1995; Gill 1997; Jackson & Morpeth 1999; Simpson 2001; Day *et al.* 2003). While these have often proven successful for understanding the preferences of more permanent stakeholders, they have generally proven unsuccessful for visitors (Haywood 1988; Gill & Williams 1994). The most commonly used technique for quantitatively eliciting visitor demand has been through conventional surveys. However, while these studies have been carried out to better understand skier preferences, none have looked at preferences for environmentally sustainable ski hill management as a component of a ski hill's operations, and rarely have their conclusions been used to help better inform ski hill managers with regards to hill management. Instead, the results are often used by the marketing administration of companies as an advisory tool to help guide and develop the necessary marketing strategies to increase customer satisfaction, loyalty and retention, and thus strengthening their competitive position (Echelberger & Shafer 1970; Morey 1981; 84; Greig 1983; Walsh *et al.* 1983; Klenosky *et al.* 1993; Ormiston *et al.* 1998; Riddington *et al.* 2000; Ferrand & Vecchiatini 2002; Perdue 2002; Tangian 2002; Siomkos *et al.* 2005; Mulligan 2006). Furthermore, due to the inherent weaknesses in the surveying techniques used (Haider 2002; Haider & Rasid 2002), and the fact that understanding of skier preferences for multi-attribute products such as ski hill can provide an empirical foundation for environmentally sustainable ski hill management, more systematic and reliable methods for understanding skier demand is needed. Therefore, and because of these issues, the overall goals of this study were twofold; first, to create and develop a systematic process for empirically measuring skier preferences for ski hill design and management attributes. Once measured, these preferences were used to

investigate skier demand for environmentally sustainable ski hill initiatives through the use of a simple Decision Support Tool (DST); and second, to examine if these preferences vary between different skier groups.

Overall, this study has shown that the majority of skiers have strong preferences for certain ski hill design and management attributes, such as shorter gondola wait times and larger areas of skiable terrain, while they are indifferent towards other attributes, such as snowmaking capacity and number of terrain parks. In regards to environmentally sustainable management initiatives, the majority of skiers showed a preference for environmentally certified ski hills. This result coheres to previous research regarding skier's environmental consciousness (Hudson 2000a; Jesitus 2000; Mihalic 2000; The Colorado Department of Public Health and Environment & Tetra Tech 2002; NSAA 2003). However, despite this preference for certification, all skiers showed a preference for no environmental surcharge. This result highlights the fact that while some environmentally sustainable initiatives are popular amongst skiers, not all initiatives will positively influence skier experience and thus ski hill choice. Furthermore, this study has also shown that while skier preferences for ski hill design and management attributes may seem homogenous (when based on demographic characteristics, frequency of visits, and activities undertaken in Whistler), heterogeneity does exist. This heterogeneity was observed once latent class segmentation was run as a three cluster solution for overnight skiers only (having removed all skiers with 'irregular' preferences[26]) and compared with day skiers. The resulting four clusters consisted of Environmentally Inclined Skiers (EIS = 191), Pleasure Seeking Skiers (PSS = 57) and Multi-Activity Orientated Skiers (MAOS

[26] Skiers in this cluster demonstrated statistically significant preferences for the less skiable terrain and groomed area, higher levels of environmental surcharge and longer gondola wait times. These results are seen as irregular, especially when compared to preferences recorded during the ski hill learning task.

= 44), all of whom were overnight skiers, and Day Skiers (DS = 48). This chapter explores some of the implications of these findings for the environmentally sustainable management of ski hill in general, and for Whistler in particular. Following this is a discussion of the research limitations and suggestions for further research. The final section concludes the study.

5.1 Implications for Ski Hill Management in Whistler & Elsewhere

This research has clearly demonstrated that DCEs can be used to effectively elicit and empirically measuring skier preferences for ski hill design and management attributes. Furthermore, it has also shown that once elicited, these preferences can be used to investigate skier demand for environmentally sustainable ski hill management. Understanding skier preferences for environmentally sustainable management through behavioural research is critical for ski hill managers to determine whether demand exists for this form of management, and the type of initiatives that will prove popular amongst skiers and thus help maintain a ski hill's market share. Additionally, ski hill managers need to be aware not only of aggregated demand, but also of any nuances in demand, such that may occur within specific skier groups. This knowledge and awareness of any heterogeneity is important since it allows ski hill managers to design and implement appropriate environmentally sustainable initiatives that appeal to the tastes and interests of most, if not all, skiers.

