INTEGRATING GIS INTO CHOICE EXPERIMENTS: AN EVALUATION OF LAND USE SCENARIOS IN WHISTLER, B.C.

by

Krista Bree Englund
Bachelor of Science, University of Victoria, 2000

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Name: **Krista Bree Englund**

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Examining Committee:

Chair: **Joe Kelly**

Dr. Wolfgang Haider
Senior Supervisor
Associate Professor
School of Resource and Environmental Management, Simon Fraser University

---

Dr. Kristina Rothley
Supervisor
Assistant Professor
School of Resource and Environmental Management, Simon Fraser University

Date Defended: October 25, 2005

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ABSTRACT

GIS and choice experiments were integrated to implement a spatial survey and create a GIS-based decision support tool. The discrete choice survey investigated preferences of visitors to Whistler, British Columbia, for alternative land use scenarios at a mountain resort. The hypothetical choice sets, developed in GIS, illustrated different amounts and arrangements of development, protected areas, and recreational opportunities. Visitors preferred resorts with greater amounts of protected areas, especially when protected areas were buffered from development and situated to protect the most ecologically valuable areas. In addition, visitors preferred to limit the amount of development at nodes external to the resort core and tolerated a high percentage of the workforce living in the resort. Finally, visitors preferred only two golf courses, but were indifferent towards the extent of the trail system. A GIS-based decision support tool created using the survey results demonstrates an effective way to communicate the findings.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

AHP	Analytical Hierarchy Process
BC	British Columbia
CSP	Comprehensive Sustainability Plan
DCE	Discrete Choice Experiment
DST	Decision Support Tool
GIS	Geographic Information System
IIA	Independence of Irrelevant Alternatives
LC	Latent Class
MADM	Multi-Attribute Decision Making
MCA	Multi-Criteria Analysis
MLE	Maximum Likelihood Estimation
MNL	Multinomial Logit
MSI	Mean Shape Index
OCP	Official Community Plan
PAN	Protected Areas Network
PSCov	Patch Size Coefficient of Variance
PWU	Part Worth Utility
SDSS	Spatial Decision Support System
RMOW	Resort Municipality of Whistler
RPL	Random Parameters Logit
RUT	Random Utility Theory
TEM	Terrestrial Ecosystem Mapping
TW	Tourism Whistler
WCED	World Commission on Economic Development
WES	Whistler Environmental Strategy

CHAPTER 1 INTRODUCTION

1.1 Introduction & Rationale

"Sustainability is widely regarded as economically and ecologically desirable; in the ultimate sense, it is the only viable long term pattern of human land use" (Dale et al., 2000: 642).

Sustainable development is widely recognized as a critical objective for local communities. Moving towards sustainability in tourism-based communities is especially important because most tourism development depends on attractions and activities related to the natural environment (Ahn, Lee, & Shafer, 2002). If the natural resources at tourist destinations are degraded or destroyed, then tourism itself will have lost its' own "raison d'etre" (Ahn et al., 2002).

Though there is still no universally accepted definition of sustainable development, the most cited definition comes from the World Commission on Economic Development (WCED) in the Brundtland Report, which states that sustainable development is development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (W.E.C.D., 1987: 8). Hunter and Green (1995: 70) reviewed the tourism literature related to sustainable development and suggested that "sustainable tourism 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 there are numerous other definitions of sustainable tourism development, Clarke (1997) claimed that the absence of a precise definition for sustainable tourism is less important than general movement in the correct direction.

Moving towards sustainability at tourist destinations requires effective planning and management of natural resources. Land use planning is a statutory process that aims to identify a vision for the spatial arrangement of an area and pursue this vision by designating a preferred pattern of land use (Dredge, 1999). Land use planning assists decision-makers to evaluate land use objectives and options and to weigh these against other policy objectives, including those derived from sustainable development principles (e.g., equity, quality of tourist experience, conservation of natural resources) (Hunter & Green, 1995: 96). This research focuses on two key goals of land use planning that must be weighed against other priorities at a tourist destination: protecting natural resources and maintaining visitor experience (i.e., ensuring economic sustainability).

An effective approach to community tourism planning includes the use of scenarios (Haywood, 1988). Scenarios are particularly popular to investigate the ecological or economic consequences of alternative land use scenarios (Hunter et al., 2003; Musacchio & Grant, 2002; Theobald, Miller, & Hobbs, 1997; White et al., 1997). While there is a growing body of literature that investigates the ecological or economic consequences of land use scenarios, few behavioural investigations of the impacts of alternative land use scenarios have been conducted. However, alternative land use scenarios are likely to have social impacts as well as ecological and economic impacts. For this reason, it is generally recognized that the preferences of the general public must be considered during the tourism planning process (Haywood, 1988; Williams & Lawson, 2001). Several studies on the preferences of residents towards tourist development at resort destinations have been published (Allen, Long, Perdue, & Kieselback, 1988; Harrill, 2004; Lindberg, Andersson, & Dellaert, 2001). However, there has been little effort to include tourists in preference research or in actual planning processes for resort destinations. This is somewhat surprising given that maintaining visitor experience requires an understanding of how land use changes at a tourist destination will affect visitor behaviour.

Because tourists can be difficult to include in typical public involvement processes (e.g., open houses, workshops, multi-stakeholder processes) due to their transient nature and lack of familiarity with the host community, one of the most effective ways to involve tourists may be to conduct a questionnaire or survey to investigate their preferences and potential reactions to alternative planning scenarios.

An effective survey technique that permits behavioural evaluations of planning alternatives is a discrete choice experiment (DCE). In choice experiments, individuals are asked to make tradeoffs between entire alternatives, which enables the researcher to determine the preferences, or partial utilities, of the various survey attributes, which often correspond to policy objectives or outcomes. Choice experiments have been implemented to investigate alternative planning scenarios in transportation (e.g. Yamada & Thill, 2003), agriculture (e.g. Mallawaarachchi, Blamey, Morrison, Johnson, & Bennett, 2001), siting of noxious facilities (e.g. Opaluch, Swallow, Weaver, Wessells, & Wichelns, 1993), recreational opportunities (e.g. Dennis, 1998), interior design (e.g. Dijkstra, van Leeuwen, & Timmermans, 2003), and urban development (e.g. Johnston, Swallow, & Bauer, 2002).

Several of these planning related DCE studies recognized the value of utilizing graphic tools in order to clarify the alternatives being presented in the DCE (Dijkstra et al., 2003; Opaluch et al., 1993; Yamada & Thill, 2003). However, except for one study (Johnston et al., 2002), the graphics used in the surveys simply illustrated the aspatial attributes pictorially. Preferences for alternative spatial arrangements of the attributes were not investigated. Because planning is inherently spatial, any research that does not explicitly incorporate spatial relationships between attributes ignores an important aspect. This research addresses this gap by developing a spatially-explicit DCE to examine tourist preferences for alternative land use scenarios. The research also explores how geographic information systems (GIS) can be used to develop a spatially explicit survey instrument and create a simple decision support tool that effectively communicates the results of the survey.

The utility of this research approach was examined using the internationally renowned mountain destination of Whistler, British Columbia as a case study. Spatial planning scenarios presented in the DCE survey instrument were developed using landscape indices, which were implemented through a GIS. The results of the DCE were used to investigate the potential impact of changes to a protected areas network (PAN), recreational opportunities, and urban development in Whistler on visitor preference. A simple spatial decision support tool was created by importing the results of the discrete choice survey into GIS. This exploratory study represents the most elaborate use of GIS in a DCE application and recommendations are given for improving the efficacy of spatial DCEs as well as linking DCE and GIS to encourage future research in this area.

1.2 Research Goals and Questions

The general goal of this research is to implement a spatial discrete choice experiment for obtaining preference information for planning scenarios and demonstrate how GIS and DCE can be linked in a way that would enable the results to be used in larger land use or conservation planning processes. To meet this overarching goal, the research has two specific research questions:

I. Can spatial discrete choice surveys assess visitor preferences for alternative land use configurations at mountain resorts? More specifically:
   a. What preferences do visitors to Whistler have for the amount and configuration of protected areas, urban development, and recreational opportunities?
   b. What are the visitors' tradeoffs between recreational opportunities and the level of protection afforded to ecological values?
   c. How do preferences for landscape features vary depending on key characteristics of the visitors, such as their place of residency, their length of stay in Whistler, and the activities they undertook while in Whistler?

II. Can GIS be used to develop spatial scenarios for the survey instrument, as well as a simple decision support tool that displays visitor preferences for potential future land use scenarios in Whistler?

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

1.3.1 Location and Description

These research questions were answered by undertaking a case study in Whistler, British Columbia (B.C.). Whistler is located in British Columbia's Coast Mountain range, 40 km east of the Pacific Ocean and 120 km north of Greater

Vancouver, B.C.'s largest metropolitan region (R.M.O.W., 2004a). The town is nestled in the Whistler Valley between Green Lake in the North and Brandywine Creek in the South, at about 668 m in elevation. The 16,500 ha of land within the municipal boundaries includes wetlands and riparian area surrounding several rivers and lakes in the valley bottom (~1%), residential and commercial development primarily in the valley bottom (~8%), high elevation coastal forests in the Coastal Western Hemlock and Mountain Hemlock zones (~45%), and alpine tundra on Whistler and Blackcomb Mountains (~9%) (Green, 2004; Lindh & Martin, 2004; R.M.O.W., 2004b). This range of ecosystem types provides habitat for a diversity of wildlife, including a number of rare and endangered species (Lindh & Martin, 2004).

1.3.2 Whistler the Community: Past to Present

The community of Whistler was originally founded on the shores of Alta Lake in the early 1900's. When the first ski lifts and roads were installed in 1965-66, the valley was home to just over 500 people (R.M.O.W., 1997). After a period of rapid growth, the provincial government froze all land development in 1974 to establish a local government capable of planning future development in the valley (R.M.O.W., 1997). Over the years, growth has continued in Whistler, but in a more controlled fashion. Today, the community supports 10,000 residents and draws over 2 million visitors each year (R.M.O.W., 2004a). While more tourists visit in the winter for the world-class skiing on Whistler and Blackcomb mountains, summer visitation accounted for over 40% of the total visitation in 2001 (R.M.O.W., 2003). Popular summer activities include hiking, mountain biking, bear viewing, helicopter tours, golfing, ecotours, all terrain vehicle (ATV) tours, swimming, and other water-based sports (Lindh & Martin, 2004; Needham, Wood, & Rollins, 2004).

1.3.3 Whistler the Community: The Future

In recent years, the community of Whistler has undertaken several planning processes to ensure that they can attain their shared vision of the future, which is "to be the premier mountain resort community" (R.M.O.W., 1997: 10). In 2002, the community began a process called "Whistler - Its Our Future." The outcome of this process is the

Whistler 2020 Comprehensive Sustainability Plan (CSP), which contains three volumes of documents outlining the resort community vision, values, priorities, and directions[1]. Throughout the entire planning process, planners have undertaken extensive efforts to involve the residents of Whistler by holding open houses, providing information online, and conducting opinion surveys. While planners in Whistler have undertaken extensive efforts to obtain feedback from residents, relatively little effort has been expended to engage visitors directly in the planning process, or to at least include their opinions and preferences indirectly through appropriate surveys. This research complements existing planning processes by obtaining feedback from visitors on issues related to land use planning within the Resort Municipality of Whistler.

1.4 Organization of this Report

The remainder of this report is structured as follows. Chapter 2 reviews literature relevant to land use planning at tourist destinations, past research on choice experiments in planning, and literature on the use of landscape indices for measuring land use patterns. Chapter 3 reviews the methodology used to develop and implement the discrete choice survey and the decision support tools. Chapter 4 discusses the research findings. This includes a presentation of the results of the discrete choice experiment, including a basic multinomial logit (MNL) model, several key segmentations, and models with additional attributes and interactions. The strongest model is then used to evaluate several alternative land use scenarios in Whistler using an aspatial decision support tool and a spatial GIS-based decision support tool. Finally, Chapter 5 presents the key implications of this study for (a) planning at resort destinations in general, (b) future planning in Whistler, (c) development and implementation of spatial DCEs, and (d) extension of spatial decision support tools in GIS.

[1] These documents can be viewed at http://www.whistler.ca/Sustainability/Whistler_2020/; accessed July 8, 2005.

CHAPTER 2 LITERATURE REVIEW

2.1 Land Use Planning at Tourist Destinations

Land use denotes the human employment of the land, such as settlement, recreation, pasture, rangeland, etc. (Turner & Meyer, 1994). Land use differs from land cover, which describes the physical state of the land, although a single land use often corresponds well to a single class of land cover (e.g., pastoralism to unimproved grassland) (Turner & Meyer, 1994). In general terms, land uses at a resort destination can be broadly categorized into three classes: (a) developed areas (i.e., land with permanent structures for tourist facilities, resident housing, commercial buildings, roads, etc.), (b) protected areas and other environmentally sensitive areas that are protected from activities such as development and recreation, and (c) a matrix of relatively undeveloped land that includes recreational areas (i.e., urban parks and fields, trails, golf courses, etc.) as well as areas for potential future development or resource extraction.[2]

Different amounts and spatial arrangements of developed areas, recreational opportunities, and protected areas can be expected to result in differing impacts on the environment of a resort. Alternative spatial arrangements also clearly have economic and social implications, which may inhibit or promote land use configurations that support environmental sustainability. This research attempts to better understand some of the social implications of alternative land use configurations. In particular, the expected impact of alternative land use configurations on the tourist experience is investigated. The alternative land use configurations investigated are those that could have very different environmental impacts. Modeling such land use configurations ensures that the social preferences obtained could be linked to ecological models in a

2 The categories of land uses used by the Whistler Environmental Strategy are grey areas (developed areas), light green areas (recreational greenways), and dark green areas (protected areas).

larger process that jointly investigates the social and environmental impacts of alternative land use configurations.

In the following three subsections, the environmental impacts associated with different patterns of the three land uses (developed areas, undeveloped and recreational areas, and protected areas) are discussed. For each land use, a review of the impacts is followed by a summary of literature that identifies preferred patterns of land use at resort destinations. It should be noted that while there has been significant work on developing spatial models for tourism (e.g., Getz 1988; Inskeep 1988, 1991; Lawson and Boyd-Bovy 1977), existing models have been developed independently of one another and are highly fragmented (Pearce, 1995). Furthermore, existing models are not structured to be capable of identifying a preferred pattern of land use due to their descriptive or explanatory nature (Dredge, 1999). Therefore, the review of preferred spatial patterns at destinations will focus on summarizing guidelines and recommendations developed by researchers, planners, and architects based on their own experiences and evaluations of what patterns of land use have proven to be successful at resort destinations in the past. These planning guidelines are complemented by a review of empirical research on the preferences of residents or tourists for alternatives related to land use. Finally, the spatial strategies adopted in Whistler are reviewed for each type of land use.

2.1.1 Developed Areas

2.1.1.1 Impacts of Development

Tourism development can generate both negative and positive environmental impacts depending on how the development is planned and managed (Inskeep, 1991). In terms of positive impacts, tourism can help justify and pay for conserving important natural areas, archaeological sites, or historic sites. Tourism can also provide an incentive for 'cleaning up' the environment, restoring habitat, reducing exploitation pressures on wildlife, improving infrastructure, or maintaining a clean and attractive environment (Hunter & Green, 1995; Inskeep, 1991). Another commonly cited benefit of tourism is that it can increase local environmental awareness and stress the importance of ecological conservation for maintaining the economic return of the key tourism product: the destination itself (Inskeep, 1991).

There are also several negative impacts that may occur if tourism development is not carefully planned, developed, and managed (Inskeep, 1991). Components of the built environment alter the landscape by removing habitat directly and fragmenting the remaining habitat (Theobald et al., 1997). Vacation home development can lead to problems associated with urban sprawl (Inskeep, 1991) and urbanization is a leading cause of species endangerment (Czech, Krausman, & Devers, 2000). Expansion of development can also disrupt animal behaviour and ecological systems (Chace, Walsh, Cruz, Prather, & Swanson, 2003; Hunter & Green, 1995; McKercher, 1993). In mountain destinations, buildings tend to occupy critical ecotones (e.g., valley bottom riparian areas) and the construction of subdivisions can affect entire valley cross-sections and disrupt migration routes along valley bottoms (Riebsame, Gosnell, & Theobald, 1996). Road infrastructure is generally associated with development, and roads travelled by cars result in wildlife road kills, vehicle disturbance and avoidance, and barrier effects (Forman & Alexander, 1998). The impervious surfaces associated with roads, buildings, and other infrastructure greatly intensify stormwater runoff, enhance stream channel erosion, diminish groundwater recharge, produce non-point source water pollution, and influence regional climate and air quality (Stone, 2004). Air pollution at tourist destinations can result from excessive use of internal combustion vehicles (cars, buses, and motorcycles) and the burning of fossil fuels to provide heat and power (Hunter & Green, 1995; Inskeep, 1991; Kirkpatrick & Reeser, 1976). Noise and visual pollution can also be generated by a concentration of tourists and poorly planned development (Hunter & Green, 1995; Inskeep, 1991). Finally, significant amounts of tourism development can pose a challenge for waste disposal and utilize harmful amounts of energy, water, and other materials (Hunter & Green, 1995; Inskeep, 1991; McKercher, 1993).

Some of the environmental impacts of development can be exacerbated or mitigated with different patterns of development. For example, a more compact, clustered type of development has the potential to decrease fragmentation of wildlife habitat caused by roads and houses, leaving the rest of the landscape in a condition more suitable for wildlife species that are sensitive to elevated human presence (Odell, Theobald, & Knight, 2003; Theobald et al., 1997). Development patterns also affect the feasibility of using alternative, lower impact systems to supply resources and services (Alberti, 1999). For example, compact development tends to be associated with mixed land uses, which leads to a reduction in the need for transportation infrastructure and travel and an increase in lower impact forms of transportation, such as walking, biking, or transit (Frank & Pivo, 1994; Handy, 2005; Kenworthy & Laube, 1996). Another key consideration related to transportation in a resort destination is the proximity of workforce housing to employment opportunities in the resort. In some tourist destinations, employees live in neighbouring communities and commute to work (Gober, McHugh, & Leclerc, 1993), which contributes to road congestion, energy consumption, and air pollution. Finally, different urban patterns require different resources to support human activities (Alberti, 1999). For example, a destination with a large proportion of single family dwellings as opposed to multifamily dwellings increases the amount of land and materials needed for housing construction and lowers the efficiency of resource use per capita (Liu, Daily, Ehrlich, & Luck, 2003). Overall, a sprawling pattern of development can result in both direct land transformation and resource intensive lifestyles (Alberti, 1999).

2.1.1.2 Guidelines and Preferences for Development at Resort Destinations

Typical social and economic forces give rise to pressures for increased development at tourist destinations. Despite the economic appeal of continued growth there are limits to growth for any tourist destination, especially in mountain resorts, which are typically constrained by the availability of suitable land for buildings and infrastructure (Butler, 1997; Gill & Williams, 1994). In addition, most natural sites can accommodate only a limited number of visitors without detriment because as the numbers of visitors or facilities increase, the quality of the experience progressively decreases as the site becomes physically damaged and invaded by facilities, losing its contact with the surrounding environment (Lawson & Baud-Bovy, 1977). Destination planners clearly must pay attention to the ability of an area to absorb tourism in relation to the possibility of environmental and social degradation (Hall & Page, 1999).

Growth management strategies, which may include limits on the total amount of development, are a common way for planners to deal with the perceived threats associated with excessive development (Getz, 1983; Gill & Williams, 1994). Estimating the maximum capacity of a given area without unacceptable effects on the physical environment and without an unacceptable decline in the quality of experience gained by visitors (i.e., carrying capacity) is another concept relevant to determining optimal resort size (Mathieson & Wall, 1982). While this concept of carrying capacity is intuitively appealing, it has been difficult to operationalize in tourism and researchers have long given up the search for a single number that represents the maximum capacity or size for a destination (Butler, 1997).

The planning literature that discusses preferred spatial patterns of development is somewhat more informative than the literature on resort size. In an early work on spatial planning for tourism, Gunn (1965: 25) recommended that "a tourism recreation region be designed as an entity comprising certain essential elements arranged in a purposeful manner having the objectives of improved conservation and utilization of the land, increased owners' rewards, but most of all, heightened user satisfactions." He described a regional system composed of community-attraction complexes that are clustered or buffered from one another depending on their compatibility, circulation corridors that connect the complexes, and the non-attraction hinterland where no tourism recreation development takes place. Gunn (1965) also outlined the different types of land uses considered to be appropriate within the different zones that radiate from the centre of the community (e.g., urban, urban oriented, moderately urban oriented, and slightly urban oriented).

A number of other authors have analyzed the successful elements of existing tourist destinations and subsequently outlined some general spatial principles of planning that can be applied to most tourism developments (Inskeep, 1988, 1991; Lawson & Baud-Bovy, 1977; Pearce, 1989). For example, Inskeep (1988) stated that while resort planning principles clearly vary depending on the type of resort and its environmental setting, they usually include:

> "considerations of maintaining 'contact with nature', orienting accommodation near but not encroaching on the attraction features, concentrating major commercial and cultural facilities in a central locale, providing diverse recreation facilities and activities, controlling access points, and - in a large resort - laying out land uses so that they can be developed in stages" (Inskeep, 1988: 367).

Many of these recommendations have been echoed by other researchers (Lawson & Baud-Bovy, 1977; Pearce, 1989). Additional recommendations include: developing the area harmoniously to avoid compromising the site physically or visually with inappropriately placed development (e.g., maintain view planes and corridors); providing adequate housing and facilities for employees; and creating a buffered zone of landscape area around the resort (Inskeep, 1991; Pearce, 1989).

Several authors have also provided guidelines specific to ski destinations or mountain resort communities. In a handbook on resort development, Schwanke (1997 :151) described the pattern of a successful ski resort as:

- High density development surrounding a central base area, which provides the principal activity focus.
- Medium density development located further from the core area.
- Single family development beyond medium density development, sometimes on surrounding slopes.
- Satellite development, with additional hotels or condominiums, farther from the ski area.
- Retail development arranged to serve the resort's various groups, with specialty shops, restaurants, and ski shops and services located close to the core and various services and larger stores set farther out.

Schwanke (1997) noted that a concentration of tourist facilities is important to enhance user convenience and produce social nodes or "positive congestion," and that clustering units is one of the most efficient methods to maximize residential lots while preserving open space. Dorward (1990) also provided some lessons from past ski developments. She emphasized the importance of designing a strong core, setting clear community boundaries, and maintaining important balances between urbanity vs.

wilderness and real town vs. resort that are essential to the creation of a mountain place where people want to spend time.

In summary, common elements in the mountain resort planning literature include developing a strong, compact core and locating tourist facilities and development close to the core. Separate nodes may be developed up and down the valley. Another key consideration for resort development is to be sensitive to the landscape and to blend nature and development.

While these planning guidelines help identify patterns of tourist development that can be expected to provide a quality tourist experience, they do not provide information about tourist attitudes towards alternative tourism development scenarios. This information would be especially relevant for any destination that depends on repeat visitation and would like to know how future change in land use at the resort would affect tourists. In addition, this information would be useful for planners who are developing new resorts and wish to target specific types of tourists. While some previous research has examined tourist preferences for a limited amount of tourist development in parks (Hearne & Salinas, 2002; Naidoo & Adamowicz, 2005) and tourist choices of Caribbean beach destinations (Haider & Ewing, 1990), there has been no empirical research on how tourists perceive different amounts or types of development at mountain resort destinations.

2.1.1.3 Development at Whistler

The Resort Municipality of Whistler (RMOW) has long recognized the need for a growth management plan to ensure long term success. In 1991, a 'bed cap', or a cap on the number of bed units that could be developed in the municipality, was set at 50,199 bed units. This limit has slowly increased over the years to 55,087 bed units (R.M.O.W., 2005b). This cap was set because community leaders felt that ongoing growth would negatively impact the community's social fabric and the area's natural ecology (R.M.O.W., 2004b). In addition to limiting the number of bed units, key goals are to minimize the total area developed or disturbed (currently approximately 1,250 ha or

7.6% of the municipality) and the total effective impervious area (currently approximately 13%) (R.M.O.W., 2005b).

In addition to setting strict limits on the amount of allowable development, the municipal government set restrictions on the form of development that is allowed to occur in different locations. Commercial development has been, and will continue to be, concentrated at the core of the community in Whistler Village (R.M.O.W., 2005b). In order to avoid continuous suburban sprawl, most of Whistler's current neighbourhoods have been built in distinct nodes along the highway consisting of relatively compact clusters of development that are well serviced, have a mix of residential and commercial uses, and offer access to nature (R.M.O.W., 2005b). While this pattern has helped to preserve green space in between neighbourhoods and facilitate outdoor access, it has increased Whistler's "footprint" (R.M.O.W., 2005b). As Whistler approaches "build out," the municipality plans to discourage large sprawling areas of exclusively low-density, single-family developments, while encouraging development of a strong central core at the village and complete neighbourhoods at existing nodes up and down the valley (R.M.O.W., 2002: 57).

2.1.2 Recreational Opportunities

2.1.2.1 Impacts of Recreation

A variety of outdoor recreational opportunities are common at mountain destinations in the summer, including hiking, backpacking, mountain biking, motorized tours (e.g., helicopter, ATVs), rock climbing, fishing, swimming, golfing, and other facility-based sports (e.g., tennis) (Schwanke, 1997). Notwithstanding several benefits, recreation activities can have significant detrimental impacts on a destination's natural environment. For example, recreation has been cited as the activity affecting the second greatest number of endangered or threatened species on federal land (Losos, Hayes, Phillips, Wilcove, & Alkire, 1995), and the fourth leading cause of species endangerment on all lands (Czech et al., 2000). This review will focus on the negative environmental impacts associated with two types of recreational activities that have important implications for planning at a landscape scale: golfing and trail-based activities such as hiking and biking.

Golf is a rapidly expanding sport that has gained significant popularity worldwide over the past several decades (Pleumarom, 1992) and golf courses are commonly developed in conjunction with resorts (Inskeep, 1991). Golf courses provide an excellent form of recreation and have other benefits related to aesthetics, cooling, noise abatement, and enhancement of real estate values (Balogh, Gibealt, Walker, Kenna, & Snow, 1992). However, research has shown that golf courses can have significant negative impacts on the environment. Construction and management of golf courses typically requires disturbance and exposure of soil, intensive irrigation, pest management and fertilization (Balogh et al., 1992). These activities can lead to a number of environmental problems including (a) soil erosion, (b) higher concentrations of trace metals and organochlorine pesticides in sediments, (c) contamination of groundwater and surface water with pesticides and fertilizers, and (d) changes in the biotic composition of periphyton and benthic macroinvertebrate communities in streams on golf courses (Balogh et al., 1992; King, Harmel, Torbert, & Balogh, 2001; Kunimatsu, Sudo, & Kawachi, 1999; Lewis et al., 2002; Lewis, Foss, Harris, Stanley, & Moore, 2001; Line, White, Osmond, Jennings, & Mojonnier, 2002; Mallin & Wheeler, 2000; Winter, Dillon, Paterson, Reid, & Somers, 2003; Winter, Somers, Dillon, Paterson, & Reid, 2002).

Golf courses can also impact terrestrial species and habitats (Balogh et al., 1992). Research suggests that golf courses may have similar or even higher densities and diversity of bird species compared to developed areas, farmland, and even natural areas, especially when the golf course is designed in a natural fashion (Blair, 1996; Tanner & Gange, 2005; Terman, 1997). However, golf courses do not maintain the original species composition or abundance of the predevelopment community (e.g., fewer native bird species, fewer sensitive species) and they may not be able to support ecologically viable communities of the species that are present (Blair, 1996; Dale, 2004; Terman, 1997). Terman (1997) suggested that even though naturalistic golf courses cannot offer the same habitat as natural areas for birds, constructing a naturalized golf course can help mitigate some of the negative impacts of golf courses. Overall, the potential environmental impact of golf courses is quite high, but the actual environmental impact of golf courses depends on the specific location, construction, and management of the golf course. In terms of spatial pattern, one would expect that the potential impacts of golf courses would increase as the number and density of golf courses increases in a certain area. Unfortunately, most studies simply look at the impacts of individual golf courses and do not relate the arrangement of golf courses in an area to their environmental impacts.

Other forms of outdoor recreation that are increasing rapidly in popularity are hiking and especially mountain biking (Taylor & Knight, 2003). While these forms of recreation can leave a much less noticeable change in the landscape compared to golf courses, trail-based hiking and biking activities may also have significant impacts on the environment. The impacts of recreational activities on nature include (a) changes in vegetation communities and soil structure caused by trampling (Liddle, 1975), (b) alteration of microclimatic and topoedaphic conditions near recreational trails (Cole, 1981), (c) introduction of new vectors of species dispersal, which enables the invasion of exotic species (Cole, 1981), (d) changes in nest predation rates close to trails (Miller & Hobbs, 2000; Miller, Knight, & Miller, 1998), (e) differences in the use of areas close to recreational trails by certain species (S. G. Miller et al., 1998; Whittington, St Clair, & Mercer, 2005) , and (f) direct disturbance of wildlife, which may have long term population level consequences (Miller, Knight, & Miller, 2001; Taylor & Knight, 2003; Yalden & Yalden, 1990). Some of the negative impacts of recreation can be mitigated by restricting the number and spatial arrangement of trails (e.g., consolidating trails to existing habitat edges), encouraging recreational use to occur on existing trails only, spatially or temporally restricting the amount or type of recreational use of existing trails, and implementing buffer zones or minimum approach distances to wildlife (S. G. Miller et al., 1998; Miller et al., 2001; Taylor & Knight, 2003). These recommendations suggest that different arrangements and densities of trail networks are associated with different levels of environmental impact.

2.1.2.2 Guidelines and Preferences for Recreation at Resort Destinations

Provision of recreational opportunities at resorts is a key consideration for ensuring a successful destination. The resort planning literature contains a limited number of guidelines for the ideal amount and arrangement of golfing and trail-based recreational opportunities. Some guidelines suggest that the development of golfing opportunities at a resort should depend on site considerations, the purpose of the course(s), the type of golfer that will be attracted, and the type of the resort (Schwanke, 1997). It is also recommended that multiple courses that each serves a different group of users should be developed. However, golf course development should be approached cautiously because golf course development can create significant controversy in a resort destination (Markwick, 2000; Wyllie, 1998). As well, the expansion of golfing opportunities can lead to an oversupply of golf courses, which threatens the economic viability of new and/or existing golf courses or the social and ecological sustainability of an entire region (Neo, 2001; Pleumarom, 1995; Priestley, 1995; Warnken & Thompson, 2001). Other than this research cautioning against developing an oversupply of golf courses, little academic literature addresses the ideal number of golf courses for mountain resort destinations.

There is also little research on the preferences of the public for the number of golf courses at a tourist destination. One study investigated the perceptions of golfers and non-golfers in Singapore, a country that has 22 golf courses within a total land area of 66,000 ha (Neo, 2001). When survey respondents were asked whether they would support proposals to allow more golf courses, 84% of non-golfers and 37% of golfers would not. The top reasons for not supporting golf course expansion were a scarcity of land, a preference for other land uses, and an opposition to the elitist nature of golf (Neo, 2001). This study concluded that the objection to golf largely stems from its spatial extensiveness. Similar findings may or may not be observed in a resort setting; there are no published articles on tourist preferences for golfing opportunities at resorts to date.

In terms of guidelines for trail-based recreation, there are standards for the amount of recreational activities and services that should be available at resorts (Inskeep, 1991; Lawson & Baud-Bovy, 1977). For example, standards for different types and amounts of walking, hiking, and biking trails or different types of parks are expressed in persons per kilometre of trail or persons per hectare of park. These numbers are based on the typical capacities that can be absorbed for each activity.

As with golf, there is limited research on preferences for different amounts or configurations of trail-based recreation at a destination. Only one study has investigated the perspectives of tourists towards characteristics of outdoor recreation (e.g., crowding, management strategies, trail conditions) at a resort destination in the summer (Needham et al., 2004). This research suggested that visitors to Whistler were not particularly drawn to amenities like restaurants and motorized activities, but were supportive of more interpretive and educational opportunities. Also, visits were negatively impacted by crowding and helicopter tours at some sites. The majority of recreational research has investigated preferences of users for different aspects of an outdoor recreational activity in specific locations such as National Parks or recreational areas near urban centres. In general, surveys of recreational users have generally focussed on preferences for alternative conditions, facilities, or management strategies (see a review in Manning, 1999), or different levels of crowding (Shelby, Vaske, & Heberlein, 1989). Only one study included spatial aspects such as trail lengths and topography (Morey, Buchanan, & Waldman, 2002). This study found that mountain bikers' preferences for trail length depended on the amount of elevation gained; preferences were for shorter and steeper trails or for longer and flatter trails. There is clearly an opportunity to conduct further research on the preferences of tourists for different amounts and configurations of recreational opportunities at mountain resorts.

2.1.2.3 Recreational Opportunities at Whistler

Approximately 86% of the total area in the Resort Municipality of Whistler is zoned Rural Resource One (RR1), which allows for indoor and outdoor recreation facilities, schools, and other public institutions (R.M.O.W., 2005c). Within these areas as well as some adjoining parks and developed areas, Whistler has an extensive outdoor recreation system that consists of 162 kilometres of trails, numerous parks, three golf courses, and many ski runs and the corridors that connect them (R.M.O.W., 2002). This extensive network of trails, parks, and other recreational greenspaces is cited as one of the key ingredients to the Whistler experience (R.M.O.W., 2002).

In addition to recognizing the value of these outdoor recreational opportunities, the municipality recognizes the potential environmental impacts of the various activities and several strategies have been adopted for the future. The Whistler Environmental Strategy recognizes that lower trail densities are generally better for the environment (R.M.O.W., 2002: 27). However, it is also recognized that the desire to maintain a low density network of trails must be balanced against maintaining resident and visitor experience, which may involve continual improvements to the outdoor recreation network, especially if crowding levels increase.

2.1.3 Protected Areas

2.1.3.1 Impact of Protected Areas

A protected area is an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity and natural and associated cultural resources, and managed through legal or other effective means (I.U.C.N., 1994). Protected areas generally provide environmental benefits by restricting activities that cause ecological damage. Therefore protected areas are generally associated with positive environmental impacts. Any negative impacts associated with protected areas are likely to be social or economic rather than environmental in nature. For example, setting an area aside as protected may modify the recreational or some other traditional community use of the area, increase the cost of living, or eliminate economic activities such as logging or development of tourist infrastructure (Fortin & Gagnon, 1999).

Although protected areas alone are not sufficient to conserve biodiversity, they are recognized to be the cornerstone of conservation strategies (Margules & Pressey, 2000; Noss, 2000). In addition to protecting biodiversity, some of the key environmental benefits of protected areas, especially in more urbanized areas, include (a) improvement of air quality, (b) moderation of temperature and humidity, (c) regulation of rainfall and provision of flood control, (d) filtration of water, (e) conservation of soils, and (f) noise reduction (Bolund & Hunhammar, 1999; Geoghegan, 2002; Hornsten & Fredman, 2000;

Miller, Collins, Steiner, & Cook, 1998; Morancho, 2003; Niemela, 1999). There are also a number of social benefits, such as (g) increased aesthetics, (h) better health of residents, (i) provision of recreational opportunities, and (j) enhancement of community and cultural cohesion. In many cases, especially in more developed regions, protected areas are expected to maintain these values as well as protect biodiversity (Haight, Snyder, & Revelle, 2005; Ruliffson, Haight, Gobster, & Homans, 2003).

As with development and recreation, the amount and configuration of protected areas across the landscape influences the environmental impacts associated with protected areas. A commonly cited target by many international commissions and nature conservation organizations is the protection of at least 10% or 12% of the total land area in each nation or in each ecosystem (Hummel, 1995; W.E.C.D., 1987). However, biologists warn that protecting only 10% of Earth's ecosystems could make at least half, if not all, terrestrial species vulnerable to anthropogenic extinction in the near future (Soule & Sanjayan, 1998). On average, the amount of area required to represent and protect most elements of biodiversity may be about 50% (Soule & Sanjayan, 1998), but the exact amount of area required to be protected varies widely depending on several factors (Fahrig, 2001). It is generally agreed that larger amounts of protected areas will increase the chances of successfully maintaining a full complement of species.

Although the amount of area protected is a key consideration, the spatial configuration of protected areas is also important in terms of the effectiveness of reserve networks. The two primary goals of establishing a reserve network are achieving representativeness and persistence (Margules & Pressey, 2000). Representativeness refers to the need to represent the full variety of biodiversity within reserves, while persistence refers to the ability of reserves to promote the long term survival of the species and other elements of biodiversity they contain. In order to meet the goal of representativeness, reserves must be located in relation to natural physical and biological patterns (Margules & Pressey, 2000). Various criteria have been used to select sites for protection, including measured or predicted species diversity, rarity, vulnerability/irreplaceability, naturalness, representativeness, and total area (see Scott & Sullivan, 2000 for a review). Overall, different configurations of a protected area network will contribute more or less to the goal of representativeness depending on the actual distribution of species and habitats across the landscape.

A second reason why spatial configuration of protected areas is important is because different spatial arrangements contribute more or less to the goal of persistence, which requires the maintenance of ecological processes. A number of theories on ecological and evolutionary processes provide some guidance as to the desirable spatial characteristics of protected area networks, such as the equilibrium theory of island biogeography (MacArthur & Wilson, 1969), metapopulation dynamics (Holt & Gaines, 1993), and source-sink population structure (Dias, 1996). For example, if a reserve network is highly fragmented, the ability of a species to migrate and colonize new areas may be restricted (Briers, 2002; Williams, ReVelle, & Levin, 2004). Because the spatial arrangement of reserves is important to ensure the long term maintenance of ecological processes, many reserve selection processes now explicitly consider spatial attributes such as compactness, contiguity, proximity, or some other form of connectivity as well as traditional attributes such as species richness or rarity (Briers, 2002; McDonnell, Possingham, Ball, & Cousins, 2002; Nalle, Arthur, & Sessions, 2001; Nicholls & Margules, 1993; Onal & Briers, 2002; Rothley, 1999; Siitonen, Tanskanen, & Lehtinen, 2003; Williams et al., 2004).

2.1.3.2 Guidelines and Preferences for Protected Areas at Resort Destinations

Preserving open space and the environment is a key principle in tourist destination planning. A number of authors have stressed the importance of protecting the natural environment around a resort destination, especially in mountain regions, which often contain ecologically sensitive and important areas (Economic Commission for Europe (ECE), 1988; Farrell & Runyan, 1991; Inskeep, 1991; Lawson & Baud-Bovy, 1977; Schwanke, 1997). This can be achieved by providing private open space, or by classifying important natural sites as nature parks (i.e., natural sanctuaries or strict nature reserves, national parks, regional parks, natural monuments, etc.) (Lawson & Baud-Bovy, 1977; Schwanke, 1997). This emphasis on protection is warranted because the setting is often the primary attraction at resorts, and because specific scenic areas, nature parks, conservation areas, and archaeological and historic sites are also often key tourist attractions (Inskeep, 1991; Schwanke, 1997).

In general, the type and amount of open space should relate to the expectation of the targeted markets (Schwanke, 1997). Open space can simply serve as a visual amenity and environmental asset, or it can be carefully programmed for recreational uses (Schwanke, 1997). In cases where protected areas are accessible for recreation, various standards for parks and open space in a tourist destination or urban environment may be useful (Gedikli & Ozbilen, 2004; Inskeep, 1991; Lawson & Baud-Bovy, 1977). Overall, there is a definite recognition of the importance of protected areas in the tourism planning literature, but recommendations on how much area should be protected and in what configuration are minimal.

The emphasis placed on protecting the environment by planners is justified by empirical research on tourist and resident preferences for environmental conservation and protected areas. A number of studies have shown the value or importance of protected areas, and preservation of biodiversity and the environment in general, to both tourists (Dharmaratne, Sang, & Walling, 2000; Lee & Han, 2002; Naidoo & Adamowicz, 2005) and residents (Croke, Fabian, & Brenniman, 1986; Liu, Sheldon, & Var, 1987; Lockwood & Kathy, 1995). These studies demonstrated that environmental protection and protected areas have high use and/or non-use value to residents and tourists alike. In addition, studies have shown that tourists seek activities and experiences that depend on a high-quality physical environment (Tyler, 1989) and protected areas are an important factor in destination choice (Boo, 1990).

Research has also shown that attitudes towards protected areas depend on several factors. For example, for residents of an urban area, the type of land being preserved, the degree of protection, and the amount protected seems to be important (Backlund, Stewart, & McDonald, 2004; Johnston, Opaluch, Grigalunas, & Mazzotta, 2001; Johnston et al., 2002; Kline & Wichelns, 1998). However, there is no research to date that investigates how preferences vary depending on the spatial arrangement of protected areas across the landscape. In addition, although it has been suggested that residents and visitors in resort communities are likely to place a higher value on open space left in its natural state (Schwanke, 1997), the value of different amounts of area protected within a mountain destination to tourists has not yet been reported.

2.1.3.3 Protected Areas at Whistler

The 1,300 ha of developed lands within the Resort Municipality of Whistler are primarily located in the valley bottoms, which tend to be home to the most critical habitats and the greatest biodiversity (R.M.O.W., 2005c). In total, parks and protected areas currently represent about 3.7% (603.9 ha) of the total area within the municipality of Whistler (R.M.O.W., 2005c). However, over half of this area is classified as "active use" parks such as Rainbow and Meadow Parks, which represent areas that are significantly altered from their natural state.

Over the years, there has been an increasing awareness of the importance of the environment and its intrinsic relation to Whistler's long term success (R.M.O.W., 2002). One of the recommendations of the Whistler Environmental Strategy (WES) developed in the late 1990s was to develop a protected areas network (PAN) encompassing nearly all of the remaining undeveloped area in Whistler. The primary goal of a PAN would be to ensure retention and management of 'critical natural areas' such as streams, lakes, wetlands, riparian areas, stands of old growth, a large percentage of alpine and sub-alpine areas, and the connections between these ecosystems (R.M.O.W., 2004b: 56).

A process to establish a PAN in Whistler began in 2002 and is nearly complete (R.M.O.W., 2005a). Essentially, the proposed Whistler PAN identifies a system of sensitive and important ecosystems and the corridors connecting them, creates different levels of protection for the system, and establishes measures to protect, maintain, restore and enhance the ecological attributes of the system (R.M.O.W., 2005a). The sensitive ecosystems were identified based on Terrestrial Ecosystem Mapping (TEM) of the municipality conducted in 2004 (Green, 2004). Based on the TEM maps, areas within the RMOW were classified into one of three distinct levels of protection (Table 2.1). PAN 1 areas will have greatest restriction on allowed uses and will receive the highest degree of protection while PAN 3 areas will allow a variety of uses as long as certain conditions are met.

Table 2.1 Levels of the Protected Areas Network (PAN) in Whistler

Level	Description	Management Intent	Permitted Uses, Activities & Development	Example Ecosystems Included
PAN 1	Preservation	To maintain areas in their natural state.	None. No human structures built, including trails. Ecological restoration and enhancement is permitted.	Wetlands Habitat for rare and endangered species
PAN 1	Conservation	To maintain areas in their natural state with some low impact human use possible.	Amenities/activities with minimal disturbance for interpretive, educational or research purposes and consisting of pedestrian only nature trails built to specific standards, viewing platforms and associated features such as benches and interpretive signage. Ecological restoration and enhancement is permitted.	A 30 m buffer around wetlands Alluvial forests greater than 2 ha in size Low elevation old growth plus a 30 m buffer Avalanche tracks plus a 30 m buffer
PAN 2	Conservation	Protection of ecological processes and functions.	PAN 1 permitted uses, crossings (road, bridge, ski lift, ski trail, utility, and all non-motorized municipal trail types) and fire access roads.	Wetlands 100 m review area A 15-30 m buffer around streams Riparian TEM polygons Alluvial forests less than 2 ha in size Low elevation mature forests High elevation mature and old growth forests High elevation ecosystems 100 m east-west cross-elevation corridors 500 m north-south mid-elevation corridors
PAN 3	Ecosystem Management Areas	Ecologically responsive planning and development.	PAN 1 and PAN 2 permitted uses, development as per zoning.	A 100 m buffer around permanent streams Low elevation second growth Rocky outcroppings

Data source: R.M.O.W. (2005a), Tables 26 and 27

2.1.4 Summary

The amount and spatial arrangement of developed areas, recreational opportunities, and protected areas significantly influences the ability of any community, including resort destinations, to move towards sustainability by minimizing their negative impact on the environment. The spatial arrangement of different land uses also has the potential to significantly affect the visitor experience at a resort destination. While a number of guidelines for developing successful resort destinations have been published, the outcomes of these guidelines have typically not been empirically evaluated. However, Gunn (1994: 12) suggested that the "worth of the planned development is not to be judged solely by the owner nor the planner but by the visitor." In addition, Mitchell and Murphy (1991) suggested that more research needs to be done on the tourist wants, desires and needs so that these demand characteristics can be integrated into existing tourism models. Methods are needed to investigate tourist perspectives of alternative spatial arrangements of land uses being considered for resort destinations. Certain public involvement procedures used in planning, such as stakeholder processes or open houses, are difficult to apply to such as loosely defined and transient population. Techniques such as surveys appear to be more useful to investigate the preferences of tourists. The next section describes the advantages of one survey technique in particular, discrete choice surveys, for assessing visitor preferences of alternative planning options.

2.2 Discrete Choice Experiments

2.2.1 Introduction to Discrete Choice Experiments

Among the different methods to involve a transient group of people like tourists, surveys are especially valuable. While surveys are useful for incorporating preferences of a large number of people in a quantitative manner and improving the representativeness of public input, conventional surveys are subject to a number of weaknesses. For example, the structure of questions cannot easily incorporate the multi-attribute nature of trade-offs and the wording of questions can easily influence the nature of the response (Haider & Rasid, 2002). In addition, traditional opinion surveys represent a compositional approach, which requires respondents to evaluate aspects of complex management issues separately and the researcher to calculate, or compose, an overall utility value of an alternative according to some predefined decision rule when evaluating scenarios (Haider, 2002).

One type of survey technique that overcomes some of the limitations of conventional surveys, while enabling an assessment of preferences and tradeoffs for policy outcomes, is the discrete choice experiment (DCE). Choice experiments constitute a decompositional approach (Haider, 2002), in which respondents evaluate entire alternatives, or bundles of commodities as a whole, rather than components of alternatives individually (Johnston et al., 2001). For example, respondents may be asked to choose between two bundles of public and private commodities that differ across several physical, political, environmental, aesthetic, and/or economic dimensions (Johnston et al., 2001; Swallow, Weaver, Opaluch, & Michelman, 1994). These two bundles of goods may not only differ in terms of their impact on valued resources, but there may be differences in the associated monetary cost for each profile (Johnston et al., 2001). Including a monetary component allows the researcher to estimate the respondent's willingness to pay or willingness to accept the policy outcomes being tested. Although including a payment vehicle is common in choice experiments, it may be excluded, in which case estimates of rates of in-kind trade-off or substitution may be obtained instead (Johnston et al., 2001).

Discrete choice experiments were first applied in marketing and transport economics (Louviere & Hensher, 1982; Louviere & Woodworth, 1983), but have since been applied in the fields of environmental valuation (Hanley, Wright, & Adamowicz, 1998; Johnston et al., 2001; Kline & Wichelns, 1998; Mallawaarachchi et al., 2001; Morrison, Bennett, & Blamey, 1999), recreation and tourism research (Crouch & Louviere, 2000; Haider, 2002; Haider & Ewing, 1990; Lawson & Manning, 2002), and public policy and land use research (Haider & Rasid, 2002; Johnston et al., 2002; Kline & Wichelns, 1998; Swallow, Opaluch, & Weaver, 1992). With respect to land use planning, choice experiments allow managers to compare welfare implications of growth management or land preservation alternatives and assess the likelihood that policies will receive support (Johnston et al., 2001). By asking individuals to make tradeoffs between entire alternatives, the researcher is able to determine the preferences, or partial utilities, of the various survey attributes, which often correspond to policy objectives or outcomes.

While discrete choice experiments involve considerable effort in design, both in the development of scenarios that are relevant to the respondent and in the use of statistical design methods (Adamowicz, Boxall, Williams, & Louviere, 1998), and care must be taken to ensure that the task required of the respondents is manageable, the discrete choice survey approach has several key advantages over more traditional, compositional survey designs. First, the model on which the approach is based, the random utility model, has a strong basis in behavioural theory (McFadden, 1974). Second, a task that requires a respondent to make a choice, even if only a hypothetical choice, is considered to be closer to actual behaviour than a rating or ranking task (Haider, 2002; Morey, Rossmann, Chestnut, & Ragland, 2000). Third, the method enables the exploration of hypothetical alternatives (e.g., future planning scenarios) (Haider, 2002). Finally, the alternatives are constructed following statistical design principles, which allows the researcher to avoid the problem of multi-colinearity. Following a design plan also allows researchers to determine the significance of the different policy outcomes investigated (Haider, 2002).

In many cases, the results of the survey are used simply to inform planners of public preferences for various outcomes or objectives. In other cases, the results of the survey are used to create a decision support tool that can be used to evaluate real alternatives and determine which alternatives the public best supports in a similar way to a multi-criteria analysis (see Haider & Rasid, 2002). Decision support tools based on the results of a discrete choice survey allow users to select different combinations of attribute levels and determine the market share for each combination or scenario.

Typically, decision support tools developed based on the results of a discrete choice survey are aspatial. However, in the case of land use planning, it would be useful to develop a spatial decision support tool. In recent years, there has been a rapid expansion of research on spatial decision support systems (SDSS) (Hill, Braaten, Veitch, Lees, & Sharma, 2005). Most of these spatial decision support systems have been developed utilizing multi-criteria analysis (MCA) that is implemented through both a spatial and an aspatial software program (i.e., a loosely coupled system) or entirely within a spatial software program such as GIS (i.e., a tightly coupled system) (Jankowski, 1995). Depending on the type of MCA method used, the SDSS is designed to either identify an 'optimal' solution to a given problem (e.g. Gomes & Lins, 2002), or evaluate alternative solutions (e.g. Jankowski, 1995).

Developing a decision support tool based on a DCE would be most similar to developing a tool that uses MCA techniques such as multi attribute decision making (MADM) techniques like the Analytical Hierarchy Process (AHP) (Hwang & Yoon, 1981). AHP allows the user to define relative weights (i.e., preferences) for the objectives, which are then combined with the impacts of each alternative scenario on the objectives for an overall evaluation of each scenario (Saaty, 1992). These weights typically represent the values of single decision-maker or several decision-makers or stakeholders. The output from a DCE is somewhat similar except that the parameter estimates represent the average values of an entire group of individuals. While there are no examples currently in the literature, it would be valuable to develop a spatial decision support tool that would allow researchers or planners to investigate the impact of alternative scenarios from the perspectives of tourists rather than a single decision-maker. In order to develop a spatial decision support tool based on a discrete choice survey, it is important that the survey be designed appropriately to ensure that the relative preferences for the attributes will correspond to measurable characteristics of the different land use alternatives considered. The next section explores previous research on the utilization of spatial concepts in discrete choice surveys.

2.2.2 Incorporation of Spatial Concepts in Discrete Choice Surveys

In the vast majority of cases, the alternatives in a discrete choice survey are presented as written descriptions. While presenting choice alternatives as written descriptions may be useful in certain cases, other applications may benefit from the use of other visual stimuli. Several studies have incorporated pictorial representations (e.g., simple maps, diagrams, photographs, and virtual reality images) in discrete choice surveys to clarify the context or implications of the scenarios presented (e.g. Arnberger & Haider, 2005; Dijkstra et al., 2003; Louviere, Schroeder, Louviere, & Woodworth, 1987; Opaluch et al., 1993; Vriens, Loosschilder, Rosenbergen, & Wittink, 1998; Yamada & Thill, 2003). The benefits of using pictorial representations to display attributes of interest are improved realism (Dijkstra et al., 2003; Louviere et al., 1987), enhancement of respondents' understanding of decision scenarios (Vriens et al., 1998; Yamada & Thill, 2003), and potential improvement of external validity of the survey results (Vriens et al., 1998).

Although some DCE studies recognize the benefits of using pictorial representations, very few studies have explicitly incorporated spatial attributes or addressed spatial patterns in a systematic way (Johnston et al., 2002). For example, researchers may present a single image composed of multiple attributes (e.g., Opaluch et al. 1993), but the spatial presentation of the attributes in the image is typically not accounted for in the experimental design. In many cases, the spatial arrangement of attributes shown in the image is not of interest; however, in the case of land use planning, the spatial arrangement of land uses could be quite important and of interest for the development of land use planning policies.

Only one study has explicitly incorporated spatial elements in the design plan of a discrete choice experiment. Johnston et al. (2002) utilized a spatial DCE to investigate preferences of residents for alternative proposals to develop rural lands for residential purposes. The survey asked respondents to choose between two development plans that demonstrated the spatial arrangements of different amounts and densities of development. Other attributes shown on the schematic maps included the degree to which the development was buffered from the road, and the location of any protected open space, sports fields, and traffic signals. The researchers found that increasing the size of the developed area or the density of housing always had a negative impact on residents' preferences. In terms of spatial configurations, respondents preferred contiguous, unfragmented developments to developments split (or fragmented) into two or more parts. However, this finding was somewhat contradicted by respondents' preferences for developments characterised by greater edge-area ratios. Respondents also preferred open space to be isolated from residential developments and main roads. Johnston et al. (2002) concluded that spatial attributes can influence estimated willingness to pay for alternatives, even in cases where images are used only to clarify written descriptions of survey scenarios. While their research did not proceed to this level, they recognize that a systematic treatment of spatial effects may (a) enable examination of preferences for spatial attributes that have policy implications, and (b) facilitate coordination between economic preference models and ecological landscape and habitat models.

Examining preferences of tourists for potential land use planning alternatives at a resort destination provides a unique opportunity to extend the research directions suggested by Johnston et al. (2002). Development of a spatial decision support tool based on the results of a spatially-explicit DCE would enable researchers to evaluate land use planning alternatives that have obvious policy implications and combine preference models with ecological models. In order to ensure that a spatial decision support tool can be developed using the survey results, it is important that the survey be designed appropriately. In particular, the survey must incorporate spatial patterns that are important from a policy and ecological perspective, as well as a social perspective. In addition, the spatial patterns must be modelled in a way that enables the survey results to be linked with ecological models. Lessons on how to model spatial patterns can be drawn from literature on landscape metrics, which have been developed and utilized in the fields of landscape ecology and sustainable landscape planning.

2.3 Quantifying Spatial Arrangement: Landscape Metrics

2.3.1 Defining a Landscape

A landscape can be defined as a "mosaic where the mix of local ecosystems or land uses is repeated in similar form over a kilometers-wide area" (Forman, 1995: 13). It is an area viewed in an aerial photograph or from a high point on the land in which unity is provided by repeated pattern. A landscape is not necessarily defined by its size, but is better defined according to what is relevant to the phenomenon under consideration (e.g. ecological process, public preference, etc.) (McGarigal & Marks, 1995). One popular model for describing a landscape is the patch-corridor-matrix model (Forman, 1995). Under this model, a patch represents a relatively homogeneous non-linear area that differs from its surroundings. Like the landscape itself, patches in a landscape must be defined relative to the phenomenon under consideration (McGarigal & Marks, 1995). A corridor is a strip of a land that differs from the adjacent land on both sides. The matrix is the background ecosystem or land use, which is typically characterized by extensive cover (e.g., greater than 50%), high connectivity, and/or major control over dynamics (Forman, 1995). Each patch, corridor, and area of matrix in the landscape is referred to as a landscape element (Forman, 1995). Landscape elements that share common properties are said to belong to the same class. For example, all individual patches of urban development would belong to the urban development class and all individual patches of old growth would belong to the old growth forest class (Rempel & Carr, 2003). The concept of patches of different classes in a landscape matrix formed the basis for the spatial discrete choice experiment in this study.

In addition to characterizing the basic elements of landscape, landscape ecologists are interested in describing the patterns of these elements across the landscape, largely because patterns of patches across the landscape can have strong influences on ecological characteristics and function (McGarigal & Marks, 1995). Because the ability to quantitatively describe landscape structure is a prerequisite to the study of landscape function and change, various metrics have emerged from landscape ecology for this purpose (McGarigal & Marks, 1995). Landscape metrics quantitatively describe the pattern of patches, corridors, and the matrix across the landscape. Landscape metrics quantify two key components of landscape structure: composition and configuration. Composition measures the non-spatially explicit characteristics of a landscape (e.g., proportion, richness, evenness or dominance, and diversity of uses) (Leitao & Ahern, 2002; McGarigal & Marks, 1995). In contrast, configuration refers to spatially-explicit characteristics (e.g., the physical distribution) of landscape elements. In the simplest case, configuration metrics assess the size and shape of patches (e.g., average size, mean shape, or core area). Other aspects of configuration measure the placement of patch types relative to other patch types or features of interest (e.g., patch isolation or patch contagion). Such configuration based landscape metrics explicitly recognize that ecological processes and organisms are affected by the interspersion and juxtaposition of patch types within the landscape, and not just the composition of patches within the landscape (McGarigal & Marks, 1995).

Using landscape metrics to describe landscape structure allows planners to establish relationships between landscape structure and ecological function (Leitao & Ahern, 2002). Once a relationship between structure and function has been established, planners can model and predict the impacts of planned activities on ecological systems (Leitao & Ahern, 2002). Thus, landscape metrics help to bridge the gap between ecology and planning (Leitao & Ahern, 2002).

Landscape metrics are gaining popularity in a number of fields, including those relevant to social and ecological planning. For example, landscape metrics have been used to establish a relationship between landscape structure and species distribution (McGarigal & McComb, 1995; Westphal, Field, Tyre, Paton, & Possingham, 2003), the scenic beauty of a landscape (Franco, Mannino, & Zanetto, 2003), and the value of houses (Geoghegan, Wainger, & Bockstael, 1997). In addition, landscape metrics have been used to analyze the spatial and temporal dynamics of urban growth and even forecast future growth patterns (Herold, Liu, & Clarke, 2003; Zhang, Wu, Zhen, & Shu, 2004). Notwithstanding their popularity, the use of landscape metrics poses a number of challenges, which must be carefully considered in any application. The next section reviews these challenges and describes how they were addressed in the present study.