The day-to-day use and operations of on-hill facilities adversely affect the surrounding natural environment. Soil erosion, compaction and damage to shrubs and protruding branches, caused by snow grooming and recreational activities, all impede vegetation growth. The operation of on-slope transportation facilities, on and off-piste

recreational activities, night skiing, snowmaking, and on-slope restaurants and snack bars also contribute to wildlife disturbance and habitat destruction (Todd 1994; Price *et al.* 1997; Wilde 1998; Wardle & Fahey 1999; Holden 2000; NSAA 2000; Simpson & Terry 2000; Pelley 2001; Waldron and Williams 2002; Wipf *et al.* 2005). However, while these activities may have adverse impacts on the surrounding natural environment, they constitute the core and expected attributes of a ski hill, without which the hill would cease to exist (Levitt 1983). Therefore, ski hill managers need to be cognizant of skier preferences for these attributes in order to ensure that any environmentally sustainable management initiatives do not negatively impact those that are most popular and influential on ski hill choice.

With regards ski hill design attributes, EIS segment had the strongest preferences for an advanced ski run distribution, greater amounts of skiable terrain and shorter gondola wait times. The PSS segment had the strongest preferences for a beginner-style ski run distribution, shorter gondola wait times and no significant night skiing opportunities. The MAOS segment had the strongest preferences for an advanced ski run distribution, three terrain parks and shorter gondola wait times. Finally, DS had strongest preferences for greater amounts of skiable terrain, shorter gondola wait times and a greater number of on-slope snack bars. From these results, it is clear that all skiers highly value ski hills with shorter gondola wait times. It is also evident that the majority of skiers highly value an advanced form of ski run distribution (except for PSS and DS = 31%), and greater amounts of skiable terrain (except PSS and MOAS = 30%). These findings are not surprising, and are consistent with previous research concerning skier's preference for more skiable terrain (Walsh *et al.* 1983; Morey 1981; 84; Ormiston *et al.* 1998;

Perdue 2002; Mulligan 2006) and shorter gondola wait times (Greig 1983; Walsh *et al.* 1983; Williams & Dossa 1994; Orminston *et al.* 1998; Perdue 2002; Mulligan 2006). Furthermore, it is also evident that only a small percentage of skier's ski hill choice is heavily influenced by the number of terrain parks (MAOS only = 13%), on-slope restaurants (DS only = 14%) and snack bars (DS only = 14%), the availability of significant night skiing opportunities (only PSS = 17%), and the number of days during which the bottom half of the mountain was closed (DS only = 14%).

For the ski hill management attributes, EIS had the strongest preferences for backcountry access without a lift, environmental certification and no environmental surcharge. PSS had strongest preferences for groomed areas between 600ha and 750ha, backcountry access with a lift, and no environmental surcharge. MAOS had the strongest preferences for greater snowmaking capacity, backcountry access without a lift, environmental certification and no environmental surcharge. Finally, DS had strongest preferences for environmental certification no environmental surcharge. From these results, it is clear that all skiers highly value ski hills with no environmental surcharge. It is also evident that the majority of skiers highly value ski hills that provide backcountry access without a lift (except for PSS and DS = 31%) and that are environmentally certified (except PSS = 17%). This preference for environmental certification is consistent with previous research highlighting the environmental consciousness of skiers (Hudson 2000a; Jesitus 2000; Mihalic 2000; The Colorado Department of Public Health and Environment & Tetra Tech 2002; NSAA 2003). It is also evident that only a small percentage of skier's ski hill choice is heavily influenced by groomed area (PSS only = 17%) and snow making capacity (MAOS only = 13%).