2.3.2 Landscape Metrics: Problems and Solutions

The use of landscape metrics for social or ecological modelling can be problematic for several reasons. First, there is often a lack of reliable information on which to base models (Leitao & Ahern, 2002). A related problem is that there is often insufficient understanding of the link between landscape structural components and landscape functions (Leitao & Ahern, 2002). Second, there is seldom a one-to-one relationship between index values and pattern (i.e., several configurations may produce the same index value) (Gustafson, 1998). This can complicate our understanding of the relationships between pattern and ecological function or social preferences. Third, many metrics are correlated or confounded (i.e., they measure multiple components of pattern) (Gustafson, 1998; McGarigal & Marks, 1995). High correlation between metrics poses a challenge for creating orthogonal discrete choice experiment designs because it may not be possible to vary the metrics independently. Finally, indices are dependent on scale (Saura & Martinez-Millan, 2001). This means that certain landscape patterns can result in different values across landscape metrics depending on the scale (i.e., extent and grain) used in the analysis.

In order to address some of these limitations, it is necessary to use landscape metrics appropriately. One of the key applications of landscape metrics is to compare alternative landscape configurations (i.e., the same landscape under different scenarios or different landscapes mapped in the same manner) (Gustafson, 1998; Leitao & Ahern, 2002). For example, different scenarios can be developed and metrics can be used to assess the impacts of the proposed changes on the processes of concern for each of the alternative scenarios and the baseline scenario (Leitao & Ahern, 2002).

In addition to using metrics appropriately, suitable metrics should be selected. According to Gustafson (1998), metrics should be relatively independent of, and used at the appropriate level of, scale. Given that this research investigated preferences of visitors for alternative land use configurations, the appropriate extent was the area in which tradeoffs must be made between development, recreation, and protection. In a mountain resort destination, this generally refers to the developable area in the valley bottom that is within the boundaries of the resort. Another consideration of scale is the grain, or the smallest unit of measurement, used for the analysis. Following common planning practice, the smallest unit utilized in this research represented was a contiguous block, or patch, of a particular land use. Because it is possible to confound the results of any spatial analysis by measuring pattern and process at different spatial scales (Gustafson, 1998), the results of the DCE should only be used to predict preferences for alternative land use configurations at a scale similar to the actual DCE.

Another consideration involves selecting metrics that measure the fundamental components of spatial pattern and are independent of one another (i.e., not confounded)

(Gustafson, 1998). This is particularly important when the metrics will be used as attributes in a discrete choice experiment due to the requirement that all attributes be orthogonal. A number of research studies have tested the independence of various landscape metrics (Hargis, Bissonette, & David, 1998; Li & Reynolds, 1994; McGarigal & McComb, 1995; Riitters et al., 1995; Tinker et al., 1998). Based on this research, these investigators and various others have composed lists of independent components of landscape heterogeneity and appropriate metrics to measure these components (Leitao & Ahern, 2002; Li & Reynolds, 1995). In general, the metrics considered to be independent typically measure the following spatial characteristics: (a) diversity, (b) class area (e.g., proportions), (c) patch density, size or variability, (d) patch shape, and (e) spatial arrangement (Gustafson, 1998; Li & Reynolds, 1995). In this research, metrics were used to quantify the first four of these spatial characteristics. The fifth characteristic, the spatial arrangement of the landscape, was captured using simple concepts, such as number of patches, rather than complex metrics such as contagion due to an inability to reconcile the need for complete independence of attributes.

The final consideration is to select metrics that quantify spatial patterns hypothesized to be important. Johnston et al. (2002) investigated the preferences of residents for different amounts and spatial arrangements of a new subdivision within the developing rural fringe and suggested that these preferences were driven by a perception of differing ecological or aesthetic effects associated with the various patterns of development. Visitors to a resort destination can be expected to show similar behaviour towards development, especially since the natural environment is crucial to the attractiveness of almost all destinations (Farrell & Runyan, 1991). Visitors may also react to the amount and location of protected areas because it could impact the scenic quality of the resort, limit development opportunities, or restrict recreational opportunities. Finally, visitors may react to different spatial opportunities for recreation for use and non-use reasons. The methods used to develop and implement a discrete choice experiment capable of testing these spatial patterns hypothesized to be important are described in the next chapter.

CHAPTER 3 METHODS

3.1 Recruitment of Survey Respondents

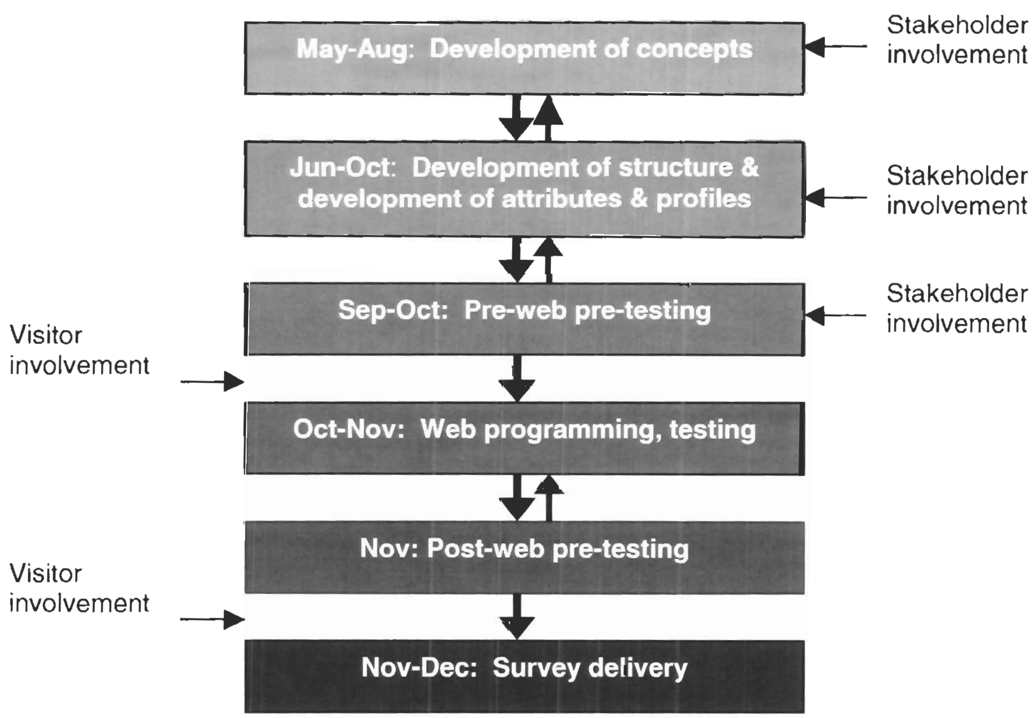
The target population for this research was all summer visitors to Whistler. In order to recruit participants for the web survey, ten paid and volunteer research assistants conducted short intercept surveys of visitors in Whistler daily between 12 noon and 8 pm from August 7 to September 6 and on the weekends of September 10-12, 17-19, and 25-26, 2004. The purpose of the intercept survey was to ask visitors several screening questions and obtain an email address that could be used to send a link to the web survey at a later date (see Appendix A for an example of the intercept survey). In order to conduct the intercept surveys, research assistants walked slowly through Whistler Village or on the path between the Upper Village and Whistler Village and invited one member from every third party encountered to participate in the survey. When more than one individual in the party qualified for participation in the web survey (i.e., over the age of 19, in possession of a functional email address, willing to participate in the survey), the individual who was next celebrating their birthday was selected. Everyone who completed the intercept survey received a Canadian flag pin as a token gift.

A total of 2016 email addresses were collected during the sampling period. The total time required to obtain these emails was approximately 264 hours, which means an average of 7.6 successful interviews were conducted per hour. Three of the ten research assistants collected statistics on the number of individuals who were unwilling or not capable of participating in the web survey. Based on a sample of about 1611 individuals who initially agreed to do the intercept survey, 104 (6%) could not complete it because they did not possess an email address and a further 545 (34%) declined to participate because of an unwillingness to give out their email address, a lack of time to do the internet survey, or a lack of interest in the research subject. Note that the intercept survey was terminated if the individual declined to participate in the future internet survey.

3.2 Development of Web Survey Instrument

The web survey was developed over an eight month period from May 2004 to November 2004. The stages in survey development are shown in Figure 3.1 and described in greater detail below.

Figure 3.1 Stages in survey development, May – November 2004



3.2.1 Development of Web Survey Concepts

Consistent with the proposal for the Social Sciences and Humanities Research Council funding for this project, the purpose of the web survey was to examine tourist preferences for the outcomes of policies that could be implemented at mountain resorts to increase environmental sustainability. Within this overarching purpose, the specific policies to be tested in the survey were based on a literature review, discussions with stakeholders in Whistler, and the academic interests of all researchers involved. Early in

May, 2004, the research team drafted a list of policies to be included in the survey. These policies were presented to planners and managers from the Resort Municipality of Whistler (RMOW) and Tourism Whistler. Based on positive feedback from the planners and managers, these key policies were flushed out in greater detail with the goal of generating a core list of attributes for the discrete choice experiments. A second meeting was held in Whistler in June 2004 during which time a complete list of potential attributes was presented. As a follow up to this meeting, planners and managers of the RMOW, and representatives from Whistler Housing Authority and Tourism Whistler, were asked to prioritize the attributes and suggest appropriate levels for the priority attributes. This feedback was considered during subsequent survey development stages.

3.2.2 Development of Web Survey Structure

Once the key policies and attributes to be included in the survey were developed, efforts focussed on developing a logical structure for the survey. Because the survey was implemented to address several research objectives, multiple sections and choice experiments were required. After significant consideration, three separate choice experiments were included: one to assess preferences for different aspects of resorts in general, one to focus on resort landscapes in particular, and a third to assess preferences for transportation between Vancouver and Whistler. Once this decision was made, the key outstanding issues were (a) the most appropriate sequence for the discrete choice experiments, and (b) the content of the instructional sections (i.e., the learning tasks) preceding each DCE. The final version of the survey contained five sections with the three discrete choice experiments, several learning tasks, and general questions about the respondents' trip to Whistler, socio-demographic characteristics, and general attitudes and travel preferences (Table 3.1).

Table 3.1 Sections of the web survey

Sec.	Title	Explanation
1	Your trip to Whistler	Included questions about the respondent's trip to Whistler including length and location of stay, activities pursued, etc.
2	Transportation to Whistler	A discrete choice survey that asked respondents to indicate which mode of transportation they would use to travel between Vancouver and Whistler under different conditions.
3a	Opinions of Mountain Resorts	Included questions to familiarize the respondent with the variables included in the discrete choice experiment in Section 3b.
3b	Choose your Favourite Resort (aspatial DCE)	A discrete choice experiment that asked respondents to choose their preferred resort. Pairs of resorts were described by development, automobile access, public transit availability, recreational opportunities, and environmental initiatives.
4	Choose your Favourite Resort Landscape (spatial DCE)	A discrete choice experiment that asked respondents to choose their preferred resort landscape. Pairs of resorts were described by both a map and a legend informing respondents about different aspects of developed areas, recreational areas, and protected areas.
5	General Questions	Included several follow up questions related to travel behaviour and socio-demographics.

Only the methods and results associated with sections 1, 3a, 4 and 5 of the survey are discussed in greater detail below; the other sections are discussed elsewhere.[3] The next section describes the methods associated with the spatial discrete choice experiment.

3.3 Discrete Choice Experiments: Theoretical Background

Discrete choice experiments are a type of stated preference model whereby respondents are asked to choose between hypothetical or altered real alternatives. These stated choices are then used to determine preferences or utility functions for the various elements, or attributes, of the alternatives (Louviere & Timmermans, 1990). Each alternative configuration, or profile, consists of the same set of attributes, but the levels of the attributes vary among the profiles. The profiles are constructed using statistical design principles to ensure orthogonality and enable the researcher to calculate the individual contribution of each attribute to overall preference (Montgomery, 2001).

[3] The transportation and aspatial choice experiments were developed by Joe Kelly as part of his PhD dissertation at the School of Resource and Environmental Management at Simon Fraser University.

In a discrete choice experiment, respondents are asked to choose their most, or least, preferred profile from a set of two or more profiles. The advantage of a discrete choice experiment is that they are based on a strong behavioural theory, the random utility theory (RUT), and not just a statistical theory. RUT posits that choices are a function of the attributes of the alternatives and individuals select the utility maximizing option (McFadden, 1974). Although individual behaviour is assumed to be deterministic, the research process cannot account for all the influencing factors. Therefore, the overall utility gained by person *n* from alternative *i* is comprised of both a deterministic (*V*) and a stochastic (random) component (ε) (equation 1) (McFadden, 1974):

$$U_{in} = V_{in} + \varepsilon_{in} \tag{1}$$

Because of the presence of a random component, one can only predict the probability that a randomly selected consumer will chose one option over another (Crouch & Louviere, 2000). The probability that one alternative will be selected over another is equal to the probability that the utility gained from alternative *i* (U_i) is greater or equal to the utilities of choosing any other alternative in the set of possible alternatives (C) (equation 2):

$$\Pr\text{ob}\,(i|C) = \Pr\text{ob}\{V_{in} + \varepsilon_{in} > V_{jn} + \varepsilon_{jn}; \forall j \in C\} \tag{2}$$

All RUT-based choice models are derived by making assumptions about the distribution and statistical properties of the random components of utility (ε) (Crouch & Louviere, 2000). If it is assumed that the random components are (a) independently distributed, (b) identically distributed, and (c) Gumbel-distributed (McFadden, 1974), a simple closed form specification of choice probabilities with the multinomial logit (MNL) model arises (equation 3):

$$\text{Prob}(i) = \frac{\exp^{\mu v_i}}{\sum_{j \in C} \exp^{\mu v_j}} \tag{3}$$

However, this specification requires the researcher to accept the "independence of irrelevant alternatives" (IIA) assumption. IIA means that the alternatives are assumed to be independent of one another, so the addition or deletion of additional alternatives in a choice set will not affect the ratio of the probabilities of choosing one alternative over another (Louviere, Hensher, & Swait, 2000). The scale parameter μ is not identifiable and the usual procedure is to arbitrarily set it to a convenient value, such as one (Ben-Akiva & Lerman, 1985). This implies that the variances of the random components of the utilities are equal (Ben-Akiva & Lerman, 1985). Once these assumptions are made, the observable component of utility (V) can be expanded to a linear-in-parameters utility function (equation 4):

$$V_{in} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k \qquad (4)$$

where β_0 is a constant (i.e., an intercept), β_1 is the coefficient for the first attribute, X_1 is the level for the first attribute, and there are a total of k attributes. For MNL models, the most common method of estimating the value of the βs is maximum likelihood estimation (Louviere et al., 2000). This technique involves determining the value of β_k that maximizes the probability that the sampled respondents would choose the alternatives that they actually chose. Thus, the maximum likelihood estimates represent the set of population parameters that generated the observed sample most often (Louviere et al., 2000).

The outputs from a maximum likelihood estimation procedure 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). Multiplying the parameter estimate β by the level of the corresponding attribute X produces a part worth utility (PWU), which is the total utility associated with a given level of an attribute. The relative utility of any alternative can be calculated by summing the βs and the Xs for alternative i using equation 4 (Louviere et al., 2000).

The t-values associated with the parameter estimates indicate the statistical significance of the estimates. T-values greater or lesser than 1.96 are considered significant at the 5% level, but practitioners often accept t-values as low as 1.6 (i.e., 10% level) (Louviere et al., 2000). The log likelihood function indicates the explanatory power of the Xs; the larger the log likelihood, the higher the explanatory power. The primary goodness of fit measure is the likelihood-ratio index (rho squared or ρ^2). The adjusted ρ^2 is corrected for the degrees of freedom used to estimate the model and can be used to compare different models (Louviere et al., 2000). These measures are often considered to be analogous to an R^2 value in an ordinary regression; however, Ben-Akiva and Lerman (1985) warn that these measures should not be interpreted in analogy to R^2. In general, values between 0.2 and 0.4 are considered to be indicative of an extremely good model fit (Louviere et al., 2000).

3.4 Development of Attribute Lists & Profiles

3.4.1 Attribute List

The spatial DCE contained fourteen attributes (Table 3.2). Six attributes were only shown in the map, five were shown in the map and described in the legend, and three were only described in the legend. These attributes were developed into profiles, and two profiles were paired to form a choice set (Figure 3.2). The attributes and their levels, and the presentation format of the map, were developed through an iterative process that involved extensive literature review of spatial metrics, previous spatial discrete choice experiments, and several scenic beauty studies. In addition, significant pre-testing was required to generate a map that made sense to the average person (see section 3.5 below).

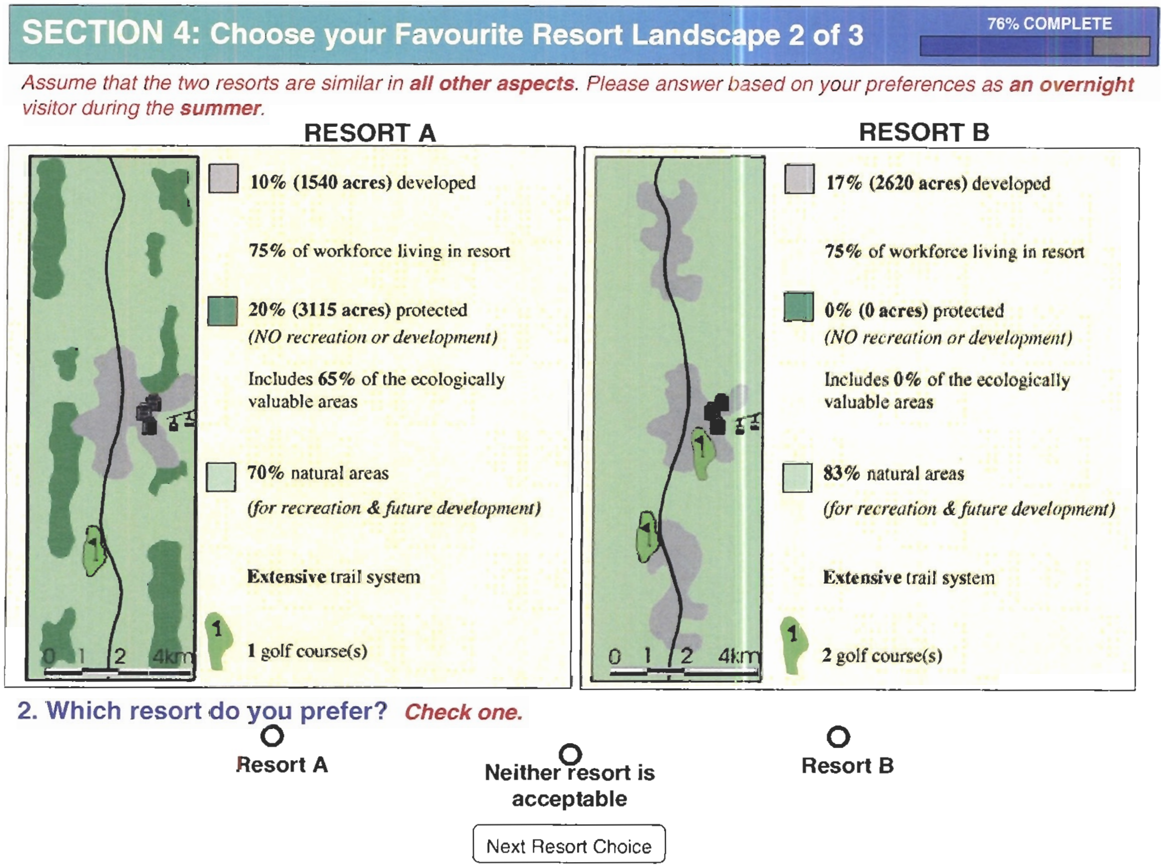
Table 3.2 Attributes and levels for the spatial discrete choice experiment

Attribute		Levels	Descriptions	Map	Legend
1	Land protected	2	No Yes*	Yes	Yes
2	Amount of land protected	3	5%* 20% 35%	Yes	Yes
3	Percent critical areas protected	3	35%* 65% 95%	No	Yes
4	Proximity of protected areas to development	2	All buffered One third buffered*	Yes	No
5	Fragmentation of protected areas	3	3 patches* 9 patches 18 patches	Yes	No
6	Variability in size of protected areas	2	Patches equal in size Patches unequal in size*	Yes	No
7	Map version (protected areas)	2	A B	Yes	No
8	Amount of land developed beyond 2 km from core	3	0 ha 350 ha* 700 ha	Yes	Yes**
9	Amount of land developed close to the core	3	200 ha 400 ha* 600 ha	Yes	Yes **
10	Percent employees housed in the community	3	25% 75%* 100%	No	Yes
11	Number of nodes developed	2	1 2*	Yes	No
12	Shape of developed areas	2	Smooth, roundish (MSI=1.2 ± 0.05) Convoluted, irregular* (MSI=1.78 ± 0.05)	Yes	No
13	Number of golf courses	3	1 2 3*	Yes	Yes
14	Extent of hiking trails in unprotected areas & parks	2	Moderate Extensive*	No	Yes

* Represents the approximate current Whistler situation.

**The legend displayed the total amount of development (i.e., amount of development close plus development far).

Figure 3.2 Example spatial DCE choice set



3.4.2 Design Plan

One hundred and eight unique profiles were created by combining different levels of the attributes in Table 3.2 in accordance with a fractional factorial design plan, which ensured the main effects could be estimated independently of one another. The 108 profiles were paired into 54 choice sets, which were blocked into 18 versions containing three choice sets each. Each respondent answered only one of the 18 versions. However, the large number of respondents meant that each choice set was evaluated at least 39 times.

Two unique aspects of the design are worth noting. First, every third choice set in each of the 18 versions had no protected areas.[4] Second, within each version, the choice sets were rotated systematically so that some respondents received the choice set

[4] Profiles with no protected areas always occurred in the Resort A position.

with no protected areas first, while others received it second or last. This was done to avoid any potential bias caused by showing the choice sets in a fixed order.

3.4.3 Development of Maps

A total of 36 individual maps[5] were created using ArcView GIS version 3.2 and CorelDRAW® version 10. [6] Each map encompassed 6,300 ha (~4.5 km x 13.8 km) and displayed a road running north-south through the centre of the map, a village on the east side of the road at mid-height, and ski lifts adjacent to the village. Each of the 36 maps displayed a different arrangement of four different types of land uses: developed patches, protected areas, golf courses, and remaining natural areas (including recreational areas, parks, and areas with very low density development).

In order to simplify the map making process and avoid introducing any uncontrolled spatial characteristics that could influence preferences, base maps were created in separate GIS themes for the developed areas (see Appendix B) and the protected areas (see Appendix C). This made creating the maps for each profile relatively easy because, once developed, the appropriate base maps (themes) simply had to be combined. The final step in the creation of the maps was to add other graphic elements such as the road, background colour, scale bar, village buildings, and ski lifts. The steps followed to create each map are described below (Figure 3.3):

> **Step 1**: Add the appropriate development close and development far base maps to the ArcView view.
>
> **Step 2**: Select the appropriate protected area base map.

---

[5] An additional 36 maps were created by simply varying the aspatial attributes and the remaining 36 maps were created by simply leaving out the protected areas (e.g. no land protected).

[6] All of Corel's trademarks used, beginning with "Corel" followed by any other marks in alphabetical order are trademarks or registered trademarks of Corel Corporation and/or its subsidiaries in Canada, the United States and/or other countries.

Step 3: If only 5% or 20% protected area, "shrink down" the patches contained within the protected area base map proportionately until the amount of total area protected is 5% or 20%[7].

Step 4: If protected areas are adjacent to developed areas, move some of the protected area patches to be adjacent to developed areas following the rules described in

Table 3.3.[8] If protected areas are buffered from development, keep the centroids of the shrunken patches in the same location as in the base map (i.e., to ensure that the minimum buffering distance of 250 m is maintained). Once completed, export the image from ArcView in a Windows Metafile format.

Step 5: Import the image into CorelDRAW and add graphic features including several tall buildings to represent the village, ski lifts, a scale bar, and one golf course located next to the core. If required by the design plan, add additional golf courses following the rules described in Table 3.4.[9]

Table 3.3 Rules followed to determine the placement of adjacent protected area patches

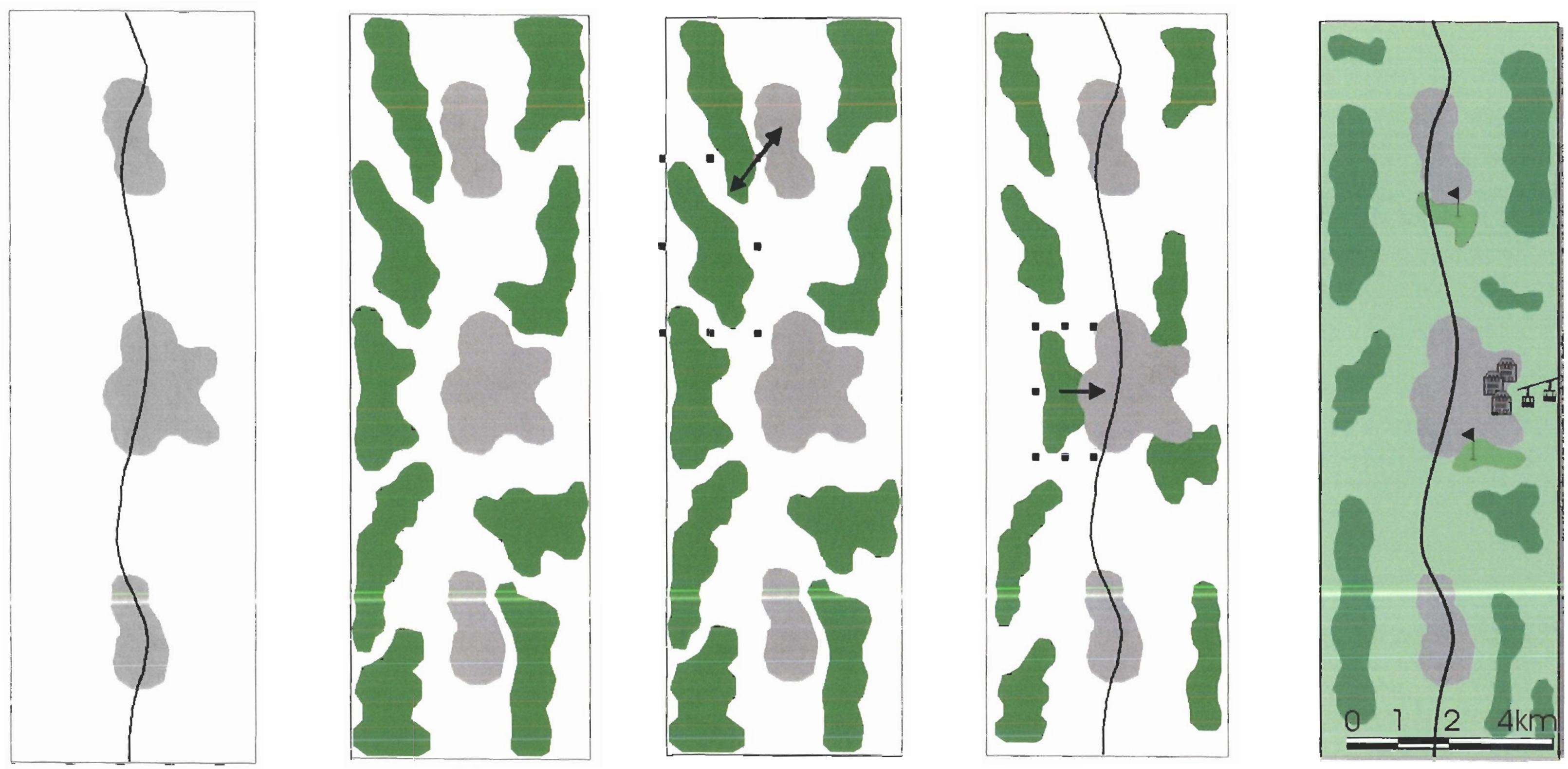
Nodes developed	Fragmentation Level 3 patches	9 patches	18 patches
No nodes	1/3 – at core	3/9 – all at core	5/18 – all at core
Two nodes	1/3 – at core	3/9 – one per node & one at core	6/18 – two at core, two per node
Four nodes	1/3 – at core	3/9 – one close, one far & one at core	6/18 – two at core, one per node

[7] All protected area base maps had 35% protected area.

[8] When the protected area patches were unequal in size, one patch of each different size was moved to be adjacent to development and modified to ensure that the protected areas fit closely to the developed areas while maintaining the necessary shape requirements and 18-22% of the edge of each developed area was bordered by a protected area. Several exceptions were necessary when the amount of development was high and protected area was low (i.e. maps 6, 21, 22, and 23).

[9] To keep the appearance of golf courses as consistent as possible, one full side of each golf course was adjacent to development and the other side open to undeveloped natural area. The exceptions were the maps with no nodes developed outside of the core and two or three golf courses. In these cases, the second and third golf courses were entirely surrounded by natural areas.

Figure 3.3 Map making process



Step 1
Select the correct development base maps (themes)

→

Step 2
Select the correct protected area base map (theme)

→

Step 3
Resize the protected area patches if 5% or 20% protected

→

Step 4
Move and adjust protected area patches if adjacent
Save as a windows metafile (WMF)

→

Step 5
Export to CorelDRAW and add graphics
Save as a compu serve bitmap (GIF)

Table 3.4 Rules followed to determine the placement of golf courses

# of Golf Courses	# of Nodes Developed	Location of Golf Course Course #1	Course #2	Course #3
1	NA	Adjacent to core	---	---
2	2	Adjacent to core	Between the north node & the core	---
2	4	Adjacent to core	Between the two north nodes	---
3	2	Adjacent to core	Between the north node & the core	Beside closest south node
3	4	Adjacent to core	Between the two north nodes	Beside closest south node

3.5 Pre-testing & Web Programming

3.5.1 Pre-web Pre-testing

During the first stage of pre-tests, more than 20 colleagues, friends, and family members reviewed the survey and provided suggestions for improving the structure and content. This testing was primarily conducted using a PowerPoint version of the survey to facilitate quick and easy modifications to the survey. The final attribute list and map presentation style reflects a format that was understood and effective during these pre-tests.

3.5.2 Web Programming & Testing

After the survey had undergone about a month of pre-testing in PowerPoint, the survey was programmed to the Internet. The survey was hosted through Simon Fraser University's domain at: www.whistlerstudy.rem.sfu.ca on a server that was secured in a locked cabinet at the University.

Several key decisions regarding the web programming are worth noting here. First, the survey was programmed without Javascript because of the challenges that Javascript poses for users who do not have it enabled on their computers. Second, the web pages auto fit to the width of the users' screens. This option was selected over fixed widths to avoid the need for horizontal scrolling or excessive white space on the screen.

Third, the web survey was tested at several different screen resolutions (600x800, 1024x768), on three major web browsers (Internet Explorer, Netscape, and Firefox), and on computers using both high speed and dial-up Internet service. This was important to ensure that the survey was functional, clear, and consistent for the respondents. Finally, the logic and the outputs of the survey were checked extensively prior to delivery to ensure that the flow of the survey was as expected and the correct value was recorded in the database for each response.

3.5.3 Post-web Pre-Testing

Once the web survey had been tested extensively to ensure proper function, two additional stages of pre-testing were conducted. The first test involved emailing the survey's web address to 44 randomly selected respondents of the entire sample on November 5, 2004. The purpose of this pre-test was to check the length of the survey and ensure that individuals would respond to the tradeoffs in the discrete choice experiments. Nine of the 44 (20.5%) individuals completed the test web survey within one week. Following this pre-test, small modifications were made to the wording of questions, the instructions, and the presentation of several questions. In addition, the design plans for the discrete choice surveys were finalized and linked to the web survey.

For the second web pre-test, the survey's web address was emailed to 54 recruited respondents on November 13, 2004. This pre-test indicated that a surprisingly high number of individuals who accessed the link did not proceed past the introductory web page. In order to entice individuals to continue past the introductory page, the amount of text was reduced and several photos of mountain resorts were added to increase the aesthetic appeal. Because no significant changes were made to the survey after this pre-test, the 16 individuals who responded to the survey during this last pre-testing phase were included in the final sample.

3.6 Web Survey Delivery

The web survey was delivered to the remaining email addresses on November 18, 2004 (1315 in total) and November 20, 2004 (577 in total) using Microsoft Mail Merge.

A total of 191 of the 2016 (9.5%) emails could not be delivered due to an error in the email address. The addresses of the undeliverable emails were corrected and resent on the same day if possible, but 23 revised emails were sent on November 23, 2004. The cover letter, which was contained within the body of the email, was addressed to the respondent with their first name, where a first name had been obtained, and referred to the month of their visit (see Appendix D). A reminder email with a modified cover letter (see Appendix E) was sent to all respondents who had not yet proceeded past the introductory webpage on December 6, 2004. In total, 784 completed web surveys were obtained for the final analysis from the original 2016 emails.

Both cover letters also contained a link to the web survey. To be able to match a user with their intercept data when they entered the website, 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»). When the respondent clicked the link they were automatically logged onto the website and matched with the appropriate record in the database. This enabled the wording of the questions to be varied depending on the characteristics of the individual. For example, if a user indicated during the intercept survey that they were visiting Whistler only for the day, the instructions for the discrete choice experiments asked the respondents to imagine that they were planning a day-only trip to a resort when making their choices. Conversely, overnight visitors were asked to assume they were taking an overnight visit.

3.7 Data Analysis

Most of the survey data was analyzed using SPSS 10.0. However, analysis of the discrete choice data was conducted in LIMDEP 7.0 (Green, 1998) and Latent Gold Choice 3.0.6 (Vermund & Magidson, 2003). Certain aspects of the discrete choice analysis are described in greater detail below.

3.7.1 Basic MNL Model

A multinomial logit (MNL) choice model was estimated using maximum likelihood procedures. 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. The restricted model was retained only if the likelihood ratio test enabled rejection of the null hypothesis, which states that the particular subset of βs removed from the model are equal to zero (Louviere et al., 2000).

In addition to estimating the basic MNL model, the data were further explored using several techniques. First, interactions between specific attributes were investigated to determine if preferences for some attributes were affected by preferences for other attributes. Second, the influence of spatial relationships created during the map-making process, but not explicitly controlled by the design plan, was examined. Finally, several techniques were used to investigate heterogeneity in the data. Each of these extensions of the basic model is described in greater detail below.

3.7.2 Interactions between Attributes

The design plan was developed to allow the estimation of several interactions in addition to the main effects (Anderson, D. pers. comm. October 29, 2004). The linear terms for the following pairs of attributes were interacted: (a) amount of area protected and fragmentation, (b) amount of area protected and amount of critical areas protected, and (c) amount of land developed (close and far) and amount of area protected. Interactions between the categorical attributes and continuous attributes (e.g., amount of land developed far interacted with number of nodes developed) could not be estimated as efficiently, but were still investigated. Only one interaction term was included with all other attributes of the full model at a time.

3.7.3 Additional Spatial Attributes

A unique outcome of conducting a spatial discrete choice experiment is that the combination of different spatial attributes creates additional, uncontrolled spatial relationships (Johnston et al., 2002). Attributes were selected to minimize the possibility of creating additional spatial features that might influence preferences. Despite these efforts, there were still a number of spatial features that could be measured and included as additional attributes in the model. These spatial features included the total amount of edge surrounding development areas and protected areas, the edge: area ratio for developed areas and protected areas, and the average size of developed areas and protected areas. Because of the high degree of colinearity between these additional attributes, only one additional attribute was included in the model at a time.

3.7.4 Investigation of Heterogeneity

The MNL model implicitly assumes that all individuals have identical preferences (i.e., the β weights for the attributes do not vary over the population) (Hunt, Haider, & Bottan, 2005). Since this assumption is unlikely to be true, various methods have been developed to incorporate or explain aspects of heterogeneity in preferences, including estimating separate models for different segments of the sample, interacting individual specific characteristics with various attributes of the choices (Breffle & Morey, 2000; Morey, Breffle, Rowe, & Waldman, 2002), utilizing a random parameter logit/probit model that allows model parameters to vary randomly over individuals (Layton, 1996; Train, 1998), or utilizing a latent class model (Swait, 1994). In addition to estimating the basic model, several of these techniques were used to investigate heterogeneity.[10] To investigate heterogeneity, the sample was first stratified into different segments and separate parameter estimates were derived for each segment (e.g., overnight vs. day visitors). When the two segments were found to differ across only one key attribute (e.g., extent of trail system), respondent characteristics were incorporated directly by interacting specific characteristics of individuals with specific parameters. The methods associated with conducting segmentations and interactions using respondent characteristics are described further below.

[10] A random parameters logit model (RPL) and a latent class model (LC) were beyond the scope of the current study. The methods associated with conducting segmentation and interactions using respondent characteristics are described further below.

3.7.4.1 A Priori Segmentations

Conducting a priori segmentations is a simple and common way to investigate heterogeneity in preferences within a single sample. A priori segmentation requires some knowledge of potential sources of heterogeneity. Ideally, theory should provide a foundation for potential sources of heterogeneity. While socio-demographics are consistently cited as a source of heterogeneity, theory also suggests that other characteristics of individuals, such as attitudes, perceptions, and past experiences, may also be important (Boxall & Adamowicz, 2002). It is expected that segments may have fundamentally different preferences across the entire profile and not just one or two specific attributes. In this research, it was expected that preferences might vary depending on two characteristics of the respondents: whether they were a local (i.e., from B.C.) or non-local visitor, and whether they were a day or an overnight visitor. Separate models were estimated for locals versus non-locals and day versus overnight visitors. The estimates derived for each model were compared for statistically significant differences using the following equation for a t-test:

$$t = \frac{\beta_1 - \beta_2}{\sqrt{(SE_1)^2 + (SE_2)^2}} \qquad (5)$$

where β_1 and β_2 are the estimates for the same parameter 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 $p<0.05$.

3.7.4.2 Character Specific Interactions

Interacting model parameters with observable socio-demographic characteristics of individuals is another commonly used "classic" method of incorporating heterogeneity, which enables the researcher to capture attribute sensitivities (Adamowicz, Louviere, & Swait, 1998; Breffle & Morey, 2000). The key advantage of this technique is that it allows β_i to vary across individuals in a systematic way as a function of individual characteristics. As a result of such interactions, utility is not only a function of the attributes of the survey, but also of characteristics that vary across the sample (Breffle & Morey, 2000; Morey et al., 2000):

$$U_{in} = V(X_i, C_n; \beta) + \varepsilon \qquad (6)$$

where V is the non-stochastic part of the utility function, X is a vector of attributes, C is a vector of personal characteristics, and ε is the error term. When using the interaction technique, it is common to select a characteristic that might influence preferences for a specific model parameter and interact (i.e., multiply) the two parameters (Louviere et al., 2000). A variety of characteristics have been used in previous applications, such as socio-economic status (age, gender, income) (Morey et al., 2000), place of residence (Morey, Breffle et al., 2002), or experience/frequency of use (Adamowicz, Louviere et al., 1998). In this study, recreational characteristics of the respondents were interacted with the recreational attributes in the survey[11]. More specifically, each individual's participation in golfing at Whistler was interacted with the attribute describing the number of golf courses. Also, each individual's participation in trail-based mountain biking was interacted with the trail system attribute. Therefore, the non-stochastic part of the utility function is:

$$V_i = \beta_0 + \beta_1 (land\ pro) + [\beta_2 (amt\ pro) + \beta_3 (amt\ pro)^2] + \beta_4 (frag) + \beta_5 (proximity) + \beta_6 (variability) + \beta_7 (map\ version) + \beta_8 (dev\ close) + [\beta_9 (dev\ far) + \beta_{10} (dev\ far)^2] + \beta_{11} (nodes) + \beta_{12} (shape) + [\beta_{13} (workforce) + \beta_{14} (workforce)^2] + \boldsymbol{[\beta_{15Biker}(BIKER) + \beta_{15Non\text{-}biker}(1 - BIKER)]\ (trail) + [\beta_{16\,Golfer}(GOLFER) + \beta_{16\,Non\text{-}golfer}(1 - GOLFER)]\ (golf) + [\beta_{17\,Golfer}(GOLFER) + \beta_{17\,Non\text{-}golfer}(1 - GOLFER)]\ (golf)^2}$$

where BIKER and GOLFER are dummy variables that describe whether each individual participated in trail biking or golfing during their trip to Whistler, respectively. This model specification allows separate parameter estimates for the extent of the trail system (*trail*) and the number of golf courses (*golf*) to be obtained for bikers vs. non-bikers and golfers vs. non-golfers.

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[11] Note that segmentations based on recreational activities demonstrated that preferences only differed across one or two attributes, as would be predicted, and so interacting specific characteristics with model parameters is more efficient than estimating entirely separate models for each recreational segment.

3.8 Computerized Decision Support Systems

The part worth utility (PWU) estimates for the full model plus the significant interactions were used to create computerized decision support tools (DST) in Microsoft Excel®[12] and ArcView 3.2 GIS. The aspatial DST programmed in Excel allows the user to compare overall preference for two different planning scenarios by adjusting the levels of each attribute for both scenarios. For all linear and quadratic coded attributes, the user may select any number between the minimum and maximum values included in the DCE. For all categorical attributes, the user simply selects from the levels used in the survey. Whenever a user selects a new level for one of the attributes, the DST utilizes equation 3 to calculate the probability that each scenario would be chosen. This calculated probability essentially represents a market share, or level of support, for each scenario. The DST thus allows decision-makers to predict the likely level of support for proposed plans or changes in specific policies.

Because the land use scenarios being evaluated are spatial, a simple, spatial DST was developed in GIS. In order to implement the spatial DST, several scenarios representing the current situation in Whistler and potential future conditions in Whistler were developed in ArcView 3.2.[13] This involved creating layers that contained different patches of development and patches of protected area. Next, the ArcView extensions Patch Analyst and Spatial Analyst were used to calculate summary statistics for each new scenario (i.e., amount of development close and far, development MSI, amount of protected area, number of PAN patches, PAN PSCov, etc.). The statistics for the current situation and each potential future situation were then entered as levels into the aspatial DST to calculate the overall market share for each scenario compared to the current situation. The market share was then displayed in a text box on each scenario, which was contained within a separate view in GIS. The following chapter summarizes the results of these DST applications and Chapter 5 presents some extensions.

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

[13] The potential future scenarios developed were loosely based on possibilities that were explored during a recent planning process undertaken in Whistler. It should be noted that these possibilities were modeled for illustration purposes only.

CHAPTER 4 RESULTS & ANALYSIS

This chapter presents the research findings. It starts with a description of the characteristics of visitors (e.g., socio-demographics, travel to Whistler, travel motivations) as well as their general preferences for resort characteristics. Next is a summary of the behaviour of the respondents during the discrete choice survey, which includes an investigation of general patterns in response behaviour and a summary of responses to the follow-up questions to the spatial DCE. This analysis of respondent behaviour during the discrete choice experiment is followed by a summary of the various models estimated from the DCE data. These include the basic multinomial logit model (MNL), segmentations, and interactions. The final section contains an example application of an aspatial and a spatial (GIS-based) decision support tool.

4.1 Visitor Characteristics

This section describes a number of characteristics of the survey respondents. The characteristics of the survey respondents are also compared to the characteristics of respondents surveyed by Tourism Whistler throughout the summer of 2004 (May-October).[14] Comparing these two samples helps us determine how well our sample of respondents, recruited only in the months of August and September, represents the entire population of summer visitors to Whistler.

4.1.1 Socio-demographics

During the intercept survey and the first section of the web survey, respondents were asked various socio-demographic questions such as the place of their residence, age, sex, income and the highest level of education completed. Slightly more males (56%) completed the web survey than females (44%) and three-quarters of survey

[14] Tourism Whistler conducted 300 in-person surveys per month with visitors intercepted in Whistler Village.

respondents were between the ages of 26 and 55 (Table 4.1). Most survey respondents were well educated, with almost 90% having at least some technical training or college. Remarkably, 28% of the respondents had a university postgraduate degree. Incomes were also relatively high; only 8% of respondents had household incomes less than $25,000 while a sizable proportion (32.8%) had incomes greater than $100,000. Almost one quarter of the respondents indicated that their income was in American rather than Canadian dollars. As a result, the income levels are somewhat underestimated.

Almost half (45%) of the survey respondents were from British Columbia, with the majority (84%) of these people residing in the Lower Mainland (Table 4.1). About 14% of respondents were from other provinces in Canada, with the largest shares coming from Ontario (8%), Alberta (3%), and Quebec (2%). Just over one quarter of respondents originated from the United States, with the largest shares coming from Washington State (13%), California (3%), Oregon (2%), and New York (2%). The remainder of respondents resided in other countries, most significantly the United Kingdom (6%), the Netherlands (2%), and Germany (1%). Visitors from all other countries comprised less than 1% of the total sample.

The socio-demographic characteristics of the respondents for this survey were significantly different from those of the sample obtained by Tourism Whistler during their visitor surveys (Table 4.1). First, our respondents were more likely to be from B.C., whereas Tourism Whistler respondents were more likely to be from the United States or another country. This may reflect a difference in the time spent conducting interviews in different locations, which are known to have differing proportions of local (i.e., from B.C.) and non-local visitors. In addition, our respondents tended to be younger. This trend might be due to the fact that Tourism Whistler surveys are conducted in person where as our survey was conducted online, and past research has shown that internet surveys tend to under-represent older age classes and over-represent younger age classes (Roster, Rogers, Albaum, & Klein, 2004; Zhang, 1999). Finally, our sample included individuals from a greater range of household incomes compared to the Tourism Whistler sample.

Table 4.1 Socio-demographic characteristics of respondents

	Recruited Respondents		Tourism Whistler Respondents		Chi square (p-value)
Place of Residence					63.846 (0.000)
BC	351	44.8%	417	28.1%	
Other Canada	109	13.9%	272	18.3%	
USA	211	26.9%	517	34.8%	
Other International	113	14.4%	279	18.8%	
Unknown	---	---	6	---	
Gender					0.044 (0.834)
Male	433	55.5%	812	55.1%	
Female	347	44.5%	663	44.9%	
Unknown	4	---	16	---	
Age					18.417 (0.001)
25 or younger	89	11.3%	123	8.3%	
26-35 years	210	26.8%	323	21.9%	
36-45 years	207	26.4%	392	26.6%	
46-55 years	181	23.1%	398	27.0%	
56 years +	96	12.3%	238	16.1%	
Unknown	1	---	17	---	
Education					---
High school or less	87	11.1%	---	---	
Technical training/college	212	27.1%	---	---	
University undergraduate	268	34.2%	---	---	
University postgraduate	215	27.4%	---	---	
Unknown	2	---	---	---	
Income					73.957 (0.000)
Under $49,999	183	24.8%	211	23.9%	
$50,000-$74,999	192	26%	213	24.1%	
$75,000-$99,999	125	16.9%	217	24.6%	
$100,000-$149,999	133	18.0%	145	16.4%	
$150,000-$199,999	58	7.8%	97	11.0%	
$200,000 or over	48	6.5%	0	0%	
Unknown	45	---	608	---	

4.1.2 Travel to Whistler

In section 1 of the survey, respondents were asked questions about their past and expected future travel to Whistler as well as some questions about the trip to Whistler when they were recruited for the survey.

4.1.2.1 Past and Future Travel to Whistler

Approximately two-thirds of survey respondents had been to Whistler two or more times while about a third had visited only once (i.e., the trip on which they were recruited) (Table 4.2). When asked how likely they were to return to Whistler during the summer and winter seasons within the next two years, the vast majority of respondents were moderately or very likely to return to Whistler in the summer (80%). A slightly lower proportion of respondents were moderately or very likely to return in the winter (60%). Compared to the Tourism Whistler sample, our respondents were more likely to be repeat visitors and were more likely to return again both in the summer and the winter. This is likely due to the fact that we conducted more intercept surveys in Village North, which has a greater proportion of repeat visitors from Greater Vancouver.

Table 4.2 Respondent's past and future travel to Whistler

	Recruited Respondents		Tourism Whistler Respondents		Chi square (p-value)
Number of Past Visits					42.973 (0.000)
One visit (first time)	269	34.6%	725	49.0%	
Two or more visits	509	65.4%	755	51.0%	
Unknown	6	---	11	---	
Expected Future Summer Visits					147.50 (0.000)
Very / Moderately Likely	624	80.3%	847	58.3%	
Very / Moderately Unlikely	121	15.5%	332	22.8%	
Unsure	32	4.1%	275	18.9%	
Unknown	7	---	37	---	
Expected Future Winter Visits					118.02 (0.000)
Very / Moderately Likely	452	60.2%	633	43.4%	
Very / Moderately Unlikely	252	33.6%	587	40.3%	
Unsure	46	6.1%	237	16.3%	
Unknown	34	---	34	---	

4.1.2.2 Current Trip to Whistler

Respondents were asked several questions about their current trip, including the primary purpose, the overall length, their accommodation type and location, and the composition of their travel party. The primary purpose of traveling to Whistler for the vast majority of survey respondents (96%) was leisure; business was the primary purpose for the remaining 4% (Table 4.3). In addition, substantially more survey respondents were on an overnight trip to Whistler (79%) than a day trip (21%). Overnight visitors stayed an average of 3.96 nights at Whistler.

Most survey respondents (84%) who stayed overnight during their trip stayed in paid accommodations such as hotels, condominiums, timeshares, B&Bs, hostels or campgrounds. Only about 11% of overnight respondents stayed at the home of friends and family while another 5% stayed at their second home. Most survey respondents (64%) who visited overnight stayed at accommodations located in the Village or Village North. About 21% of overnight respondents stayed within 2 km of Whistler Village and the remaining 15% stayed more than 2 km beyond the Village.

The vast majority of survey respondents were traveling with other people during their trip to Whistler. In fact, only 4% of respondents were traveling alone. About two thirds of respondents (66%) were traveling with their spouse, about 42% were traveling with other adults, and approximately one-quarter of respondents were traveling with dependents. A very small proportion of respondents (1.5%) were traveling with a tour group. The most frequently occurring travel party size was two (37%), which reflects the high proportion of respondents traveling with their spouse or one other adult. Using a conservative approximation that a response of "six or more" is equivalent to six gives an average travel party size of 3.08 people.

Our sample of visitors was similar to the Tourism Whistler sample in terms of the proportion of day vs. overnight visitors and the length of stay (TW mean=3.39 nights, t stat=-1.59, p-value=0.112), but there were several other significant differences (Table 4.3). The Tourism Whistler sample contained a greater proportion of individuals who stayed with friends or family during their trip compared to our sample. In addition, the Tourism Whistler sample contained a greater proportion of individuals who were travelling with a moderately sized party (two to five individuals), whereas our sample contained a greater proportion of visitors who were travelling alone or with larger groups.

Table 4.3 Characteristics of respondent's current trip to Whistler

	Recruited Respondents		Tourism Whistler Respondents		Chi Square (p-value)
Trip Purpose					---
Business	32	4.1%	---	---	
Leisure	752	95.9%	---	---	
Type of Trip					2.562 (0.109)
Overnight	619	79.1%	1212	81.8%	
Day	164	20.9%	269	18.2%	
Unknown	1	---	10	---	
Accommodation Type*					39.751 (0.00)
Hotel, condo, or chalet	367	59.2%	673	55.7%	
Timeshare	103	16.6%	169	14.0%	
Home of friends or family	69	11.1%	239	19.8%	
Second home	28	4.5%	45	3.7%	
Hostel or club cabin	16	2.6%	46	3.8%	
B&B or pension	8	1.3%	18	1.5%	
Campground or Other	29	4.7%	18	1.5%	
Unknown	---	---	14	---	
Accommodation Location*					---
Whistler Village or Village North	397	64.1%	---	---	
Within 2km of Whistler Village	127	20.5%	---	---	
Further than 2km from Village	93	15.0%	---	---	
Do not know	2	0.3%	---	---	
Travel Party Composition**					---
Traveling alone	34	4.3%	---	---	
Traveling with spouse	514	65.6%	---	---	
Traveling with other adults	328	41.8%	---	---	
Traveling with dependents	192	24.5%	---	---	
Traveling with tour group	12	1.5%	---	---	
Travel Party Size					78.674 (0.00)
One	97	12.5%	104	7.0%	
Two	290	37.3%	658	44.3%	
Three, four or five	289	37.2%	652	43.9%	
Six or more	102	13.1%	70	4.7%	
Unknown	6	---	7	---	

* The sum of column percentages is greater than 100% because respondents could select more than one category.
** Day only visitors were excluded from the percentage calculations.

4.1.3 Recreational Activities

In section 1 of the survey, respondents were also asked about the recreational activities they participated in during their trip to Whistler. For each activity listed in Table 4.4, respondents were asked to indicate whether they did not participate in the activity, or they participated once, twice, or three or more times. The most frequent activities undertaken were shopping (93%), dining out at a restaurant (90%), and walking, roller blading or biking on the paved paths in and close to Whistler Village (86%) (Table 4.4). The high rate of participation in these activities may be due to the fact that nearly all respondents were recruited in Whistler Village, where these activities occur. Other popular activities included taking a walk or hike on the nature trails close to the Village (59%), taking a ride on the gondola (45%), and going to a bar or nightclub (38%). More summer visitors went mountain biking on trails in the Whistler area (20%) than in the bike park (13%). The least frequent activities undertaken were participating in a motorized tour or activity (8%), participating in a non-motorized water activity (10%), and playing a round of golf in the Whistler area (10%).

Table 4.4 Frequency of respondent participation in different activities in Whistler (n=784)

Activity	Frequency*		Mean	Std.Dev.
Went shopping	730	93.1%	2.10	0.96
Dined out at a restaurant	702	89.5%	2.02	1.04
Went walking, roller blading, or biking on paved paths in and close to Whistler Village	671	85.5%	1.88	1.12
Took a walk or hike on gravel/dirt trails close to Village	466	59.4%	1.07	1.12
Took a gondola ride up or down Whistler Mountain	352	44.9%	0.59	0.78
Went to a bar or nightclub	301	38.4%	0.66	0.97
Went to a beach or went swimming in a lake	176	22.4%	0.34	0.74
Participated in facility based recreation	175	22.3%	0.31	0.66
Went mountain biking on the trails in the Whistler area	157	20.0%	0.36	0.82
Attended a show, event, or festival	140	17.9%	0.23	0.54
Went for a day/overnight hike on trails in Whistler area	110	14.0%	0.21	0.60
Went mountain biking in the Whistler Bike Park	102	13.2%	0.25	0.72
Played a round of golf in the Whistler area	77	9.8%	0.16	0.53
Participated in a non-motorized water activity	76	9.7%	0.13	0.42
Participated in a motorized tour or activity	63	8.0%	0.10	0.35

* The sum of column percentages is greater than 100% because respondents could select more than one category.

4.1.4 Travel Motivations

In the last section of the survey, respondents were asked to rate the importance of 16 different factors when visiting a mountain resort. Overall, the ratings were quite high, which indicates that the respondents value all factors to some degree (Table 4.5). Despite the high ratings nearly across the board, there was some variation in the relative importance of different factors. The highest rated factor overall was visiting a place that takes good care of its environment (mean=4.36). The high rating for this factor suggests that respondents agree environmental protection should be a key priority for mountain resorts like Whistler. However, it may also indicate that respondents were influenced by the subject matter in previous sections of the survey or they simply agree with such a motherhood statement. Other highly rated factors (mean>4) were resting and relaxing, experiencing and seeing a mountain area, getting value for the cost of the trip, being physically active, and participating in outdoor activities. The least important factors (mean<3) included attending a festival or event, enjoying nightlife and entertainment, and indulging in luxury, staying at first class hotels.

Table 4.5 Respondent travel motivations

Motivation Factor	N	Mean Rating*	Std. Dev.
Visiting a place that takes good care of its environment	780	4.36	0.76
Resting and relaxing	784	4.24	0.87
Experiencing and seeing a mountain area	784	4.22	0.89
Getting value for the cost of the trip	783	4.18	0.89
Participating in outdoor activities	783	4.09	0.99
Being physically active	783	4.10	0.95
Visiting wilderness and undisturbed areas	783	3.75	1.08
Learning new things, increasing my knowledge	783	3.58	1.08
Visiting a place with unique and interesting restaurants	784	3.52	1.04
Viewing wildlife and birds	782	3.45	1.12
Going to a place that is family oriented	780	3.34	1.32
Enjoying cultural or historic sites/attractions	783	3.24	1.05
Having opportunities to shop	784	3.15	1.11
Attending a festival or event	783	2.87	1.07
Enjoying nightlife and entertainment	781	2.78	1.21
Indulging in luxury, staying at first class hotels	784	2.55	1.24

*Average rating on a scale of one to five, with five being the most important.

4.2 Preferences for Resort Characteristics

In section 3 of the survey, respondents were asked about their opinions for basic characteristics of mountain resorts related to development, recreational opportunities, local transportation, and environmental initiatives.[15] A summary of the responses are shown in Table 4.6. In terms of development, respondents slightly preferred a multi-centred type of development pattern to a highly compact or dispersed pattern. When asked what percent of the resort's employees should live within the resort boundaries, most respondents indicated 50% or less, even though many workers would be forced to commute.

In terms of recreation, respondents were more apt to prefer an extensive trail system (60%) to a moderate system, extensive cultural and educational opportunities over limited opportunities (57%), and an absence of motorized sports at the resort (55%). Furthermore, respondents preferred a resort with two golf courses (33%), followed closely by one course (28%), while three or more courses and no golf courses were each preferred by one-fifth of respondents.

Respondents were also asked about their preferences for environmental initiatives, including a protected area network, utilization of renewable energy, recycling and waste management, and a fee to cover the cost of environmental initiatives. Respondents were very supportive of protected areas: over three-quarters of respondents felt that 20% or 35% of the land within the resort should be protected. When asked about renewable energy, one third considered the current level of 40% most desirable while almost all others thought increasing the percentage to 60% was more desirable. In terms of the amount of waste recycled, the vast majority (80%) indicated that achieving a greater percentage than the current 25% was desirable. Finally, most respondents indicated a willingness to pay for environmental initiatives, with the most desirable amount being a 2% tax.