Based on the above results, it may seems obvious which ski hill design and management attributes ski hill managers should introduce / increase, and which should be removed / decreased. However, in reality resources are not unlimited, and the introduction of specific attributes may occur at the detriment of others. Although this results show that demand exists for environmental certification, certification alone cannot drive the demand exorbitantly. This was clearly demonstrated in scenario 1 of the DST (Table 4.14), in which the hypothetical ski hill was potentially the most environmentally sustainable because it used the minimal amount of resources by providing the minimal amount of each ski hill attribute (i.e., the lowest level of skiable terrain, groomed area, snowmaking capacity, no backcountry access). Under this scenario, the market share for this ski hill was only 6%, 37%, 3% and 3% for EIS, PSS, MAOS and DS, respectively. While these low shares occurred for different reasons, the overall impacts were the same. Therefore, ski hill managers need to ensure that the attainment of an environmental certification for the ski hill will not negatively affect the ski hill design and management attributes that skiers view as important.

5.2 Limitations

Despite the utility of this research for ski hill managers in Whistler and elsewhere, some limitations exist. Although the preferences elicited in the DCE were intended to be hypothetical, there is a slight possibility that many choices were made with a real ski hill in mind. That is, because the hypothetical ski hills were heavily based on the ski hills in Whistler, skiers were recruited in Whistler, and the survey asked numerous questions about their trip to Whistler, respondents may not have expressed their preferences for a hypothetical ski hill, but for an existing ski hill. Skiers therefore may have been thinking

about the Whistler ski hills when making their choices. It is possible that skier preferences would differ in a completely hypothetical survey, or if skiers from different ski resorts were surveyed.

A somewhat related limitation is the transferability of the results. Exactly how transferable are the preferences measured in the hypothetical DCE to preferences for actual ski hill management? The value of this DCE is that it allows managers to estimate the preferences for, and tradeoffs between, attributes in hypothetical ski hills, and that it enables the use of these results to estimate demand for environmentally sustainable ski hill management. While all attempts were made to ensure that skiers answer the survey as honestly as possible, a hypothetical DCE may not capture the full tradeoffs associated with particular ski hill attributes. In other words, skier's responses to the questions may not represent their actual behaviour. While this issue may be unresolvable for this research, validation studies comparing stated and revealed preferences have shown that the results of these studies are similar, and thus this caveat is not an issue. However, despite these studies, it is important to acknowledge that actual preferences for certain attributes among skiers may differ slightly from those suggested in this research (Finn *et al.* 1992).

A third limitation of this research relates to the insignificant attributes. It is difficult to determine whether these attributes were insignificant because they are deemed unimportant by respondents, because they were not extreme enough, or because they were simply not perceived by respondents. For example, the lack of significance for the number of one-slope restaurants and snack bars suggests that the number of these facilities does not matter. Is this really the case, or were the levels set too low to be

important? A similar question could be asked about snowmaking. Is snowmaking capacity unimportant? Were visitors simply unable to differentiate between the different capacities, or were the levels tested too low to be important? While these issues may not be perfectly resolvable, a partial solution would be to ensure that future attribute levels are selected to ensure that different ranges are tested, regardless of possible alternatives being considered for a specific ski hill. However, despite this lack of significance, the conclusions within the attribute ranges offered are highly plausible.

5.3 Further Research Suggestions

This research has shown that most skiers highly value environmental certified ski hills, and that they consider an environmental surcharge to be unacceptable. Yet further research is needed into understanding the details of these preferences. First, demand for environmental certification require investigation. Do skiers have particular preferences for what constitutes these certificates, or are their preferences simply for their attainment of such certifications? The former would necessitate greater understanding to ensure that skiers both accept and approve of these certifications. A related issue regards who should be responsible for developing these certifications, and which governing body should be in charge to ensure that skier confidence and trust is maintained? If those in charge are not well respected and trusted by skiers as an independent and impartial authority, then overall preferences for ski hills may be affected. Furthermore, should these certifications focus solely on the ski hill, prohibit ski hill expansion, involve third party oversight and sanctions for infractions?