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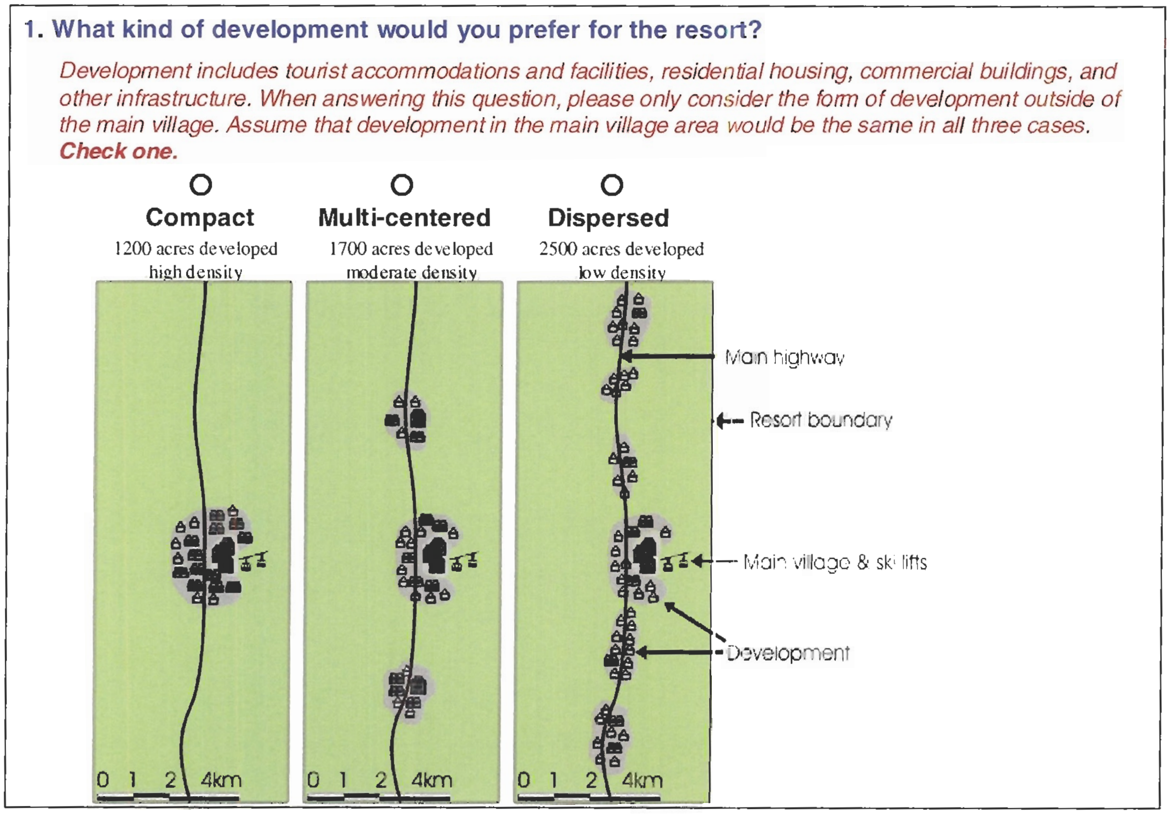
[15] Respondents were asked to answer these questions based on their preferences for a possible mountain resort that has a maximum capacity of 50,000 people including visitors, residents and second home owners (i.e. about the same size as Whistler).

Table 4.6 Respondent's preferences for resort characteristics

Resort Characteristic and Description	Levels	Frequency	
Form of Development	Compact	237	30.9%
See Figure 4.1	Multi-centered	335	43.7%
	Dispersed	195	25.4%
Percent Resident Workforce	25% or less	194	25.0%
A resident workforce was defined as the percent of the workforce living within the resort boundary. Respondents were told that employees who do not live in the resort typically live in neighbouring towns and commute to work every day.	50%	336	43.4%
	75%	169	21.8%
	100%	76	9.8%
Extent of Trail System	Moderate	309	39.6%
Nature trails were defined as gravel or dirt trails for hiking and mountain biking through forested areas, grasslands, and other undeveloped areas in the resort. Moderate = a few trails of different degrees of difficulty, encounters with others common. Extensive = many trails, encounters with others uncommon.	Extensive	471	60.4%
Availability of Motorized Sports	No	428	54.7%
Examples of motorized sports given included ATV or Hummer tours that were available in or near the resort.	Yes	354	45.3%
Availability of Cultural & Educational Activities	Limited	332	42.6%
Examples of cultural and education activities given included museums, historic sites, interpretive sites, & demonstrations.	Extensive	447	57.4%
Number of Golf Courses	0	151	19.3%
Respondents were told to assume that these golf courses were 18-hole golf courses.	1	215	27.5%
	2	261	33.4%
	3 or more	154	19.7%
Percent of Area Protected	0%	2	0.3%
Protected land was defined as land that would be set aside to preserve wildlife habitat and ecologically valuable areas (e.g., wetlands, habitat for rare species) and would not be available for future development or recreation. Respondents were informed that currently about 5% of the land in Whistler is protected.	5%	175	22.4%
	20%	300	38.4%
	35% or more	304	38.9%
Percent of Energy from Renewable Sources	20% or less	14	1.8%
Renewable energy sources were defined as sources that emit less pollution than non-renewable sources such as fossil fuels (e.g., wind, hydro-electric and geothermal). Respondents were told that about 40% Whistler's energy is from renewable sources.	40%	273	34.9%
	60%	274	35.0%
	80% or more	221	28.3%
Percent of Waste Recycled or Composted	0%	4	0.5%
Respondents were told that recycling or composting the waste generated in the resort would reduce the amount sent to landfills. They were informed that about 25% of Whistler's waste is recycled.	25%	143	18.3%
	50%	315	40.2%
	75% or more	321	41.0%
Level of Environmental Fee	0%	97	12.5%
Respondents were told the fee would be a tax added to accommodation, restaurant, and activity bills and revenues generated from this tax would not be used for any purpose other than local environmental initiatives.	2%	365	46.9%
	4%	206	26.4%
	6% or more	111	14.2%

Figure 4.1 Question on development in the learning task



4.3 Observed Behaviour during the DCE

One noteworthy observation is that 26 of the 784 individuals (3%) who answered all three spatial discrete choice questions selected "neither" for each resort choice. In addition, a fairly high proportion (9%) of respondents selected "neither" twice. Upon completing the survey, individuals were given an opportunity to submit general comments on the survey. Five of the 26 individuals who selected "neither" for all three choices stated reasons for their actions:

- Wanted to give qualitative responses
- Required better use of colour to differentiate options
- Wanted a go-back option
- Wanted more options (x2)

These comments suggest at least some individuals preferred to select 'neither' because they had difficulty with the response task or they were protesting to the response format. Others likely selected 'neither' because they considered certain aspects of the profiles to be unacceptable for a mountain resort. Because it was impossible to differentiate between the respondents who selected neither as a protest from those who selected neither because they were not satisfied with either resort, the choices for these 26 individuals were retained in the final sample.

4.4 Responses to DCE Debriefing Questions

After completing the spatial discrete choice questions, respondents were asked several questions to assess how much the various spatial features influenced their choices. First, respondents were asked whether they (a) equally considered the map and the text next to the map, (b) considered the map more than the text, or (c) considered the text more than the map. The greatest proportion of people considered the map and the text equally (52%). Approximately 37% considered the text more, while 12% considered the map more.

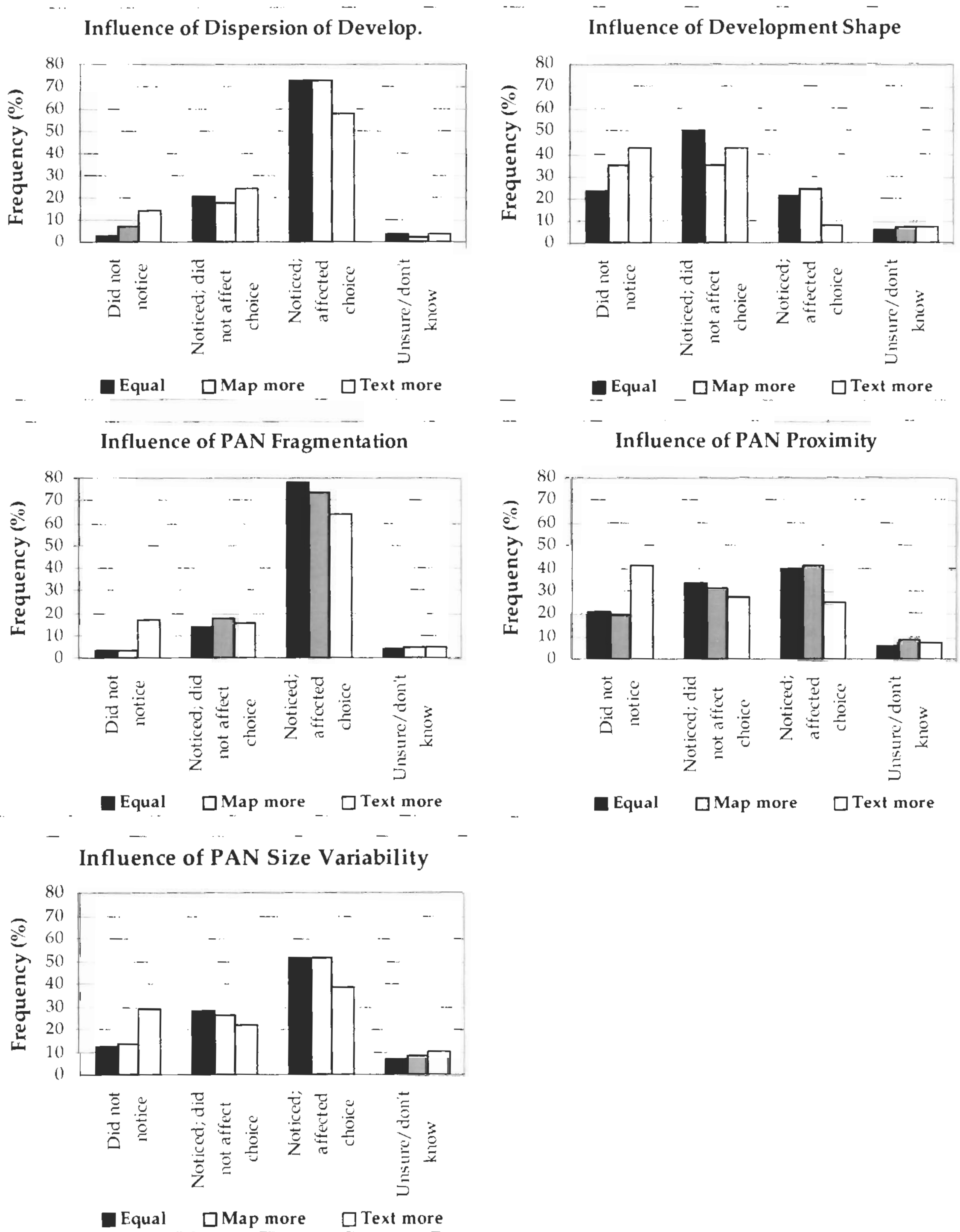
In addition to being asked how much they considered the map in their choices, respondents were asked whether they considered various spatial characteristics or map features in their choices. The five spatial features that varied in the maps were:

- Number of developed areas (i.e., dispersion)
- Shape of developed areas (i.e., irregularity)
- Number of protected areas (i.e., fragmentation)
- Proximity of protected areas to developed areas (i.e., adjacency)
- Consistency of size of protected areas (i.e., variability)

Individuals were asked to state whether they (a) did not notice these features, (b) noticed these features, but did not consider them in their choices, (c) noticed and considered these features in their choices, or (d) were unsure. The highest proportion of individuals noticed and considered the fragmentation of protected areas (72%) and the dispersion of development (67%) (Figure 4.2). The variability in sizes of protected areas was noticed and considered by just under half of the respondents (47%). Approximately 34% of individuals considered proximity in their choices while similar proportions indicated that they either did not notice this feature (28%) or they noticed it but did not consider it in their choices (31%). The least considered spatial feature was shape of developed areas (16%); a larger number either did not notice this feature (32%) or did not consider it in their choices (45%).

The responses to these questions indicate that individuals who considered the text more than the map were more likely to not notice or not consider the various spatial features in their choices (Figure 4.2). In contrast, individuals who considered the map more or the text and map equally were more likely to notice and consider each of the spatial features in their choices. The differences between respondents who considered the map more versus respondents who considered the map and text equally are very slight; individuals in both groups were influenced by the individual map features to a similar degree.

Figure 4.2 Responses to spatial resort choice follow up questions



4.5 Discrete Choice Experiment

4.5.1 Full MNL Model

The full discrete choice model contains 22 parameters when the continuous attributes are coded with both linear and quadratic terms and one intercept is included (Table 4.7). The negative intercept shows that respondents preferred neither resort when the alternatives were set to the base case scenario. This finding is not surprising given the high proportion of individuals who selected the base alternative of 'neither.'

Several parameters related to protected areas were significant in the model (Table 4.7). Overall, visitors demonstrated a strong preference for having some protected areas at mountain resorts, but preferences started to level off as the amount of protected area approached 35%. This finding is consistent with the belief that maintaining natural areas at resort destinations is very important (Farrell & Runyan, 1991; Gunn, 1965; Inskeep, 1987). The amount of critical areas protected is also significant (at the 10% level), which suggests that individuals also preferred that the land placed under protection includes areas with high ecological value (e.g., habitat for rare or sensitive species). The other significant parameter related to protected areas is the proximity of protected areas to developed areas. Respondents preferred scenarios in which all protected areas were buffered from developed areas over scenarios where some of the protected areas were adjacent to development. This finding is consistent with research by Johnston et al. (2002), which showed that residents preferred development scenarios in which preserved open space was separated from the development. Visitors may perceive a negative impact of development on the protected areas, prefer to have access to land immediately adjacent to developed areas, or expect that the close proximity of protected areas to development may increase the likelihood of some negative impact (e.g., an increase in nuisance wildlife).[16]

Several of the protected area attributes were not significant, including fragmentation, variability in size of protected areas, and map version. Two of these (i.e.,

[16] Problems with wildlife for individuals living next to protected areas, such as damage to property, noise, and pet predation, has been reported in the literature (Harris, Shaw, & Schelhas, 1997).

size variability and map version), were expected to be insignificant because they were included only to test the influence of different visual representations of similar spatial arrangements not of interest from a policy perspective, but potentially influential on preferences. However, the lack of significance for the fragmentation attribute is somewhat surprising, particularly since a large proportion of respondents claimed to have considered fragmentation in their choices (see section 4.4). It is possible that respondents were extremely inconsistent or heterogeneous in their preferences for fragmentation or that their responses to the follow up question did not represent their actual behaviour.

Table 4.7 Parameter estimates and model fit for the full and restricted DCE models (n=784)

Attribute		Full Model		Restricted Model	
		Coeff.	Std.Err.	Coeff.	Std.Err.
PROTECTED AREA ATTRIBUTES					
Land protected?	No	-1.267	0.076	-1.264	0.076
	Yes	1.267***	0.076	1.264***	0.076
Amount protected	Linear term	0.510***	0.049	0.527***	0.048
	Quadratic term	-0.105***	0.024	-0.103***	0.024
Percent critical area protected	Linear term	0.100*	0.053	0.119**	0.051
	Quadratic term	0.032	0.023	NE	NE
Proximity to development	Buffered	0.077	0.035	0.067	0.035
	Adjacent	-0.077**	0.035	-0.067**	0.035
Fragmentation	Linear term	-0.001	0.007	-0.005	0.006
	Quadratic term	-0.001	0.002	NE	NE
Size variability	Equal sizes	0.006	0.035	0.012	0.035
	Unequal sizes	-0.006	0.035	-0.012	0.035
Map version	A	0.018	0.031	0.015	0.031
	B	-0.018	0.031	-0.015	0.031
DEVELOPMENT ATTRIBUTES					
Amount development far	Linear term	0.050	0.045	0.041	0.044
	Quadratic term	-0.059**	0.024	-0.054**	0.024
Amount development close	Linear term	-0.001	0.044	0.0023	0.044
	Quadratic term	0.027	0.025	NE	NE
Percent of workforce living in the resort	Linear term	-0.004***	0.001	-0.005***	0.001
	Quadratic term	0.0001*	0.0001	0.0001*	0.0001
Number of nodes developed	2 Nodes	0.042	0.033	0.045	0.033
	4 Nodes	-0.042	0.033	-0.045	0.033
Shape of developed areas	Regular, smooth	0.010	0.035	0.013	0.035
	Irregular, convol.	-0.010	0.035	-0.013	0.035
RECREATION ATTRIBUTES					
Number of golf courses	Linear term	-0.092**	0.041	-0.101**	0.040
	Quadratic term	-0.116***	0.026	-0.116***	0.026
Extent of trail system	Moderate	-0.045	0.037	-0.043	0.037
	Extensive	0.045	0.037	0.043	0.037
INTERCEPT		-0.178**	0.089	-0.175**	0.089
LL (0)		-2583.936		-2583.936	
LL (β)		-2062.368		-2064.119	
ρ^2 (adjusted ρ^2)		0.2019 (0.1981)		0.2012 (0.1979)	

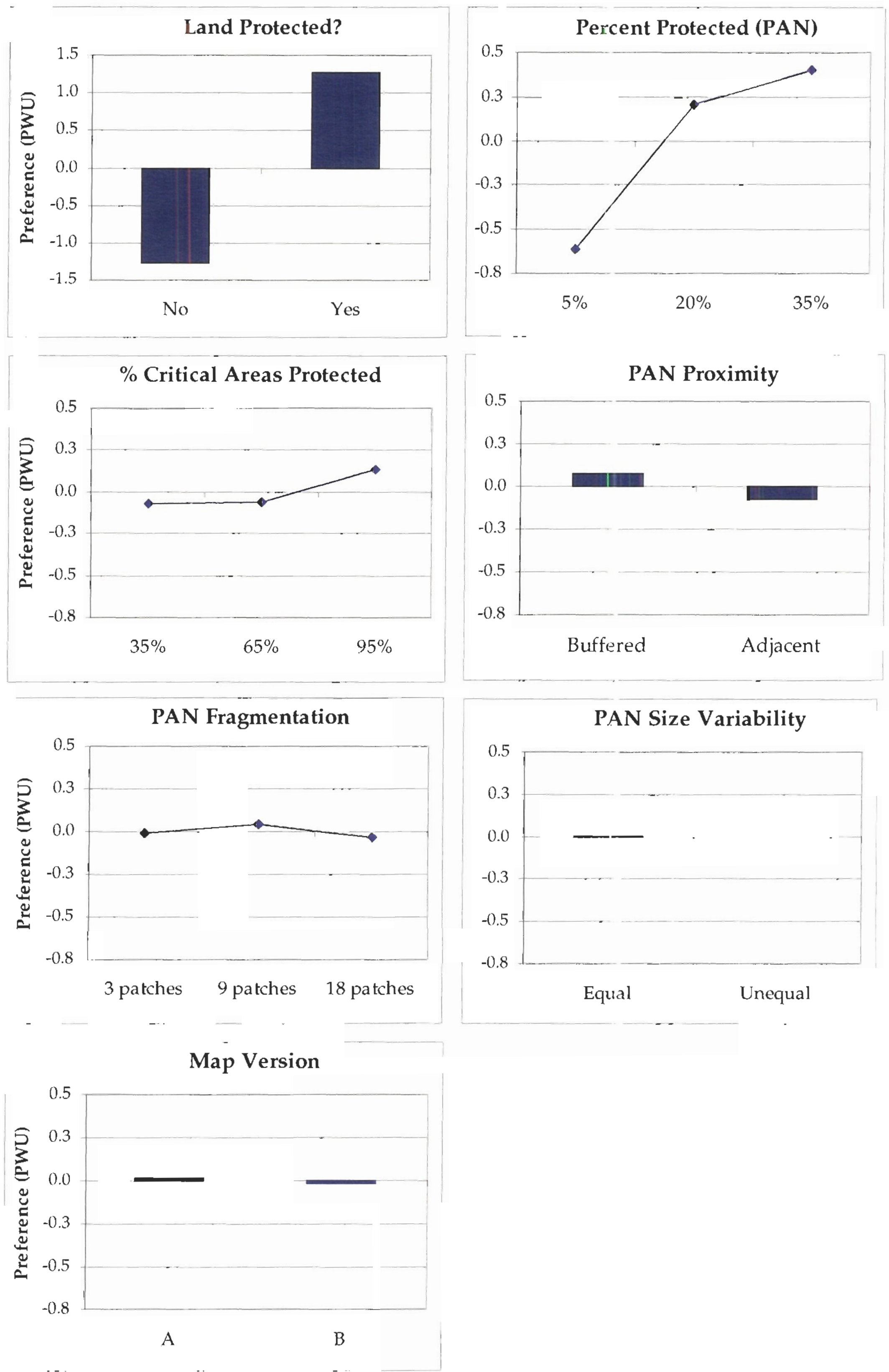
NE = not estimated

* $0.10 > p \geq 0.05$

** $0.05 > p \geq 0.01$

*** $p < 0.01$

Figure 4.3 Part worth utilities (PWU) for different levels of protected area attributes (n=784)



A few of the development-related attributes were significant (Table 4.7). The quadratic term for the amount of development far from the core was negatively significant, indicating that respondents preferred some development outside of the core, but only up to a limited amount (Figure 4.4). Conversely, respondents did not show a significant preference for the amount of development close to the core. Overall, respondents did not seem to be strongly averse to the maximum amount of development tested in this survey, which was slightly more than the current amount of development in Whistler. The lack of a strong negative reaction to amount of development contrasts with previous findings that increasing the size of residential developments has a negative influence on visitor preferences (Johnston et al. 2002).

Another highly significant development-related attribute was the percent of the resort's workforce living within the resort boundaries. Respondents considered 25% to 75% of the workforce living in the resort to be acceptable, but higher than 75% to be undesirable. Perhaps visitors were expressing fear over a change in the atmosphere of the resort with such a high percentage of resident employees. Alternatively, perhaps visitors were expressing a dislike for a high amount of a certain type of development typically associated with employee housing. The reasons for this finding need to be explored in greater detail. It is important to note that the difference between 25% workforce and 75% workforce is not significant though, which shows that visitors support a large percentage of the workforce living in the resort.[17]

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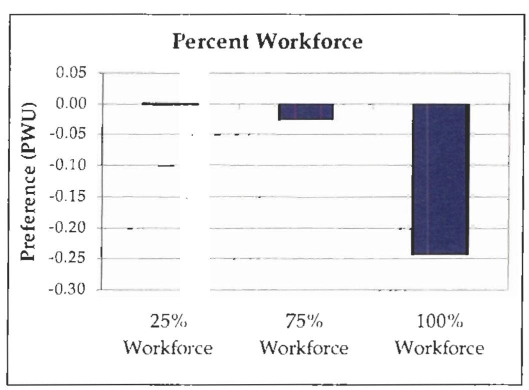
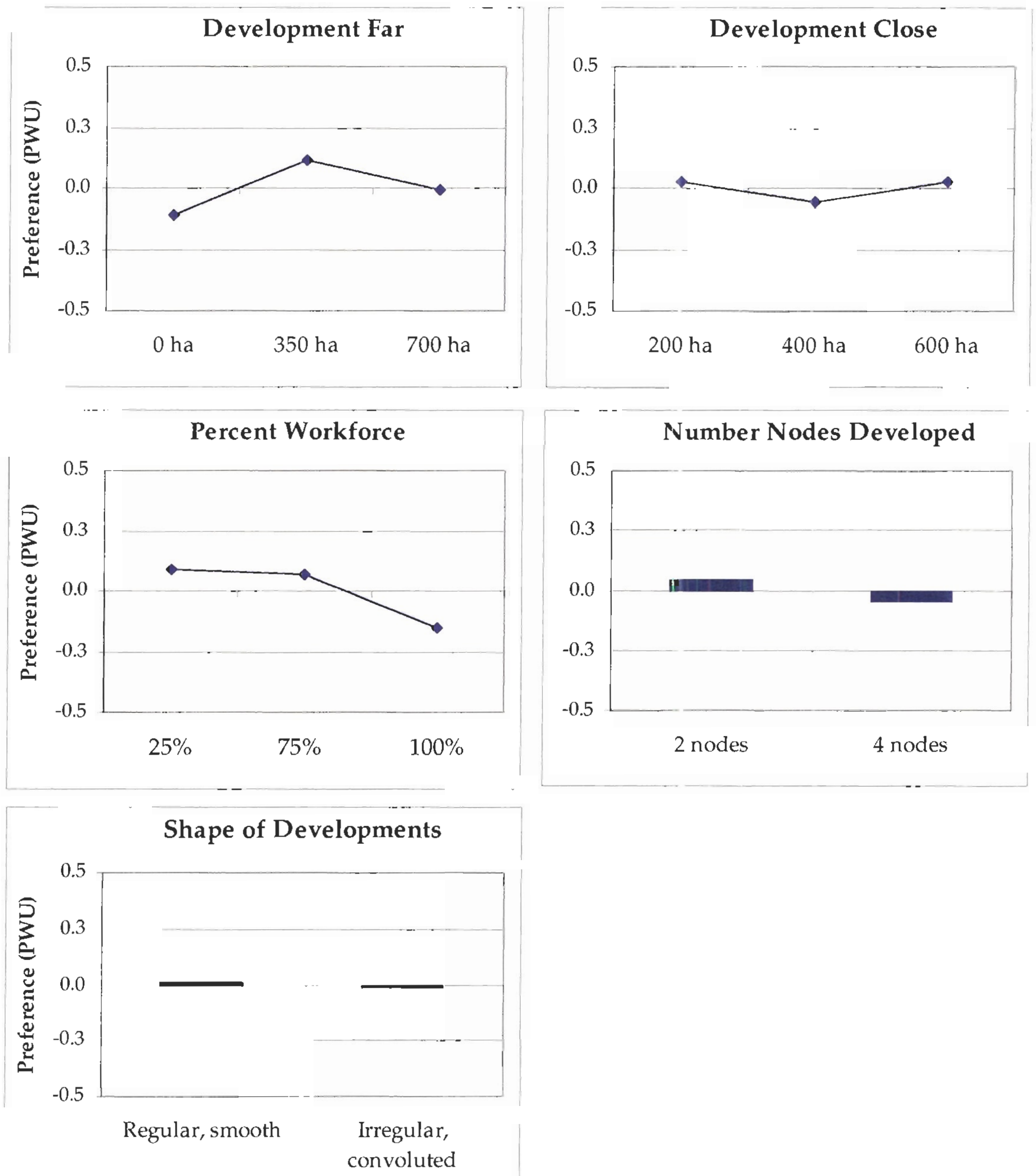
17 This interpretation becomes clear when the workforce attribute is dummy coded as opposed to linear and quadratic coded. As shown by the p-values and the graph below, the difference between 25% and 75% workforce is not significant.

Level	Coefficient	Std. Err.	p-value
25% workforce	0		
75% Workforce	-0.0258864	0.088184	0.769
100% Workforce	-0.243048	0.089074	0.006



The attributes describing how many nodes were developed and the shape of development were not significant in the overall model. The lack of significance for development shape in the overall model may be explained by the fact that a very low proportion of respondents noticed development shape in the maps; this feature may have been too subtle to detect amongst all the other, more obvious spatial attributes. The lack of a strong preference for the number of nodes developed is somewhat surprising, especially since this attribute was quite obvious. Johnston et al. (2002) found that resident preferences for the distribution of development across the landscape depended on the size of the development; respondents preferred longer, narrower, multi-section developments when the total amount was low and a less fragmented form when the total amount was high. Taken together, these findings suggest that preferences for form of development may vary quite substantially depending on the situation and they may be difficult to estimate.

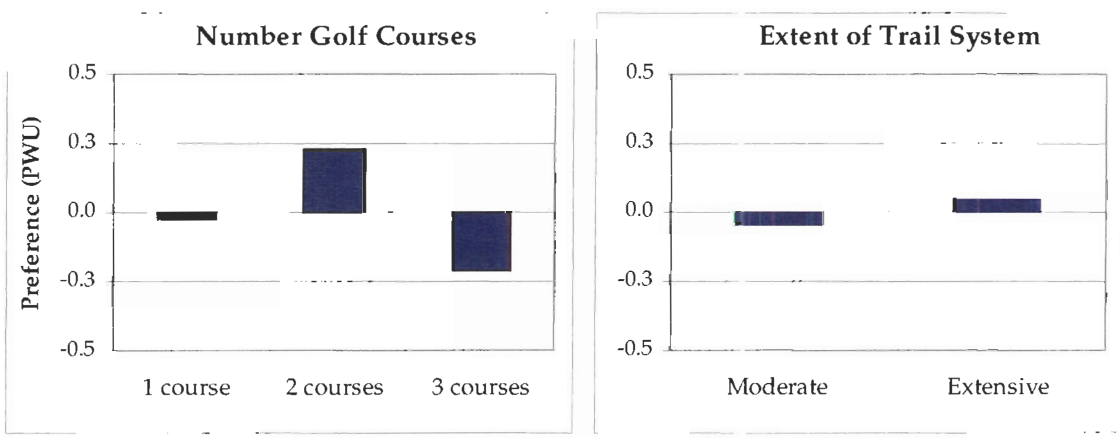
Figure 4.4 Part worth utilities (PWU) for different levels of developed area attributes (n=784)



In terms of recreation, respondents preferred one or two golf courses, but preferences declined drastically when there were three golf courses at the resort (Figure 4.5). The strong preference for one or two golf courses is somewhat surprising given that only 10% of the respondents golfed during their trip to Whistler. Golf courses clearly must provide some benefit to non-golfers who may derive non-utilitarian benefits from golf courses, are travelling with golfers, or prefer to have the option to golf if they choose. However, the negative impacts associated with golf courses appear to outweigh the positive aspects as the number of golf courses increase. Thus, golf course expansion at a tourist destination may not only be controversial from a resident's perspective as shown by Markwick (2000) and Wyllie (1998), but also from a visitor's point of view.

Respondents did not show a strong preference either way for a moderate or extensive trail system (Figure 4.5). This finding suggests that a sizable group of summer visitors are content with a system composed of just a few trails of different degrees of difficulty where encounters with others may be common. However, perhaps these two levels were simply not distinct enough to elicit a significant response from such a diverse sample of visitors.

Figure 4.5 Part worth utilities (PWU) for different levels of recreational attributes (n=784)



Overall, the model fit is satisfactory. The ρ^2 and adjusted ρ^2 values of 0.2027 and 0.1988, respectively, are considered to be acceptable for a typical DCE (Louviere et al., 2000)[18]. The high log likelihood value of – 2060 reflects the insignificance of a number of attributes. The insignificant attributes either were not important in this context, were not perceived by respondents (e.g., shape of developed areas), or were not correctly specified in terms of their levels. Respondents may also have been very inconsistent or

[18] Louviere et al. (2000) state that values of ρ^2 between 0.2 and 0.4 are considered to be indicative of extremely good model fits.

heterogeneous in their preferences. Additional analyses that can help explore potential reasons, such as a priori segmentations and character interactions, are discussed below.

4.5.2 Interactions between Attributes

As permitted by the design plan, several attributes were interacted with one another, and models were estimated by including one of these additional interactions per run. Table 4.8 shows the coefficients and standard errors for the various interaction terms investigated, along with the model fit parameters, for each model run with the basic attributes shown in Table 4.7 plus one additional interaction. Of the various interactions hypothesized to be potentially important, only one was significant: the amount of protected areas interacted with the amount of critical areas protected. The positive coefficient indicates that the likelihood of a respondent choosing a resort with higher critical areas protected increases as the amount of area protected increases. This finding is intuitive and means that the combination high amounts of protected areas and a high percentage of critical areas protected is even more valuable (Figure 4.6).

Table 4.8 Parameter estimates for linear by linear interactions and model fit[1]

Parameter	Parameter Estimates			Model Fit		
	Coefficient	St. Error	T-ratio	LL(B)	ρ^2	ρ^2 adjusted
Full model without interactions				-2062.368	0.202	0.198
Amount of protected areas X fragmentation	0.016	0.011	1.393	-2061.397	0.202	0.198
Amount of protected areas X proximity	0.020	0.056	0.352	-2062.306	0.202	0.198
Development far X number of nodes developed	-0.040	0.055	-0.720	-2062.109	0.202	0.198
Amount of protected areas X amount critical areas protect[2]	0.130	0.064	2.033**	-2060.306	0.202	0.199
Amount of protected areas X extent of trail system	0.036	0.046	0.785	-2062.060	0.202	0.198

[1] Note that the estimates for the model parameters that comprise the full model are not shown for the sake of brevity. In these models with interactions, the magnitude and direction of the parameters that comprise the full model remain virtually the same as when the model is run without the interactions.

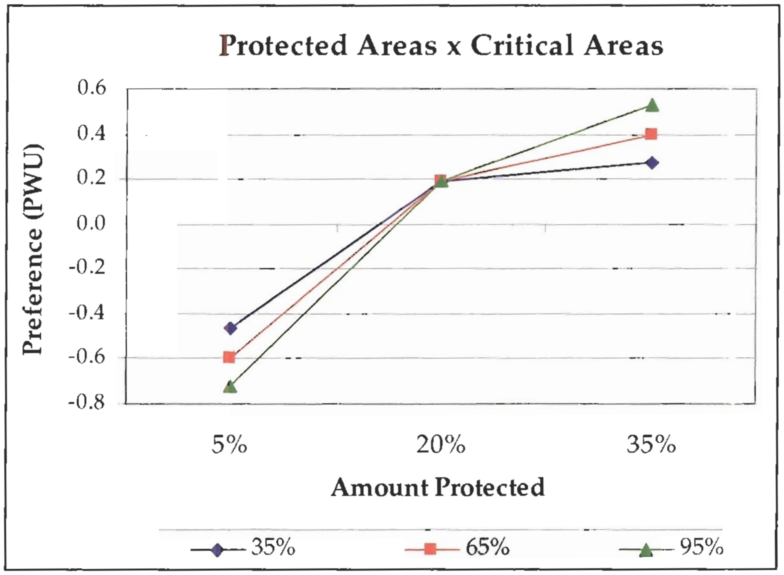
[2] The log likelihood test with 1df indicates this model is a significant improvement over the full at 5% level.

* $0.10 > p \geq 0.05$

** $0.05 > p \geq 0.01$

*** $p < 0.01$

Figure 4.6 PWU for different amounts of protected areas as a function of the amount of critical areas included in the protected areas



4.5.3 Additional Spatial Attributes

A consequence of conducting a spatial discrete choice experiment is that additional attributes, such as spatial features not controlled by the design plan, but caused by interactions between other controlled spatial features, can be included in the model. In this study, several additional spatial features were measured for each profile and included as explanatory parameters in the model (Table 4.9). Only one of the additional measured attributes was significant: the average size of protected areas. Average size of protected areas is a function of the total amount of protected areas and the number of protected patches. From the direction and magnitude of the coefficient for this interaction, respondents appear to prefer smaller patches of protected areas. It should be noted that this attribute is only significant at the 10% level and the model fit improves only slightly when this additional attribute is included. Therefore, this interaction will not be included in the final model used for the decision support tools.

Table 4.9 Parameter estimates for additional spatial attributes and model fit[1]

Parameter	Parameter Estimates			Model Fit		
	Coefficient	St. Error	T-ratio	LL(B)	ρ^2	ρ^2 adjusted
Full model without additional attributes				-2062.368	0.202	0.198
Average size of developments				-2061.588	0.202	0.198
DV_AVSZL	0.097	0.105	0.929			
DV_AVSZQ	-0.007	0.032	-0.217			
Edge density of developed areas				-2061.594	0.202	0.198
DEV_ED_L	-0.014	0.025	-0.569			
DEV_ED_Q	0.000	0.001	-0.544			
Development edge: area ratio				-2061.445	0.202	0.198
DEV_EA_L	-0.176	0.164	-1.068			
DEV_EA_Q	-0.039	0.078	-0.492			
Average size of protected areas				-2060.715	0.202	0.198
PN_AVSZL	-0.212	0.118	-1.801*			
PN_AVSZQ	0.031	0.018	1.679*			
Edge density of protected areas				-2061.265	0.202	0.198
PAN_ED_L	0.000	0.022	0.005			
PAN_ED_Q	0.000	0.000	0.631			
Protected area edge: area ratio				-2061.588	0.202	0.198
PAN_EA_L	-0.067	0.251	-0.269			
PAN_EA_Q	-0.001	0.018	-0.071			

[1] Note that the estimates for the model parameters that comprise the full model are not shown for the sake of brevity. In these models with interactions, the magnitude and direction of the parameters that comprise the full model remain virtually the same as when the model is run without the interactions.

* $0.10 > p \geq 0.05$

** $0.05 > p \geq 0.01$

*** $p < 0.01$

4.5.4 A Priori Segmentation

While understanding overall preferences is informative and necessary, it is often more revealing to investigate the preferences of specific segments of the sample, particularly when the entire sample contains a diverse group of people. The segmentations examined in this study relate directly to the objectives of the study, which hypothesized that day and overnight visitors, and local and non-local visitors, may have different preferences for resort characteristics.

4.5.4.1 Length of Stay

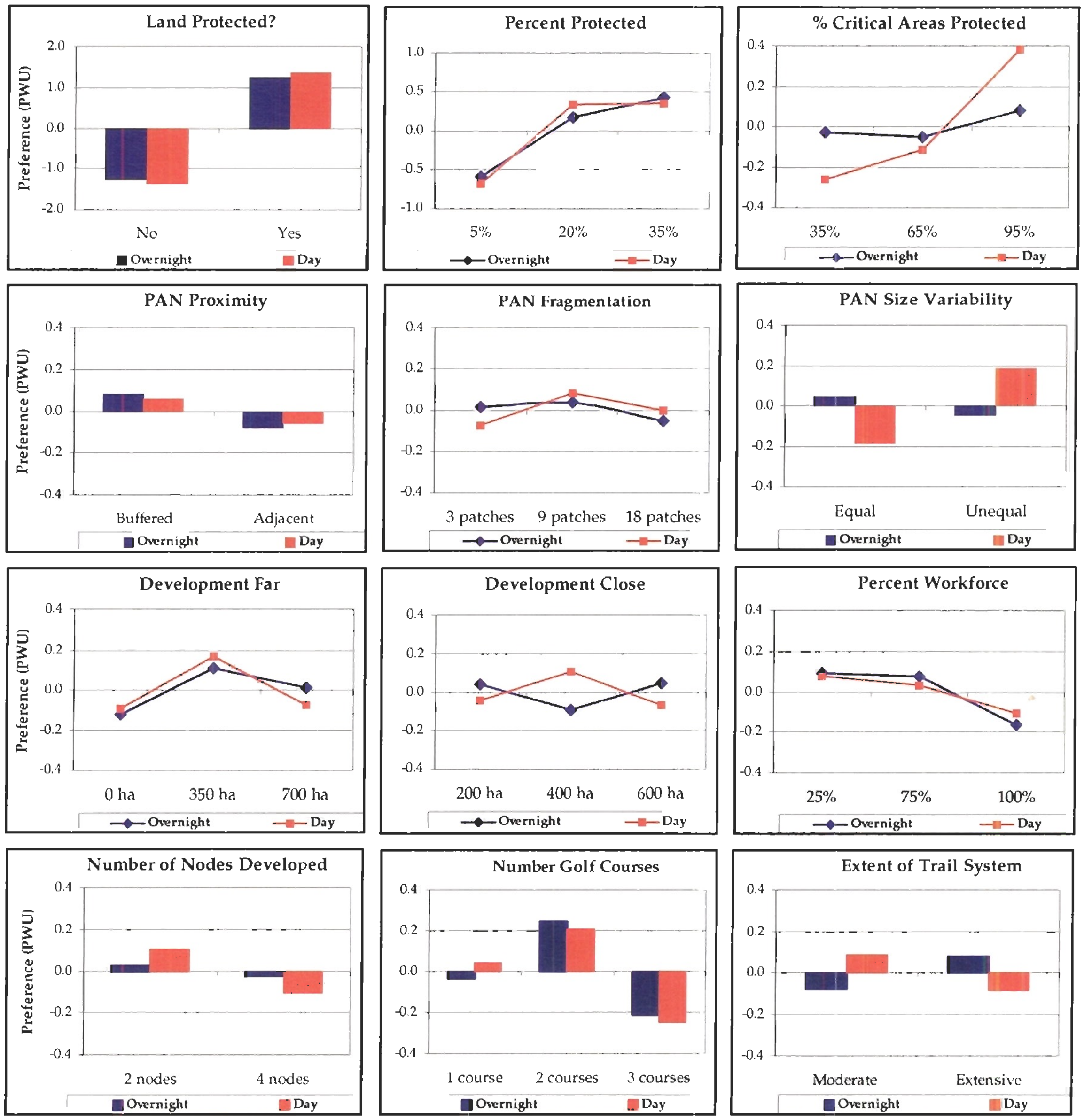
Separate models specified for day (n=146) and overnight (n=619) visitors highlight minor differences between these two segments of visitors (Table 4.10, Figure 4.7). Day visitors had stronger preferences for protecting higher amounts of critical areas. Day visitors also appeared to respond to the variability in size of protected areas and preferred maps with size variability. Perhaps day visitors were influenced by the aesthetics of a landscape and preferred resort landscapes that looked more natural. Overnight visitors preferred an extensive trail system while day visitors were indifferent to the trail system. This makes sense as overnight visitors would have more opportunity than day visitors to explore a more extensive trail system. Both segments had similar preferences for the number of golf courses and the percent of the workforce in the resort; however, these preferences are significant only for overnight users. Overall, this segmentation suggests that day visitors were more concerned with protecting the environment while overnight visitors were also concerned about recreational opportunities.

Table 4.10 Segmentation for overnight (n=619) and day (n=146) visitors

Attribute		Overnight Visitors Coeff.	Overnight Visitors Std.Err.	Day Visitors Coeff.	Day Visitors Std.Err.	Differ-nce
PROTECTED AREA ATTRIBUTES						
Land protected?	No	-1.251	0.084	-1.358	0.185	0.527
	Yes	1.251***	0.084	1.358***	0.185	-0.527
Amount protected	Linear term	0.509***	0.055	0.523***	0.111	-0.109
	Quadratic term	-0.087***	0.027	-0.168***	0.050	1.421
Percent critical area protected	Linear term	0.054	0.059	0.321***	0.117	**-2.034**
	Quadratic term	0.027	0.026	0.059	0.052	-0.546
Proximity to development	Buffered	0.083	0.040	0.060	0.079	0.265
	Adjacent	-0.083**	0.040	-0.060	0.079	-0.265
Fragmentation	Linear term	-0.003	0.008	0.007	0.015	-0.629
	Quadratic term	-0.001	0.002	-0.002	0.003	0.362
Size variability	Equal sizes	0.047	0.040	-0.184	0.079	**2.616**
	Unequal sizes	-0.047	0.040	0.184**	0.079	**-2.616**
Map version	A	0.006	0.035	0.059	0.071	-0.670
	B	-0.006	0.035	-0.059	0.071	0.670
DEVELOPMENT ATTRIBUTES						
Amount development far	Linear term	0.067	0.050	0.008	0.102	0.511
	Quadratic term	-0.054**	0.027	-0.085	0.053	0.528
Amount development close	Linear term	0.001	0.050	-0.011	0.097	0.110
	Quadratic term	0.046	0.028	-0.054	0.059	1.516
Percent workforce living in resort	Linear term	-0.005***	0.002	-0.003	0.003	-0.454
	Quadratic term	0.0001*	0.000	0.000	0.000	-0.410
Number of nodes developed	2 Nodes	0.027	0.038	0.104	0.075	-0.920
	4 Nodes	-0.027	0.038	-0.104	0.075	0.920
Shape of developed areas	Regular, smooth	0.016	0.039	-0.002	0.079	0.209
	Irregular, convol.	-0.016	0.039	0.002	0.079	-0.209
RECREATIONAL ATTRIBUTES						
Number of golf courses	Linear term	-0.087*	0.046	-0.141	0.095	0.506
	Quadratic term	-0.123***	0.030	-0.103*	0.057	-0.308
Extent of trail system	Moderate	-0.078	0.043	0.083	0.082	**-1.742**
	Extensive	0.078*	0.043	-0.083	0.082	**1.742**
INTERCEPT		-0.144	0.099	-0.325	0.210	0.776
LL (0)		-2040.123		-540.517		
LL (β)		-1626.342		-420.8699		
ρ^2 (adjusted ρ^2)		0.2039 (0.1989)		0.2214 (0.2036)		

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

Figure 4.7 Part worth utilities (PWU) for overnight and day visitors



4.5.4.2 Place of Residence

A second segmentation was conducted between individuals residing within B.C., most of whom are from the Lower Mainland (i.e., local visitors, n=351) and individuals residing outside of B.C. (i.e., non-local visitors, n=433). In general, non-local visitors had stronger preferences for protecting higher amounts of critical areas compared to local visitors (Table 4.11, Figure 4.8). Visitors from out of the province also reacted more negatively to a higher percentage of the workforce living in the resort than local visitors.

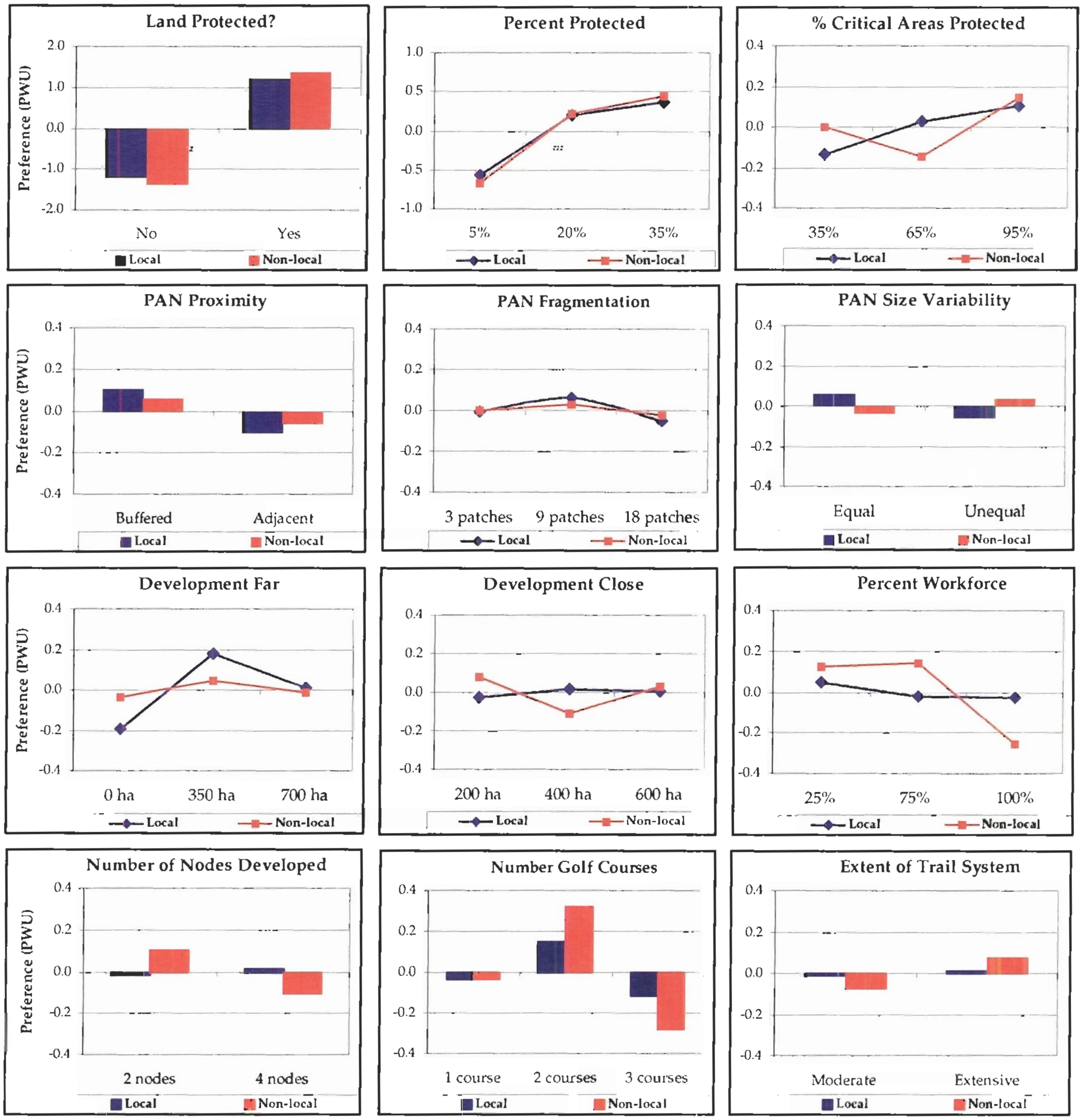
Finally, non-local visitors preferred less dispersed development than local visitors (i.e., two nodes developed rather than four nodes). These results suggest that visitors from out of the province were seeking a more natural experience where the impact on the environment was less and a strong tourist atmosphere was present at the resort.

Table 4.11 Segmentation for local (B.C. residents) (n=351) and non-local (n=433) visitors

Attribute		Local (B.C.) Coeff.	Local (B.C.) Std.Err.	Non-Local Coeff.	Non-Local Std.Err.	Differ-nce
PROTECTED AREA ATTRIBUTES						
Land protected?	No	-1.181	0.108	-1.362	0.109	1.181
	Yes	1.181***	0.108	1.362***	0.109	-1.181
Amount protected	Linear term	0.466***	0.072	0.559***	0.067	-0.942
	Quadratic term	-0.101***	0.035	-0.112***	0.033	0.221
Percent critical area protected	Linear term	0.117	0.076	0.072	0.074	0.425
	Quadratic term	-0.015	0.035	0.072**	0.032	**-1.845**
Proximity to development	Buffered	0.104	0.052	0.061	0.049	0.601
	Adjacent	-0.104**	0.052	-0.061	0.049	-0.601
Fragmentation	Linear term	-0.002	0.010	-0.001	0.010	-0.044
	Quadratic term	-0.002	0.002	-0.001	0.002	-0.293
Size variability	Equal sizes	0.056	0.053	-0.037	0.049	1.298
	Unequal sizes	-0.056	0.053	0.037	0.049	-1.298
Map version	A	0.008	0.047	0.033	0.043	-0.381
	B	-0.008	0.047	-0.033	0.043	0.381
DEVELOPMENT ATTRIBUTES						
Amount development far	Linear term	0.102	0.066	0.010	0.063	1.017
	Quadratic term	-0.091***	0.035	-0.024	0.033	-1.378
Amount development close	Linear term	0.015	0.065	-0.022	0.061	0.417
	Quadratic term	-0.010	0.037	0.055	0.035	-1.263
Percent workforce living in resort	Linear term	-0.001	0.002	-0.007***	0.002	**2.188**
	Quadratic term	0.00001	0.0001	0.0002***	0.0001	**1.872**
Number of nodes developed	2 Nodes	0.016	0.049	0.103	0.047	**-1.761**
	4 Nodes	0.016	0.049	-0.103**	0.047	**1.761**
Shape of developed areas	Regular, smooth	0.009	0.051	0.012	0.049	-0.032
	Irregular, convol.	-0.009	0.051	-0.012	0.049	0.032
RECREATIONAL ATTRIBUTES						
Number of golf courses	Linear term	-0.040	0.060	-0.123**	0.057	0.994
	Quadratic term	-0.076**	0.039	-0.160***	0.036	1.590
Extent of trail system	Moderate	-0.011	0.056	-0.074	0.051	0.825
	Extensive	0.011	0.056	0.074	0.051	-0.825
INTERCEPT		-0.197	0.127	-0.185	0.126	-0.066
LL (0)		-1156.839		-1427.097		
LL (β)		-954.009		-1089.443		
ρ^2 (adjusted ρ^2)		0.1753 (0.1666)		0.2366 (0.2298)		

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

Figure 4.8 Part worth utilities (PWU) for local (B.C. residents) and non-local visitors



4.5.4.3 Other Segmentations

A number of other segmentations on socio-demographic characteristics, activities undertaken in Whistler, and map reading skill were tested. No further segmentations are discussed because most other segmentations resulted in only one significant difference or the differences could not be rationally explained and may have been spurious. For example, segmentations based on the activities undertaken in Whistler demonstrated that individuals who participated in certain activities (i.e., golf and mountain biking on trails) differed in their preferences for specific recreational attributes (i.e., number of golf courses and extent of trail system). Therefore, these differences were included as interactions between individual characteristics and specific attributes (see below).

4.5.5 Character Specific Interactions

Interacting specific attributes with respondent characteristics is a classic way to incorporate heterogeneity in discrete choice models. In this model, interactions between respondent characteristics and the golf and trail attributes highlight differences in preferences for these attributes between golfers and non-golfers, and bikers and non-bikers. More specifically, golfers preferred more golf courses while the non-golfers preferred two golf courses and were quite negative towards three golf courses (Table 4.12, Figure 4.9). Respondents who did not use the trail system in Whistler for mountain biking did not show a significant preference for the extent of the trail system while mountain-bikers preferred an extensive trail system. It is somewhat surprising that hikers did not show the same strong preference for an extensive trail system; this suggests that hikers do not seek as extensive of a trail system as bikers, at least within the community boundaries. Overall, visitors who undertake certain activities generally seem to benefit from a greater opportunity to participate in those activities while those who do not participate may be indifferent or negative towards such recreational features.

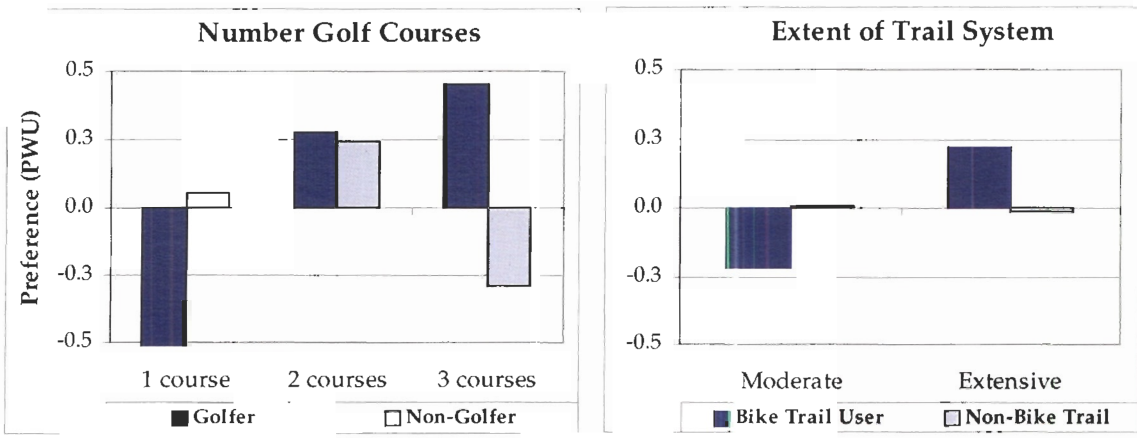
Table 4.12 Basic MNL model compared to the model with two character-specific interactions

Attribute		Basic MNL Coeff.	Basic MNL Std.Err.	With Interactions[19] Coeff.	With Interactions[19] Std.Err.
PROTECTED AREA ATTRIBUTES					
Land protected?	No	-1.267	0.076	-1.283	0.077
	Yes	1.267***	0.076	1.283***	0.077
Amount protected	Linear term	0.510***	0.049	0.516***	0.049
	Quadratic term	-0.105***	0.024	-0.103**	0.024
Percent critical area protected	Linear term	0.100*	0.053	0.106**	0.053
	Quadratic term	0.032	0.023	0.035	0.024
Proximity to development	Buffered	0.077	0.035	0.075**	0.036
	Adjacent	-0.077**	0.035	-0.075**	0.036
Fragmentation	Linear term	-0.001	0.007	0.000	0.007
	Quadratic term	-0.001	0.002	-0.001	0.002
Size variability	Equal sizes	0.006	0.035	0.005	0.036
	Unequal sizes	-0.006	0.035	-0.005	0.036
Map version	A	0.018	0.031	0.021	0.032
	B	-0.018	0.031	-0.021	0.032
DEVELOPMENT ATTRIBUTES					
Amount development far	Linear term	0.050	0.045	0.050	0.045
	Quadratic term	-0.059**	0.024	-0.060***	0.024
Amount development close	Linear term	-0.001	0.044	-0.005	0.044
	Quadratic term	0.027	0.025	0.021	0.026
Percent of workforce	Linear term	-0.004***	0.001	-0.004***	0.001
	Quadratic term	0.0001*	0.0001	0.0001*	0.0001
Number developed nodes	2 Nodes	0.042	0.033	0.038	0.034
	4 Nodes	-0.042	0.033	-0.038	0.034
Shape of developed areas	Regular, smooth	0.010	0.035	0.013	0.035
	Irregular, convol.	-0.010	0.035	-0.013	0.035
RECREATIONAL ATTRIBUTES					
Number of golf courses	Linear	-0.092**	0.041	Golfer: 0.594***	0.132
	Quadratic	-0.116***	0.026	-0.138*	0.083
		---	---	No-golf: -0.172***	0.043
		---	---	-0.120	0.027
Extent of trail system	Moderate	-0.045	0.037	Biker: -0.217***	0.080
	Extensive	0.045	0.037	0.217	0.080
		---	---	No-bike: 0.001	0.041
		---	---	-0.001	0.041
INTERCEPT		-0.178**	0.089	-0.199**	0.090

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

[19] LL (β) = -2042.596, $\rho^2 = 0.2095$, adjusted $\rho^2 = 0.2053$

Figure 4.9 Interactions between activities and golf courses and trail system



4.6 Decision Support: Measuring Tradeoffs with a DST

Decision support tools (DST) were created in Microsoft Excel® (aspatial) and ArcView 3.2 GIS (spatial) using the model summarized in Table 4.13. The aspatial DST allows the user to select any combination of levels for two different resorts, displayed side by side. Based on the levels selected by the user, the DST calculates the percentage of visitors that would select each resort, or neither resort (i.e., market share). In addition to displaying the market share for the entire sample of visitors, the DST displays market shares for specific sub-groups (i.e., golfers, non-golfers, bike trail users and non-bike trail users).

To illustrate how the aspatial DST functions, two extreme scenarios were compared (Table 4.14). The first scenario represents a highly undesirable resort in which all attributes are set to the least preferred levels. The other scenario represents a highly desirable resort in which all attributes are set to the most preferred levels. Given these two choices, the DST predicts that over 90% of the respondents would have chosen the highly desirable resort, and only 1% would have chosen the undesirable resort, with the remaining choosing neither resort. The DST also highlights the variation in preferences for the different subgroups. For example, golfers were slightly more tolerant towards the undesirable resort because it had three golf courses rather than two. Bikers, on the other hand, were less tolerant towards the undesirable resort because it only had a moderate trail system rather than an extensive system.