Second, more research is needed to determine skier preferences for smaller levels of environmental surcharge. While the results of this study have shown that skiers view

an environmental surcharge as unacceptable, nothing is known about skier preferences for a 1, 2, 3 or 4 percent surcharge. This need to break down the surcharge into smaller percentages was highlighted in scenario 4 of the DST (Table 4.14). In this DST it was found that even though EIS had a strong preference for no environmental surcharge, when a 5% surcharge was introduced market share was not negatively impacted. Therefore, and based on this outcome, it is possible that the other three skier groups (PSS, MAOS and DS), who also had a strong preference for no environmental surcharge, may actually be indifferent towards a 1, 2, 3 or even 4 percent surcharge.

5.4 Conclusion

While the literature on ski hill management offers a wide range of environmentally sustainable management initiatives, few studies have attempted to evaluate skier preferences and overall demand for these initiatives as a component of a ski hill's operations. Instead, research has simply elicited skier preferences for use by the marketing administration of companies for marketing strategies. This is somewhat surprising, as understanding skier demand for environmentally sustainable ski hill management as a component of a ski hill's operations is critical for ski hill managers to establish whether sufficient demand exists for this type of management, and the type of initiatives that will be popular amongst skiers. Furthermore, it also provides ski hill managers with an opportunity to differentiate their ski hill from others, and thus gain a competitive advantage. This research has focused on systematically eliciting and empirically measuring skier preferences for ski hill design and management attributes, and using these preferences to determine if demand currently exists for environmentally sustainable ski hill management. Additionally, this research has examined how these

preferences vary between different skier groups. Overall, the majority of skiers (83%) preferred environmentally certified ski hills. Skiers also showed a preference for no environmental surcharge. This result highlights the fact that while some environmentally sustainable initiatives are popular amongst skiers, not all initiatives will positively influence skier experience and thus ski hill choice. Based on these results, there is clearly a demand for the implementation of specific environmentally sustainable ski hill initiatives, while others initiatives are unpopular. Furthermore, this study has also shown that while skier preferences may seem homogenous (when segmentation is based on demographic characteristics, frequency of visits, and activities undertaken), preference heterogeneity does exist. Understanding of this heterogeneity is important if ski hill managers are to successfully implement the initiatives that will meet the demand of most, if not all, skiers. From the research, it is evident that all skiers highly value ski hills with shorter gondola wait times. It is also evident that the majority of skiers highly value an advanced form of ski run distribution (69%), greater amounts of skiable terrain (70%) and ski hills that provide backcountry access without a lift (69%). Therefore, although demand exists for environmental certification of ski hills, ski hill managers must take care that this initiative does not negatively impact these ski hill design and management attributes, as this will result in decreased skier enjoyment and a reduction in market share. The methodology used in this study provides a solid basis for future research into skier preferences, and demonstrates a practical tool for ski hill managers to understand skiers' demand for environmentally sustainable ski hill management. Furthermore, it illustrates the fact that skiers are concerned about the environment within which they ski, and that the demand exists for some forms of environmental sustainable ski hill management.

APPENDICES

Appendix A

Intercept Survey

Hi. My name is [your name] and I am conducting research with Simon Fraser University. We are trying to better understand what visitors think about future changes needed for Whistler to become a more sustainable resort destination. Would you be willing to take 2 minutes to answer a few questions?

1. Are you a full-time resident of Whistler or do you work in Whistler? ☐N [1] ☐Y [2] [terminate]

We will be conducting an Internet survey later this spring. By completing the online survey, you will be helping shape Whistler's future. By completing the online survey, you will be entered to win a number of draw prizes. Can we contact you by email in late March to complete the Internet survey? All personal information will only be used for the purposes of this study, and will not be released to any other individual or organization.

2. Email: _____ [double check!!]

3. Is there a name we could use when we contact you by email?

_____

Thank you. At this time, I have a few quick questions about your trip. Your participation is completely voluntary, and you may terminate the interview at any time.

4. Is this your first visit to Whistler?

☐ Y [1] ☐ N [2]

5. Where are you from? Please write out in full.

Country: _____

Province/State [if Canada/USA]: _____

City [if BC]: _____

6. What is the purpose of your trip? Check one.

☐ Business [1] ☐ Leisure [2]

7. Will you be skiing or snowboarding on this trip?

☐ Y [1] ☐ N [2]

8. Are you a day visitor or are you staying overnight? [If day visitor, terminate.]

☐ Overnight [1] ☐ Day [2]

9. How many nights are you staying in total?

_____ Nights

10. What type of accommodation are you using?

If you are staying at more than one, select the one you stayed at the longest.

☐ rented hotel room, condo, chalet [1]
☐ timeshare [2]
☐ bed & breakfast, or pension [3]
☐ hostel, or club cabin [4]
☐ campground [5]
☐ home of friends or family [6]
☐ second home [7]
☐ other [8]: _____

11. Where is your accommodation located in Whistler?

☐ In Whistler Village or Village North [1]
☐ Within 2 km of Whistler Village [2]
☐ Further than 2 km from Whistler Village [3]
☐ Don't know [4]

Appendix B

Cover Letter

Hi (first name),

You are one of the few individuals invited to participate in Simon Fraser University's survey on mountain resorts during your trip to Whistler in Feb, 2005. Thank you for agreeing to take part - your opinions and perspectives are very important to us.

This survey, which has been designed to find out what you think about different aspects of mountain resorts such as Whistler, will take about 25 minutes to complete. As a thank you for taking the time to complete the survey, you will be entered in a draw to win prizes including a minimum $100 gift certificate for Mountain Equipment Co-op. Be sure to get your responses in by October 31st in order to be eligible for the prize draw.

Please be assured that this survey is for research purposes only. Participation in this survey is voluntary and your responses will be kept strictly confidential in accordance with Simon Fraser University's research ethics guidelines. Any personal identification information you provide will be used only to contact you in the event that you win one of the prizes.

CLICK ON THE FOLLOWING LINK TO BEGIN or RE-ENTER THE SURVEY:
http://www.whistlerwinter.rem.sfu.ca/?SS=yes&pw=3706whi&di=KJ12624PW

If clicking on this link does not take you directly to the survey, please go to http://www.whistlerwinter.rem.sfu.ca/ and enter your LoginID and Password:

LoginID: (login ID)
Password: (Password)

This study is being conducted by the Centre for Tourism Policy and Research at the School of Resource and Environmental Management, Simon Fraser University, in partnership with the Resort Municipality of Whistler. If you have any comments or questions, please contact Dr. Wolfgang Haider by phone at (604) 291-3066 or by fax at (604) 291-4968. Thank you for your cooperation.

Sincerely,

Jen Reilly & Mathew Dickson
Graduate Students
School of Resource and Environmental Management
Simon Fraser University
Burnaby, B.C. Canada

Appendix C

Reminder Email Cover Letter

Hi (first name),

Several weeks ago, you were sent an email with a link to Simon Fraser University's web survey on visitor perspectives of mountain resorts. Our records indicate that you have not yet completed this survey. Therefore, we are sending you this reminder email because your completed response is important for us to obtain representative results that can help improve future planning decisions at Whistler and other mountain resorts. If you started the survey, but have not yet completed it, please keep in mind that you can log back into the survey and continue from where you left off.

The web survey asks about your preferences for recreation, development, transportation, and environmental initiatives at mountain resorts. The survey takes about 25 minutes to complete and requires no special knowledge.

Please submit your responses by October 31st to be entered in the draw for prizes including a minimum $100 gift certificate for Mountain Equipment Co-op. This survey is for research purposes only and your responses will be kept strictly confidential in accordance with Simon Fraser University's research ethics guidelines.

CLICK TO BEGIN OR RE-ENTER THE SURVEY:
http://www.whistlerwinter.rem.sfu.ca/?SS=yes&pw=1006whi&di=KJ3174PW

If clicking on this link does not take you directly to the survey, please go to http://www.whistlerwinter.rem.sfu.ca/ and enter your LoginID and password.

LoginID: (login ID)
Password: (password)

Thank you for your time and cooperation.

Sincerely,
Jen Reilly & Mathew Dickson

Graduate Students
Centre for Tourism Policy and Research
School of Resource and Environmental Management
Simon Fraser University
Email: whstudy@sfu.ca

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