Table 4.13 MNL model used for the decision support tool [20]

Attribute		Coefficient	Std.Err.
PROTECTED AREA ATTRIBUTES			
Land protected?	No	-1.288	0.077
	Yes	1.288***	0.077
Amount protected	Linear term	0.517***	0.049
	Quadratic term	-0.094**	0.024
Percent critical area protected	Linear term	0.121**	0.052
Proximity to development	Buffered	0.078**	0.036
	Adjacent	-0.078**	0.036
Fragmentation	Linear term	-0.005	0.006
Size variability	Equal sizes	0.002	0.036
	Unequal sizes	-0.002	0.036
Map version	A	0.023	0.031
	B	-0.023	0.031
DEVELOPMENT ATTRIBUTES			
Amount development far	Linear term	0.033	0.045
	Quadratic term	-0.055**	0.024
Amount development close	Linear term	-0.024	0.046
Percent of workforce	Linear term	-0.005***	0.001
	Quadratic term	0.0001**	0.0001
Number developed nodes	2 Nodes	0.050	0.034
	4 Nodes	-0.050	0.034
Shape of developed areas	Regular, smooth	0.009	0.035
	Irregular, convol.	-0.009	0.035
RECREATIONAL ATTRIBUTES			
Number of golf courses	Linear	Golfer: 0.571***	0.132
	Quadratic	-0.129	0.084
		No-golf: -0.192***	0.043
		-0.112 ***	0.027
Extent of trail system	Moderate	Biker: -0.235***	0.080
	Extensive	0.235	0.080
		No-bike: 0.019	0.043
		-0.019	0.043
INTERACTION (PAN amount x critical area)		0.127**	0.064
INTERCEPT		-0.195**	0.029

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

[20] LL (β) = -2042.414, $\rho^2 = 0.2096$, adjusted $\rho^2 = 0.2057$

Table 4.14 Market shares for an undesirable resort compared with a highly desirable resort

Attribute	Undesirable Resort	Highly Desirable Resort	Neither Resort
HIGHLY INFLUENTIAL ATTRIBUTES FOR OVERALL SAMPLE			
Land Protected?	No	Yes	---
Amount protected	0%	35%	---
Percent critical areas protected	0%	95%	---
Proximity	NA	Buffered	---
Amount developed far	700 ha	400 ha	---
Percent of workforce	100%	50%	---
Number of golf courses	3	2	---
NON-SIGNIFICANT ATTRIBUTES FOR OVERALL SAMPLE*			
Variability	NA	Equal	---
Fragmentation	NA	Low (3 patches)	---
Amount developed close	600 ha	200 ha	---
Shape of developments	Convoluted	Regular	---
Number of nodes developed	4 nodes	2 nodes	---
Extent of trail system	Moderate	Extensive	---
MARKET SHARE			
Overall Sample	**1.0%**	**90.7%**	**8.3%**
Golfers	**1.8%**	**90.3%**	**7.8%**
Non-Golfers	0.9%	**90.7%**	**8.3%**
Bikers	0.8%	92.2%	7.1%
Non-Bikers	1.1%	90.3%	8.6%

NA = not applicable because no area was protected (PWU for these attributes were zero).
* Changes in these attributes affect the market share very little.

To illustrate how the spatial DST functions, three potential future scenarios for Whistler were compared to the current situation in Whistler (Figure 4.10, Table 4.15). The first scenario represents a situation in which no further development is allowed in Whistler and approximately 10% of the low elevation areas of the RMOW (i.e. below 1,000 m) that meet the PAN 1 criteria are protected (Figure 4.10, scenario 1).[21] When compared to the current situation in Whistler, which receives 33% of the market share, scenario 1 is preferred, receiving 43% of the market share. Scenario 1 is even more popular with golfers (49% would chose scenario 1), and trail bikers (45% would chose scenario 1) because there are three golf courses and an extensive trail system.

[21] Areas classified as protected in Scenario 1 were selected randomly from all areas that met PAN 1 criteria.

Figure 4.10 Current situation in Whistler and three alternative future scenarios

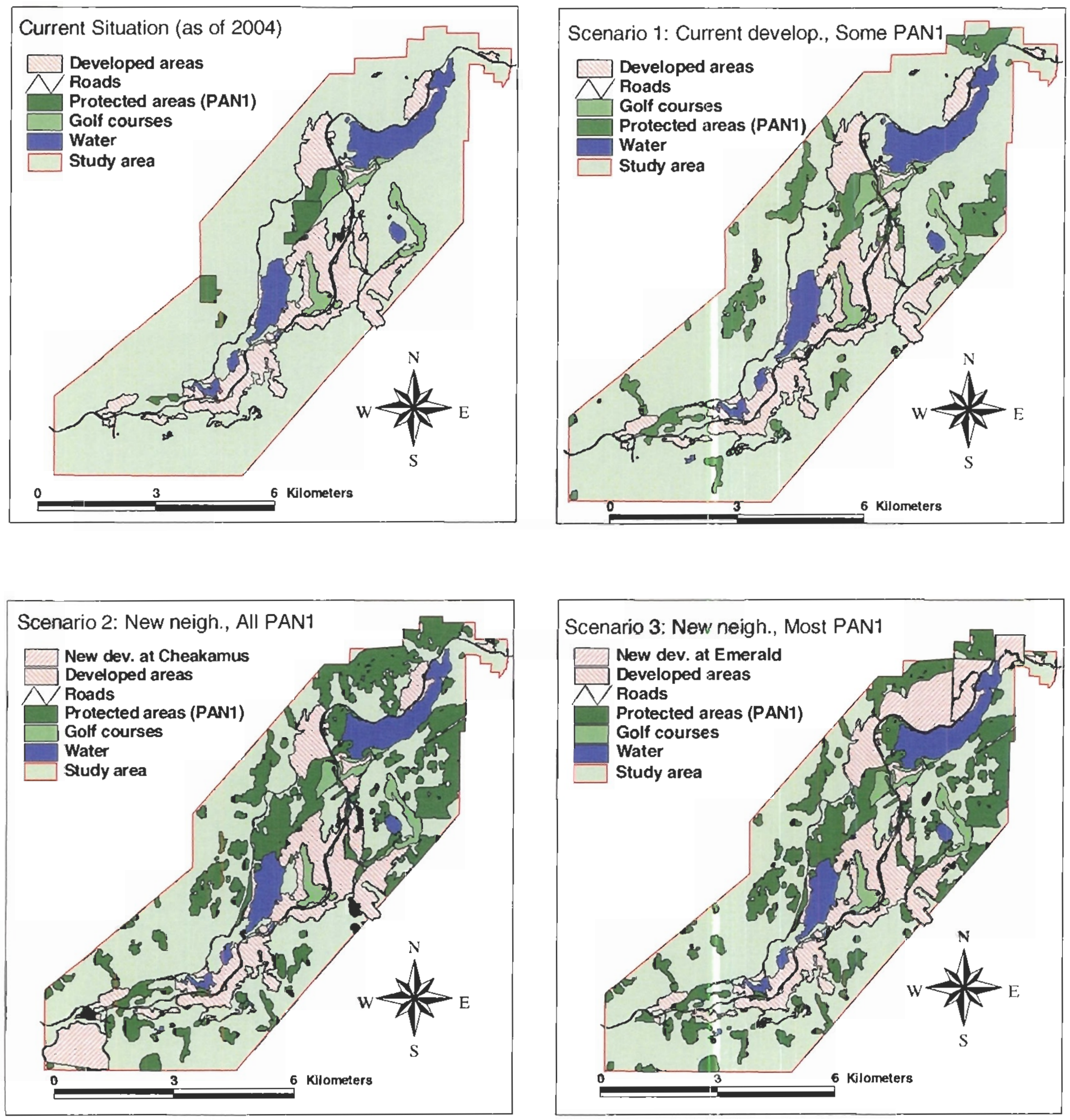


Table 4.15 Market shares for three potential future scenarios compared to the current situation in Whistler

Attribute	Current Situation	**Scenario 1**: No development, partly implement the PAN	**Scenario 2**: New neighbourhood at Cheakamus, fully implement PAN	**Scenario 3**: New development at Emerald, implement PAN nearly fully
Amount protected	3% (5%)*	10%	23%	20%
Percent critical areas protected	10% (35%)*	45%	98% (95%)*	88%
Proximity	Adjacent	Adjacent	Adjacent	Adjacent
Variability	Unequal	Unequal	Unequal	Unequal
Fragmentation	Moderate	High	High	High
Amount developed far	450 ha	450 ha	592 ha	745 ha (700 ha)*
Amount devel. close	410 ha	410 ha	410 ha	410 ha
Percent of workforce	75%	75%	75%	75%
Shape of devel. areas	Con-voluted	Convoluted	Convoluted	Convoluted
Number nodes developed	4 nodes	4 nodes	4 nodes	4 nodes
Number golf courses	3 courses	3 courses	3 courses	3 courses
Extent of trail system	Extensive	Extensive	Extensive	Extensive

Market Share	Current	Sc1	None	Current	Sc2	None	Current	Sc3	None
Overall sample	33%	**43%**	24%	24%	**60%**	16%	27%	**54%**	19%
Golfers	38%	**49%**	13%	26%	**65%**	9%	30%	**59%**	11%
Non-golfers	33%	**42%**	25%	23%	**59%**	18%	27%	**53%**	20%
Trail bikers	35%	**45%**	20%	24%	**62%**	14%	28%	**55%**	16%
Non-trail bikers	33%	**42%**	25%	23%	**59%**	17%	27%	**53%**	20%

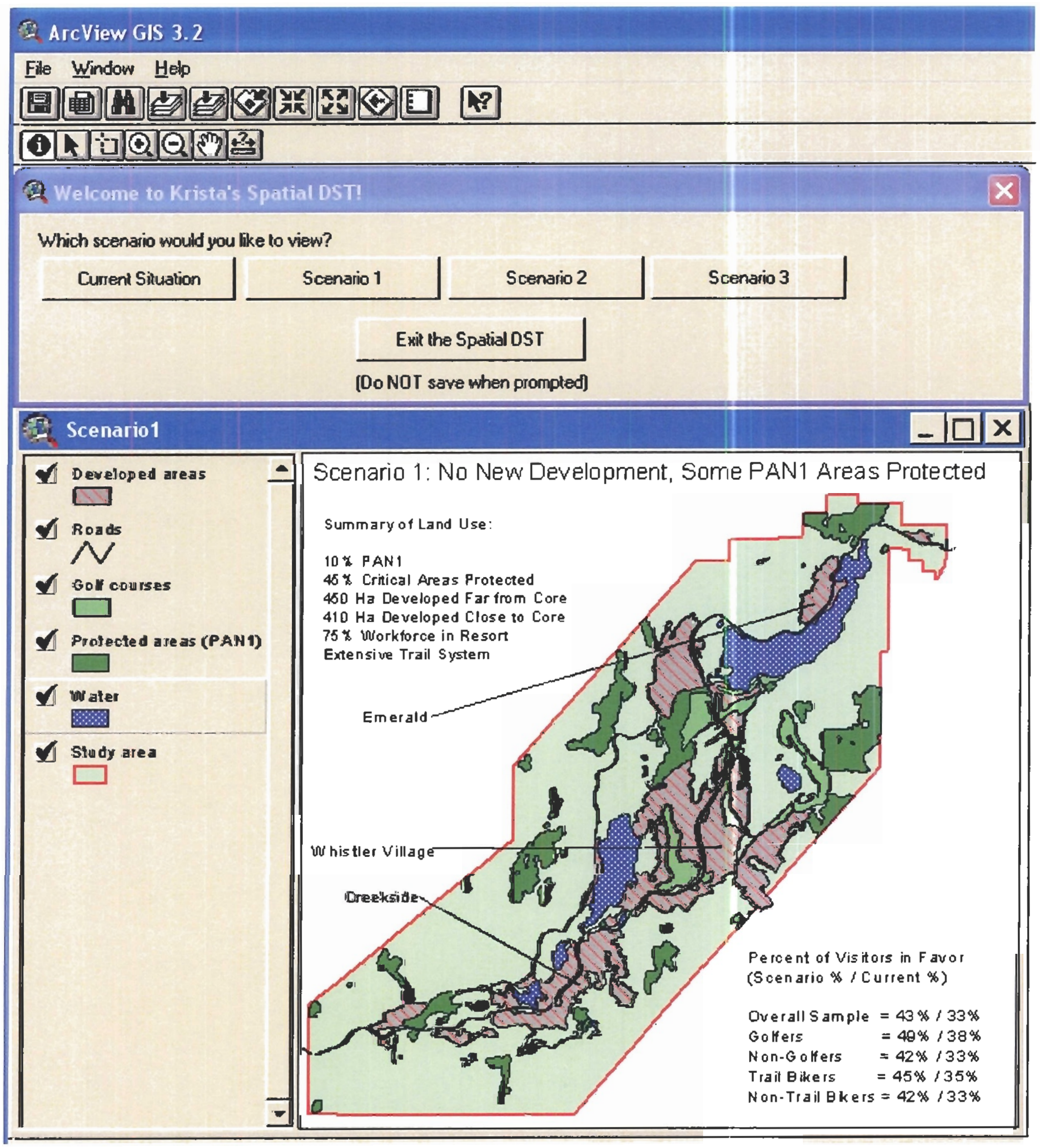
* Because the actual values calculated in the Whistler scenarios exceeded the minimum and maximum levels tested in the survey, the min and max values tested in the survey (shown in brackets) were used instead of these values.

The second scenario represents a situation in which a new neighbourhood is placed at Cheakamus, which is an area that has been identified as a potential location for more development (Figure 4.10, scenario 2). In addition, all areas that meet the PAN 1 criteria are protected (i.e. the PAN is fully implemented). When compared to the current situation, this scenario is significantly more preferred than scenario 1. In particular, scenario 2 receives 60% of the market share and the current situation receives 24% of the share. This increase in market share for scenario 2 is driven by the substantial increase in area protected. Interestingly, the increase in amount developed far from the core, which is considered by respondents to be negative overall, had a relatively minor impact on market share in scenario 2. For example, without the increase of 142 ha of development far from the core scenario 2 receives 61% of the market share; only 1% higher than market share for scenario 2 with the additional development. Another interesting variation of scenario 2 is to assume that the 142 ha increase in development would provide housing for 100% of the workforce at the resort. Under this assumption, the market share for scenario 2 decreases to 54%, with 27% choosing the current scenario and 19% choosing neither resort. This increase in resident workforce has a more significant impact on choice than increasing the amount developed far from the core.

In the third scenario, the current development at Emerald is extended and the PAN is implemented in all places except where the new development overlaps with areas that meet the PAN 1 criteria (Figure 4.10, scenario 3). This increase in the amount of development far from the core (295 ha), and slightly lower degree of protection for natural areas than scenario 2, results in an alternative that receives 54% of the market share, while 27% goes to the current situation and 19% to neither. If it is assumed that the extent of the trail system decreases from extensive to moderate as a result of the new development and protection, the market share for scenario 3 lowers to 50%, with 29% going to the current situation and 21% to neither resort. For trail bikers, the market share for scenario 3 is even lower (44%), with a significant amount preferring the current situation (36%).

To illustrate a straightforward way to create a GIS-based DST, these three potential future scenarios, and the current situation, were programmed as separate views in GIS. The market share for each scenario, as compared to the current situation in Whistler, was displayed in the corner of each view. The GIS-based DST is interactive in that it allows the user to select which alternative to view and alternate between the various scenarios for comparison (Figure 4.11). With this simple tool, the user can easily visualize and compare alternative scenarios in a way that is much more informative than comparing scenarios generated using the aspatial DST. This tool also enables the user to take advantage of regular GIS functions, such as zooming, measuring distances, and examining the attributes of the map features to explore the scenarios in greater detail.

Figure 4.11 Screen shot from the GIS-based DST



CHAPTER 5 IMPLICATIONS & RECOMMENDATIONS

The overall goal of this research was to utilize a spatial discrete choice experiment to obtain preference information for land use planning scenarios and suggest how a DCE could be linked with GIS, which would enable the results to be used in larger land use or conservation planning processes. It was shown that visitors have strong preferences for certain aspects of mountain resorts, such as the amount of protected areas or golf courses, and relatively weak preferences for other aspects, such as the shape of developed areas. This chapter explores some of the implications of the findings for landscape planning at resorts in general, and at the Resort Municipality of Whistler in particular. This is followed by a review of the limitations of the study and some suggestions for future applications of spatial discrete choice surveys and GIS-based decision support tools.

5.1 Implications for Landscape Planning at Resorts

This research demonstrates that spatial discrete choice surveys can effectively elicit visitor preferences for alternative land use scenarios at mountain resorts. The results of the survey can help decision-makers better understand the impacts of alternative planning scenarios on visitors and consider the views of visitors during the planning process. Discrete choice surveys have been used to investigate potential planning scenarios in the past (Dennis, 1998; Johnston et al., 2001; Johnston et al., 2002; Mallawaarachchi et al., 2001; Opaluch et al., 1993; Yamada & Thill, 2003). This research shows the value of using discrete choice surveys to elicit spatial preferences of tourists, which is an application that has not yet been published in the literature. Spatial discrete choice experiments can help identify the most desirable pattern, style, and nature of development for tourist destinations, which should be an important consideration of planning authorities (Dredge & Moore, 1992).

In addition to demonstrating the value of a spatial discrete choice experiment in a destination planning context, this research provides a better understanding of tourist preferences for certain aspects of mountain resorts related to protected areas, development, and recreation. A significant finding of this research is that visitors highly valued protected areas, which supports the emphasis placed on protecting the natural environment at tourist destinations (Farrell & Runyan, 1991; Inskeep, 1991; Lawson & Baud-Bovy, 1977; Lee & Han, 2002; Naidoo & Adamowicz, 2005; Schwanke, 1997). Resorts with significant protected areas may benefit from marketing this fact, especially since research has shown that protected areas can be an important factor in destination choice (Boo, 1990). In addition, the present study found that the value of having a significant amount of land protected increased when the protected areas were located in such a way as to provide a high degree of protection to ecologically important habitats. Surprisingly, visitors did not seem to have strong preferences for the number or pattern of protected areas, but they did prefer that protected areas were buffered from developed areas. If the findings of this preliminary study hold true, visitors would most prefer a network of protected areas located in such a way as to provide maximum protection to ecological processes, as long as these protected areas were buffered from developed areas.

In general, resort planners and tourism researchers suggest that development at mountain resorts should be designed to have a strong, compact core with additional nodes placed appropriately down the valley (Dorward, 1990; Gunn, 1965; Schwanke, 1997). The present study generally supports this pattern of development; visitors were not sensitive to the amount of development at the core and they seemed to prefer having at least some development occur at nodes up and down the valley, although they reacted negatively to large amounts of development beyond the core (e.g., 700 ha). A small segment of visitors (e.g., visitors from out of the province) preferred that only two nodes were developed instead of four. Surprisingly, visitors did not appear to react strongly to increasing the amount of development up to about 20% of the landscape, especially when a significant proportion of that development occurred immediately around the core. Apparently, respondents did not perceive the amount of development tested in this survey to be exceeding an acceptable limit for mountain resorts like Whistler.

Inskeep (1991) notes that development at a resort destination should include adequate facilities and services for employees (e.g., housing). Providing employee housing within the resort is certainly desirable to reduce the environmental footprint of the resort by eliminating the need for long distance commuting. However, the results of this study suggest that development for employees should be treated cautiously because visitors, particularly those from the USA and overseas, reacted negatively to scenarios with greater than 75% of the workforce accommodated within the resort. Further investigation is needed to better understand why respondents reacted negatively to a resident workforce and how this negative reaction could be mitigated.

Existing preference research and guidelines on recreational opportunities at resort destinations are minimal. Golf courses are generally considered to be desirable features at mountain destinations, but this study shows that visitors can react negatively to increasing the number of golf courses at a mountain resort. While golfers generally supported more golf courses, the strength of this preference decreased as the number of golf courses increased, and non-golfers strongly preferred to limit the number of golf courses to two. A similar negative reaction of residents to increasing the number of golf courses in Singapore was found by Neo (2001). Visitors may be aware of the potential negative impacts of golf courses on the natural environment, or they may prefer the aesthetics of wild land as opposed to manicured golf courses in mountain resort settings. Thus, this research echoes the suggestion of Schwanke (1997) that development of golf courses at resort destinations should be treated cautiously. Consideration should be given to the type of visitors being targeted at the resort and how those visitors would likely react to golf course development.

In contrast to golf course development, trail-based recreation seemed to be less contentious. The results of this survey suggest that the extent of the nature trail system at a mountain resort was not particularly important in the big picture. However, certain sub-groups (i.e., trail bikers or overnight visitors) preferred an extensive trail system to a moderate one. Also, the extensiveness of the trail system may be more important to hikers and non-trail users if (a) respondents were more aware of the potential negative impacts of trail-based recreation, and (b) the levels used in the survey were more specific about the variety of trails or the degree of crowding expected at the different levels.

Unfortunately, this research did little to address the trade-off between recreation and protection because results surrounding the trail system attribute were relatively weak for all visitors except trail bikers and overnight visitors. Trail bikers and overnight visitors demonstrated a preference for a more extensive trail system, but also a strong preference for higher amounts of protected areas. The fact that trail system extent was not significant for day visitors and non-bikers suggests that they are content with a moderate level of recreational opportunities (i.e., only a few trails of different degrees of difficulty and encounters with others common); however, this assertion should be treated cautiously. More research is needed to explore the tradeoffs between crowding levels, variety and amount of recreational opportunities, and other important recreational characteristics.

5.2 Implications for the Resort Municipality of Whistler

In addition to suggesting some general preferences for land use at mountain resorts, the results of the survey and the spatial GIS-based DCE have implications for the Resort Municipality of Whistler in particular.[22] In this survey, most visitors found protecting up to 35% of the resort landscape from development and recreation to be desirable. In the 6,000 ha of land within the RMOW boundary below approximately 1,000 m in elevation, approximately 1,350 ha (23%) meet the criteria for the highest level of protection (e.g., PAN 1).[23] Based on the results of the survey, protecting this amount of land should be highly desirable to visitors. The results also suggest that the RMOW could increase the value of its PAN from the perspective of visitors by ensuring that

[22] When considering these implications, note that the sample from which these implications are drawn differs significantly from the visitor sample obtained by Tourism Whistler. More specifically, this sample overrepresented local visitors (i.e. from B.C.), young visitors, and visitors who were repeat visitors and underrepresented visitors who stayed with friends or family compared to the Tourism Whistler sample.

[23] PAN 1 areas are protected from development and high impact forms of recreation.

buffers of undeveloped, recreational land are maintained between developed and protected areas.

The results offer only weak suggestions as to how visitors will respond to future development in Whistler. In general, visitors seem more likely to support additional development adjacent to the core rather than more development at external nodes up and down the valley. As shown by the DST, increasing development far from the core (e.g., new neighbourhoods at Cheakamus or Emerald) had a slight negative impact, but this impact could be more than offset by increasing the amount of area protected by implementing the proposed PAN. Visitors appear to be relatively supportive of Whistler's goal to provide housing for 75% of the workforce in Whistler. Should the community wish to house a greater proportion of the workforce, authorities may benefit from conducting further research to better understand why visitors reacted negatively in this survey to a fully resident workforce.

Finally, the results suggest that further golf course development in Whistler should be treated cautiously. While most golfers appear to benefit from increasing the number of golf courses, the vast majority of visitors responded negatively towards resorts with more than two golf courses. This dissatisfaction with three golf courses was not enough to deter the respondents from visiting Whistler though, which currently has three golf courses.

5.3 Limitations and Opportunities

The findings of this study are informative, but a few limitations and caveats need to be stated. First, although the discrete choice survey asked respondents to express their preferences for hypothetical resorts, the scenarios shown in these hypothetical resorts were largely based on the present and future conditions expected for Whistler. Also, all visitors were recruited in Whistler and the survey asked numerous questions about Whistler. Therefore, respondents likely would have been thinking about Whistler when they made their choices. For this reason, preferences may differ if the survey was conducted as a completely hypothetical survey or on a cross section of visitors to a different resort.

A related limitation is the transferability of the preferences measured from a hypothetical DCE to preferences for actual changes in Whistler. The value of doing a hypothetical DCE is that it facilitates estimation of the tradeoffs among multiple goods and enables the results to be used to estimate preferences for mountain resorts in general. However, when some of the attributes are spatial, a hypothetical DCE may not capture the full tradeoffs associated with the particular location of a specific land use. For example, a certain area may have high ecological or scenic value and so preferences would be affected not only by the amount and location of land uses across the entire landscape, but also by what land use was allocated to that particular location. Thus, the preferences for scenarios obtained in this survey represent general preferences for land use scenarios but do not capture location specific preferences per se and so preferences for certain scenarios may differ slightly than suggested by the decision support tools. This is also true for other methods which attempt to include values in a spatial context (e.g. Kliskey, 2000). Implementing an "alternative specific" discrete choice experiment would be one way to address this limitation.

The third limitation is the scale at which the results can be used. The survey asked respondents to state their preferences for alternative landscape configurations. The landscape of the resort was considered to be the most appropriate scale for the survey because resort planners have the greatest influence over land use within the resort boundaries and this scale seemed appropriate for the respondents as well. Because the survey was conducted at a landscape scale, the results should only be used to estimate preferences for changes that occur on a landscape scale. The results should not be used to evaluate changes at a significantly smaller or larger scale (e.g., a neighbourhood scale) because we cannot assume that the preferences for different amounts and configurations of land uses would be the same at a different scale. However, it may be that a neighbourhood scale or a regional scale is more appropriate for visitors. Alternatively, it may be more effective to model the "activity space" of a visitor, or multiple scales within a single survey. An interactive computer-based tool and in-person interviews would be useful for modelling multiple scales in a single survey.

The fourth limitation of this study is a result of the simplicity of the maps shown to respondents. It may have been difficult for respondents to sense how the resort would look and feel from the two dimensional, conceptual images used in the survey. In addition, some maps had a somewhat unrealistic appearance, which was partly caused by the strict rules followed to create the maps to avoid introducing an uncontrolled bias. The unrealistic appearance of the landscape may, in part, explain why some of the spatial attributes were not significant; the landscapes simply did not appear to be realistic. In addition, due to the simplicity of the images, the preferences obtained may represent preferences for planning concepts (i.e., in principle, were respondents opposed to development?). In order to obtain a more realistic estimate of true preferences, the profiles would need to better represent the actual look and feel of the resort under different scenarios. Visualization techniques such as three-dimensional images, photographs, or some other method would be useful to achieve this. There are a growing number of studies that use a variety of techniques to create more realistic scenarios (e.g. Bailey, Brumm, & Grossardt, 2001; Bishop & Karadaglis, 1997; Lange, 1994; Tress & Tress, 2003). Several recent studies have also linked very simple discrete choice experiments with more realistic visualization techniques (Dijkstra et al., 2003; Vriens et al., 1998). However, these discrete choice studies only used visualizations to illustrate different combinations of aspatial design features; they did not measure preferences for alternative spatial arrangements of such features. Using more realistic visualization techniques to create discrete choice experiments that investigate preferences for complex spatial arrangements would be an informative area of research.

A fifth limitation of this survey pertains to the insignificant attributes. It is not known whether these attributes, especially the spatial ones, were not significant because they were seen as not important, they were not extreme enough, or because they were not perceived by respondents. For example, the lack of significance for the amount of development close to the resort suggests that the amount of development close does not matter. However, it may be that respondents could not clearly differentiate between the different amounts of development close or that the amounts tested were too low to be important. The follow up questions, which asked respondents whether or not they noticed and/or considered individual spatial attributes in their choices, were expected to provide some insight if this case arose. Unfortunately, the responses to the follow up questions were not consistent with the significance of the attributes and so it is difficult to know the real reasons for the insignificance of certain attributes. For example, the fragmentation attribute was not significant even though a large proportion of individuals stated that they considered fragmentation in their choices. Future research on spatial DCEs should consider investigating this further, perhaps by splitting the sample and informing half of the sample about the spatial features prior to the completing the DCE. In addition, the attribute levels should be carefully selected to ensure that they will be significant enough to elicit a preference response and not necessarily because they represent possible alternatives being considered for a specific destination.

5.4 Design of Spatial DCEs: Suggestions for Future Research

This study was one of the first applications of a spatial discrete choice survey in a land use planning context and the methodology followed to design the survey was more sophisticated than in previous surveys. A lack of previous research on which to draw from made designing the survey more challenging, but also forced significant innovation. A key contribution of this research is to provide some clear suggestions for future research based on the successes and failures of these innovations.

The need to utilize orthogonal design plans for DCEs remains a significant challenge for creating spatial DCEs because of the high degree of correlation between spatial metrics. This study focussed on ensuring complete independence of spatial attributes while strictly controlling for as many spatial factors as possible. This strategy somewhat limited the ability to model spatial arrangements expected to be important from a social preference or policy perspective. In addition, the systematic design plan led to a somewhat unnatural appearance of the maps. An alternative approach would be to focus more on determining the appropriate spatial patterns that need to be modeled (socially and ecologically) and then adjusting the design plan to deal with any colinearity if needed. In the case where the spatial arrangements to be tested create highly collinear attributes, it would be worth exploring the modelling strategy used by Johnston et al. (2002), in which only some spatial attributes were controlled in the design plan and other spatial attributes were measured for each profile and included in the model after the fact.

Another challenge to creating spatial discrete choice experiments is the time required to create each landscape individually. One option may be to utilize computer programs, such as the modified random clusters method (Saura & Martinez-Millan, 2000), to generate landscapes automatically. These techniques may limit the number of different land uses that can be investigated and the ease with which the results can be used afterwards to evaluate real landscape alternatives, but they are worth further consideration.

Incorporating spatial images in discrete choice experiments may be desirable to simply provide context for aspatial attributes (e.g. Opaluch et al., 1993) or because spatial relationships are of interest from a policy perspective (Johnston et al., 2002). Previous research by Johnston et al. (2002) suggested that respondents consider spatial relationships in their choices even when the spatial features are not highlighted in preliminary survey material or controlled through the design plan. This research implies the opposite: respondents may not perceive spatial attributes included in the design plan when they are not informed about those attributes in preliminary material, particularly when the spatial attributes are subtle (e.g., patch shape). Thus, future research exploring spatial arrangements of interest from a policy perspective should consider informing respondents about the various spatial arrangements prior to the choice experiment. This can be done by providing a learning task to inform respondents about upcoming concepts.[24]

Finally, certain individuals seemed to pick up more strongly on the spatial attributes than others and there seemed to be significant heterogeneity in the model. This is not surprising since most respondents were likely not accustomed to evaluating complex spatial relationships and there is little theory on how different individuals may react to different spatial arrangements. In this research, conducting segmentations between different socio-demographic classes did relatively little to uncover the sources

[24] A learning task included in the aspatial DCE worked well and could serve as a model for other learning tasks.

of heterogeneity in the model. Future spatial models should be designed to allow analysis of heterogeneity using latent class or random parameters logit models. This means spatial DCEs should have high replication within respondents, as large a sample size as possible, and the simplest design possible (Wedel & Kamakura, 2000). Latent class and random parameters logit models could not be utilized in this study because there were too few repetitions per respondent.

5.5 Extensions of the Spatial Decision Support Tool

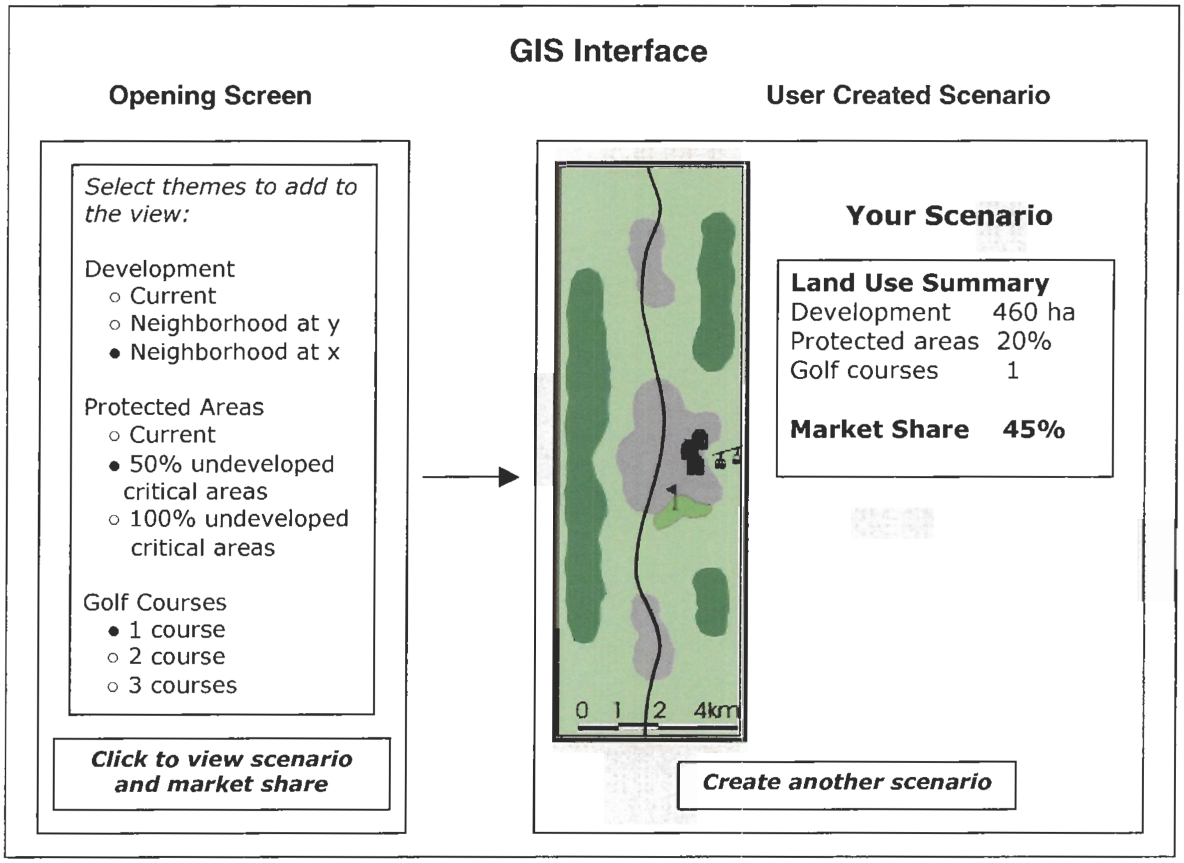
This research demonstrates a straightforward integration GIS into a discrete choice experiment, which enabled the development of a simple DST in GIS. The GIS-based DST allows users to view the outcome of alternatives of interest from a policy perspective. Such a product would be sufficient to provide planners or the public with a relatively simple tool that illustrates several key alternatives following the logic of scenario planning as proposed by landscape architects (Lange, 1994; Tress & Tress, 2003). However, creating a DST capable of evaluating scenarios based on the results of a DCE provides several advantages over traditional scenario planning. First, the preferences for the scenarios represent the opinions of a random and potentially large sample of the entire population. Second, the full range and number of scenarios to be evaluated do not necessarily have to be selected at the beginning of a planning process or a public participation campaign. Rather, a wide range of scenarios (i.e. any combination of attributes from the attribute list) can be evaluated after the survey. Therefore, as long as the levels for each attribute are within the range evaluated in the survey, any scenario could be programmed into a relatively simple GIS-based DST.

The key limitation of the simple GIS-based DST presented in this study is that the number of alternatives the user can view is limited to the alternatives that were pre-determined and programmed into GIS by the researcher. In contrast to the GIS-based tool developed in this study, the aspatial DST is more interactive as it allows the user to select any combination of levels across the attributes. A more interactive GIS-based DST, in which the user could select different combinations of levels across the attributes similar to the aspatial DST, could be developed in several ways. One approach would be for the researcher to program separate GIS layers for a number of potential alternatives for each class of land use (i.e. a new development at location x, a new development at location y, protection of all undeveloped critical areas, protection of 50% of undeveloped critical areas, etc.). The user could then select from the different layers to create a wide range of possible alternatives (Figure 5.1). In this case, the market share for the scenario could be calculated 'on the fly' and displayed along with the scenario in GIS. If this entire process took place within GIS, the system would be similar to 'tightly-coupled' decision support systems, which integrate traditional multi-criteria analysis techniques with the ability to view spatial scenarios within GIS or some other spatial software (Carver, 1991; Gomes & Lins, 2002; Jankowski, 1995). One significant challenge with this type of system would be to ensure that the alternative layers for one type of land use class would not spatially conflict with the alternative layers for the other land use classes.

An alternative approach would be to develop an interactive tool that allowed users to change the land use designation of individual parcels within the study area and then calculate the relative market shares based on the change in overall land use. This highly-interactive style of DST would allow the user full control over designing the scenarios to be evaluated. The challenges associated with this type of DST would be (a) determining how to most appropriately divide the landscape into parcels and (b) designing the tool in such a way to prevent the user from creating scenarios in which the levels for the attributes would be out of the range of levels tested in the survey.

Although developing either of these more interactive spatial-DSTs would be significantly more labour intensive than the tool presented in this study, the effort may be warranted if the goal is to provide a tool that could be used during collaborative decision-making or interactive workshops intended for exploring the impacts of a range of possibilities (Balram, Dragicevic, & Meredith, 2003; Jankowski, Nyerges, Smith, Moore, & Horvath, 1997). For example, a fully interactive spatial DST that enabled a small group of stakeholders to investigate how a full range of scenarios would affect the preferences of a larger group, such as the general public or tourists, would provide valuable information for use during collaborative decision-making processes.

Figure 5.1 Example of the function of a tightly-coupled DST



A second extension of the basic decision support tool created during this study would be to integrate the preference model obtained using a DCE with spatial ecological models. There has been a surge of efforts to develop spatial models that investigate how alternative scenarios would affect ecological systems (Hunter et al., 2003; Musacchio & Grant, 2002; Theobald et al., 1997; White et al., 1997). Integrating these ecological models with a spatial preference model would facilitate the simultaneous consideration of ecological and social impacts of alternative scenarios. For example, just as these ecological models determine the relative ecological impacts of different planning scenarios, integrated models would allow researchers to examine the likely social impacts of planning alternatives as well. Linked social preference and ecological models would allow researchers and mangers to offer more concrete advice regarding tradeoffs among ecological and social attributes of land use (Johnston et al., 2002). Such integration of social and ecological models would provide a powerful tool for land use planning.

5.6 Conclusion

Land use planning assists decision-makers to evaluate land use objectives and options and to weigh these against other policy objectives, including those derived from principles of sustainable development (e.g., equity, quality of tourist experience, conservation of natural resources) (Hunter & Green, 1995: 96). This research focused on two key goals of land use planning that must be weighed against other priorities at a tourist destination: protecting natural resources and maintaining visitor experience. In particular, the outcomes of alternative policies related to development, recreation, and protected areas were examined in terms of their impact on visitor preferences. Because of the spatial nature of land use planning, a spatial DCE developed in GIS was used to measure visitor preferences for land use scenarios. Overall, visitors preferred resorts with greater amounts of protected areas, especially when protected areas were buffered from development and situated to protect the most ecologically valuable areas in the resort. In addition, visitors preferred to limit the amount of development at nodes external to the resort core and tolerated a high percentage of the workforce living in the resort. Finally, visitors preferred fewer golf courses, but were indifferent towards the extent of the trail system. This exploratory research illustrated a highly innovative approach for (a) using GIS to create spatially explicit choice sets in the form of maps, and (b) creating a GIS-based DST. The methodology used in this study provides a solid basis for future research on spatial surveys and linking social and ecological evaluations in GIS. Linked social and ecological models would provide invaluable information for decision making and useful tools to improve land use planning and assist communities in moving towards sustainability.

REFERENCE LIST

Adamowicz, V., Boxall, P. C., Williams, M., & Louviere, J. J. (1998). Stated preference approaches for measuring passive use values: Choice experiments and contingent valuation. *American Journal of Agricultural Economics, 80*, 64-75.

Adamowicz, V., Louviere, J. J., & Swait, J. (1998). *Introduction to attribute-based stated choice methods*: Report to the Resource Valuation Branch, Damage Assessment Centre, NOAA.

Ahn, B. Y., Lee, B., & Shafer, S. (2002). Operationalizing sustainability in regional tourism planning: An application of the limits of acceptable change framework. *Tourism Management, 23*, 1-15.

Alberti, M. (1999). Urban patterns and environmental performance: What do we know? *Journal of Planning Education and Research, 19*(2), 151-163.

Allen, L. R., Long, P. T., Perdue, R. R., & Kieselback, S. (1988). The impact of tourism development on residents' perceptions of community life. *Journal of Travel Research, 27*(1), 16-21.

Arnberger, A., & Haider, W. (2005). Social effects on crowding preferences of urban forest visitors. *Urban Forestry & Urban Greening, 3*, 125-136.

Backlund, E. A., Stewart, W. P., & McDonald, C. (2004). Public evaluation of open space in Illinois: Citizen support for natural area acquisition. *Environmental Management, 34*(5), 634-641.

Bailey, K., Brumm, J., & Grossardt, T. (2001). Towards a structured public involvement in highway design: A comparative study of visualization methods and preference modeling using CAVE (Casewise Visual Evaluation). *Journal of Geographic Information and Decision Analysis, 5*(1), 1-15.

Balogh, J. C., Gibealt, V. A., Walker, W. J., Kenna, M. P., & Snow, J. T. (1992). Background and overview of environmental issues. In J. C. Balogh & W. J. Walker (Eds.), *Golf course management & construction: Environmental issues.* Chelsea, MI: Lewis Publishers.

Balram, S., Dragicevic, S., & Meredith, T. (2003). Achieving effectiveness in stakeholder participation using the GIS-based collaborative spatial delphi methodology. *Journal of Environmental Assessment Policy and Management, 5*(3), 365-394.

Ben-Akiva, M., & Lerman, S. R. (1985). *Discrete choice analysis: Theory and application to travel demand.* Cambridge: MIT Press.

Bishop, I. D., & Karadaglis, C. (1997). Linking modelling and visualization for natural resources management. *Environment and Planning B, 24,* 345-358.

Blair, R. B. (1996). Land use and avian species diversity along an urban gradient. *Ecological Applications, 6*(2), 506-519.

Bolund, P., & Hunhammar, S. (1999). Ecosystem services in urban areas. *Ecological Economics, 29,* 293-301.

Boo, E. (1990). *Ecotourism: The potentials and pitfalls* (Vol. 1). Washington, D.C.: World Wildlife Fund.

Boxall, P. C., & Adamowicz, W. L. (2002). Understanding heterogeneous preferences in random utility models: A latent class approach. *Environmental and Resource Economics, 23,* 421-446.

Breffle, W. S., & Morey, E. R. (2000). Investigating preference heterogeneity in a repeated discrete-choice recreation demand model of Atlantic salmon fishing. *Marine Resource Economics, 15,* 1-20.

Briers, R. A. (2002). Incorporating connectivity into reserve selection procedures. *Biological Conservation, 103*(1), 77-83.

Butler, R. (1997). Modeling tourism development: Evolution, growth and decline. In S. Wahab & J. J. Pigram (Eds.), *Tourism, development and growth: The challenge of sustainability*. London: Routledge.

Carver, S. J. (1991). Integrating multi-criteria evaluation with geographic information systems. *International Journal of Geographical Information Systems, 5*(3), 321-339.

Chace, J. F., Walsh, J. J., Cruz, A., Prather, J. W., & Swanson, H. M. (2003). Spatial and temporal activity patterns of the brood parasitic brown-headed cowbird at an urban/wildland interface. *Landscape and Urban Planning, 64*(3), 179-190.

Clarke, J. (1997). A framework of approaches to sustainable tourism. *Journal of Sustainable Tourism, 5*(3), 224-233.

Cole, D. N. (1981). Vegetational changes associated with recreational use and fire suppression in the Eagle Cap Wilderness, Oregon: Some management implications. *Biological Conservation, 20*(4), 247-270.

Croke, K., Fabian, R., & Brenniman, G. (1986). Estimating the value of natural open space preservation in an urban area. *Journal of Environmental Management, 23,* 317-324.

Crouch, G., & Louviere, J. J. (2000). A review of choice modeling research in tourism, hospitality, and leisure. *Tourism Analysis, 5,* 97-104.

Czech, B., Krausman, P. R., & Devers, P. K. (2000). Economic associations among causes of species endangerment in the United States. *BioScience, 50*(7), 593-601.

Dale, S. (2004). Effects of a golf course on population dynamics of the endangered ortolan bunting. *Journal of Wildlife Management, 68*(3), 719-724.

Dale, V. H., Brown, S., Haeuber, R. A., Hobbs, N. T., Naiman, R. J., Reibsame, W. E., Turner, M. G., & Valone, T. J. (2000). Ecological principles and guidelines for managing the use of land. *Ecological Applications, 10*(3), 639-670.

Dennis, D. F. (1998). Analyzing public inputs to multiple objective decisions on National forests using conjoint analysis. *Forest Science, 44*(3), 421-429.

Dharmaratne, G. S., Sang, F. Y., & Walling, L. J. (2000). Tourism potentials for financing protected areas. *Annals of Tourism Research, 27*(3), 590-610.

Dias, P. C. (1996). Sources and sinks in population biology. *Trends in Ecology & Evolution, 11*(8), 326-330.

Dijkstra, J., van Leeuwen, J., & Timmermans, H. (2003). Evaluating design alternatives using conjoint experiments in virtual reality. *Environment and Planning B: Planning and Design, 30*, 357-367.

Dorward, S. (1990). *Design for mountain communities*. New York: Van Nostrand Reinhold.

Dredge, D. (1999). Destination place planning and design. *Annals of Tourism Research, 26*(4), 772-791.

Dredge, D., & Moore, S. (1992). A methodology for the integration of tourism in town planning. *The Journal of Tourism Studies, 3*(1), 8-21.

Economic Commission for Europe (ECE). (1988). *Spatial planning for recreation and tourism in the countries of the ECE Region*. New York: United Nations.

Fahrig, L. (2001). How much habitat is enough? *Biological Conservation, 100*(1), 65-74.

Farrell, B. H., & Runyan, D. (1991). Ecology and tourism. *Annals of Tourism Research, 18*(1), 26-40.

Forman, R. T. T. (1995). *Land mosaics: The ecology of landscapes and regions*. Cambridge, Great Britain: Cambridge University Press.

Forman, R. T. T., & Alexander, L. E. (1998). Roads and their major ecological effects. *Annual Review of Ecology and Systematics, 29*, 207-231.

Fortin, M. J., & Gagnon, C. (1999). An assessment of social impacts of national parks on communities in Quebec, Canada. *Environmental Conservation, 26*(3), 200-211.

Franco, D., Mannino, I., & Zanetto, G. (2003). The impact of agroforestry networks on scenic beauty estimation - the role of a landscape ecological network on a socio-cultural process. *Landscape and Urban Planning, 62*(3), 119-138.

Frank, L. D., & Pivo, G. (1994). Impacts of mixed use and density on utilization of three modes of travel: Single-occupant vehicle, transit, and walking. *Transportation Research Record, 1466*, 44-52.

Gedikli, R., & Ozbilen, A. (2004). A mathematical model to determine unit area size per person needed in a neighbourhood park: A case study in Trabzon city (Turkey). *Building and Environment, 39*(11), 1365-1378.

Geoghegan, J. (2002). The value of open spaces in residential land use. *Land Use Policy, 19*, 91-98.

Geoghegan, J., Wainger, L. A., & Bockstael, N. E. (1997). Spatial landscape indices in a hedonic framework: An ecological economics analysis using GIS. *Ecological Economics, 23*, 251-264.

Getz, D. (1983). Capacity to absorb tourism - concepts and implications for strategic planning. *Annals of Tourism Research, 10*(2), 239-263.

Gill, A., & Williams, P. (1994). Managing growth in mountain tourism communities. *Tourism Management, 15*(3), 212-230.

Gober, P., McHugh, K. E., & Leclerc, D. (1993). Job-rich but housing-poor - the dilemma of a western amenity town. *Professional Geographer, 45*(1), 12-20.

Gomes, E. G., & Lins, M. P. E. (2002). Integrating geographical information systems and multi-criteria methods: A case study. *Annals of Operations Research, 116*, 243-269.

Green, R. N. (2004). *Terrestrial ecosystem mapping of the Resort Municipality of Whistler*. North Vancouver: B.A. Blackwell and Associates Ltd.

Green, W. H. (1998). LIMDEP Version 7.0 - User's manual revised edition. New York: Econometric Software Inc.

Gunn, C. A. (1965). *A concept for the design of a tourism-recreation region.* Unpublished Doctoral Dissertation, University of Michigan.

Gunn, C. A. (1994). *Tourism planning: Basics, concepts, cases.* Washington, DC: Taylor & Francis.

Gustafson, E. J. (1998). Quantifying landscape spatial pattern: What is the state of the art? *Ecosystems, 1*, 143-156.

Haider, W. (2002). *Stated preference and choice models - a versatile alternative to traditional recreation research.* Paper presented at the Monitoring and Management of Visitor Flows in Recreation and Protected Areas.

Haider, W., & Ewing, G. O. (1990). A model of tourist choices of hypothetical Caribbean destinations. *Leisure Sciences, 12,* 33-47.

Haider, W., & Rasid, H. (2002). Eliciting public preferences for municipal water supply options. *Environmental Impact Assessment Review, 22,* 337-360.

Haight, R. G., Snyder, S. A., & Revelle, C. S. (2005). Metropolitan open-space protection with uncertain site availability. *Conservation Biology, 19*(2), 327-337.

Hall, C. M., & Page, S. J. (1999). *The geography of tourism and recreation: Environment, place and space.* London: Routledge.

Handy, S. (2005). Smart growth and the transportation-land use connection: What does the research tell us? *International Regional Science Review, 28*(2), 146-167.

Hanley, N., Wright, R. E., & Adamowicz, V. (1998). Using choice experiments to value the environment. *Environmental and Resource Economics, 11*(3-4), 413-428.

Hargis, C. D., Bissonette, J. A., & David, J. L. (1998). The behaviour of landscape metrics commonly used in the study of habitat fragmentation. *Landscape Ecology, 13,* 167-186.

Harrill, R. (2004). Resident's attitudes toward tourism development: A literature review with implications for tourism planning. *Journal of Planning Literature, 18*(3), 251-266.

Harris, L. K., Shaw, W. W., & Schelhas, J. (1997). Urban neighbors' wildlife-related attitudes and behaviours near federally protected areas in Tuscon, Arizona, USA. *Natural Areas Journal, 17,* 144-148.

Haywood, K. M. (1988). Responsible and responsive tourism planning in the community. *Tourism Management, 9,* 105-118.

Hearne, R. R., & Salinas, Z. M. (2002). The use of choice experiments in the analysis of tourist preferences for ecotourism development in Costa Rica. *Journal of Environmental Management, 65*(2), 153-163.

Herold, M., Liu, X. H., & Clarke, K. C. (2003). Spatial metrics and image texture for mapping urban land use. *Photogrammetric Engineering and Remote Sensing, 69*(9), 991-1001.

Hill, M. J., Braaten, R., Veitch, S. M., Lees, B. G., & Sharma, S. (2005). Multi-criteria decision analysis in spatial decision support: The ASSESS analytic hierarchy process and the role of quantitative methods and spatially explicit analysis. *Environmental Modelling & Software, 20,* 955-976.

Holt, R. D., & Gaines, M. S. (1993). In S. A. Levin & T. M. Powell & J. H. Steele (Eds.), *Patch dynamics* (pp. 260-276). Berlin: Springer.

Hornsten, L., & Fredman, P. (2000). On the distance to recreational forests in Sweden. *Landscape and Urban Planning, 51*, 1-10.

Hummel, M. (1995). *Protecting Canada's endangered spaces: An owner's manual.* Toronto, Ontario: Key Porter Books.

Hunt, L. M., Haider, W., & Bottan, B. (2005). Accounting for varying setting preferences among moose hunters. *Leisure Sciences, 27*(4), 297-315.

Hunter, C., & Green, H. (1995). *Tourism and the environment: A sustainable relationship?* London: Routledge.

Hunter, L. M., Gonzalez, M. D. J., Sevenson, M., Karish, K. S., Toth, R., Edwards, T. C., Lilieholm, R. J., & Cablk, M. (2003). Population and land use change in the California Mojave: Natural habitat implications of alternative futures. *Population Research and Policy Review, 22*, 373-397.

Hwang, C., & Yoon, K. (1981). *Multi attribute decision making methods and applications: A state of the art survey*. Berlin: Springer-Verlag.

I.U.C.N. (1994). *Guidelines for protected area management categories*. Gland, Switzerland: World Conservation Union.

Inskeep, E. (1987). Environmental planning for tourism. *Annals of Tourism Research, 14*(1), 118-135.

Inskeep, E. (1988). Tourism planning - an emerging specialization. *Journal of the American Planning Association, 54*(3), 360-372.

Inskeep, E. (1991). *Tourism planning: An integrated and sustainable development approach*. New York: Van Nostrand Reinhold.

Jankowski, P. (1995). Integrating geographical information systems and multiple criteria decision-making methods. *International Journal of Geographical Information Systems, 9*(3), 251-273.

Jankowski, P., Nyerges, T. L., Smith, A., Moore, T. J., & Horvath, E. (1997). Spatial group choice: A SDSS tool for collaborative spatial decision-making. *International Journal of Geographical Information Science, 11*(6), 577-602.

Johnston, R. J., Opaluch, J. J., Grigalunas, T. A., & Mazzotta, M. J. (2001). Estimating amenity benefits of coastal farmland. *Growth and Change, 32*(Summer), 305-325.

Johnston, R. J., Swallow, S. K., & Bauer, D. M. (2002). Spatial factors and stated preference values for public goods: Considerations for rural land use. *Land Economics, 78*(4), 481-500.

Kenworthy, J. R., & Laube, F. B. (1996). Automobile dependence in cities: An international comparison of urban transport and land use patterns with implications for sustainability. *Environmental Impact Assessment Review, 16*(4-6), 279-308.

King, K. W., Harmel, R. D., Torbert, H. A., & Balogh, J. C. (2001). Impact of a turfgrass system on nutrient loadings to surface water. *Journal of the American Water Resources Association, 37*(3), 629-640.

Kirkpatrick, L. W., & Reeser, W. K. (1976). The air pollution carrying capacities of selected Colorado Mountain Valley ski communities. *Journal of the Air Pollution Control Association, 26*(10), 992-994.

Kline, J., & Wichelns, D. (1998). Measuring heterogeneous preference for preserving farmland and open space. *Ecological Economics, 26*(2), 211-224.

Kliskey, A. D. (2000). Recreation terrain suitability mapping: A spatially explicit methodology for determining recreation potential for resource use assessment. *Landscape and Urban Planning, 52*, 33-43.

Kunimatsu, T., Sudo, M., & Kawachi, T. (1999). Loading rates of nutrients discharging from a golf course and a neighboring forested basin. *Water Science and Technology, 39*(12), 99-107.

Lange, E. (1994). Integration of computerized visual simulation and visual assessment in environmental planning. *Landscape and Urban Planning, 30*, 99-112.

Lawson, F., & Baud-Bovy, M. (1977). *Tourism and recreation development*. Boston, MA: CBI Publishing Company Inc.

Lawson, S., & Manning, R. (2002). *Integrating multiple wilderness values into a decision-making model for Denali National Park and Preserve.* Paper presented at the Monitoring and Management of Visitor Flows in Recreational and Protected Areas.

Layton, D. F. (1996). *Rank-ordered, random coefficients multinomial probit models for stated preference surveys.* Paper presented at the 1996 Association of Environmental and Resource Economics Workshop, Tahoe City, California.

Lee, C.-K., & Han, S.-Y. (2002). Estimating the use and preservation values of national parks' tourism resources using a contingent valuation method. *Tourism Management, 23*, 531-540.

Leitao, A. B., & Ahern, J. (2002). Applying landscape ecological concepts and metrics in sustainable landscape planning. *Landscape and Urban Planning, 59*(2), 65-93.

Lewis, M. A., Boustany, R. G., Dantin, D. D., Quarles, R. L., Moore, J. C., & Stanley, R. S. (2002). Effects of a coastal golf complex on water quality, periphyton, and seagrass. *Ecotoxicology and Environmental Safety, 53*(1), 154-162.

Lewis, M. A., Foss, S. S., Harris, P. S., Stanley, R. S., & Moore, J. C. (2001). Sediment chemical contamination and toxicity associated with a coastal golf course complex. *Environmental Toxicology and Chemistry, 20*(7), 1390-1398.

Li, H., & Reynolds, J. F. (1994). A simulation experiment to quantify spatial heterogeneity in categorical maps. *Ecology, 75*(8), 2446-2455.

Li, H., & Reynolds, J. F. (1995). On definition and quantification of heterogeneity. *Oikos, 73*(1), 280-284.

Liddle, M. J. (1975). A selective review of the ecological effects of human trampling on natural ecosystems. *Biological Conservation, 7*, 17-36.

Lindberg, K., Andersson, T. D., & Dellaert, B. G. C. (2001). Tourism development: Assessing social gains and losses. *Annals of Tourism Research, 28*(4), 1010-1030.

Lindh, H., & Martin, K. (2004). Systematic reserve selection for conservation in Whistler, Canada. *Mountain Research and Development, 24*(4), 319-326.

Line, D. E., White, N. M., Osmond, D. L., Jennings, G. D., & Mojonnier, C. B. (2002). Pollutant export from various land uses in the upper Neuse River Basin. *Water Environment Research, 74*(1), 100-108.

Liu, J., Daily, G. C., Ehrlich, P. R., & Luck, G. W. (2003). Effects of household dynamics on resource consumption and biodiversity. *Nature, 421*, 530-533.

Liu, J. C., Sheldon, P. J., & Var, T. (1987). Resident perception of the environmental impacts of tourism. *Annals of Tourism Research, 14*(1), 17-37.

Lockwood, M., & Kathy, T. (1995). Nonmarket economic valuation of an urban recreation park. *Journal of Leisure Research, 27*(2), 155-167.

Losos, E., Hayes, J., Phillips, D., Wilcove, D. S., & Alkire, C. (1995). Taxpayer-subsidized resource extraction harms species. *BioScience, 45*, 446-455.

Louviere, J., & Timmermans, H. (1990). Stated preference and choice models applied to recreation research: A review. *Leisure Sciences, 12*, 9-32.

Louviere, J. J., & Hensher, D. A. (1982). On the design and analysis of choice or allocation experiments in travel choice modeling. *Transportation Research Record, 890*, 11-17.

Louviere, J. J., Hensher, D. A., & Swait, J. (2000). *Stated choice methods*. New York: Cambridge University Press.

Louviere, J. J., Schroeder, H., Louviere, C. H., & Woodworth, G. (1987). Do the parameters of choice models depend on difference in stimulus presentation: Visual versus verbal presentation? *Advances in Consumer Research, 14*, 79-82.

Louviere, J. J., & Woodworth, G. (1983). Design and analysis of simulated choice or allocation experiments: An approach based on aggregate data. *Journal of Marketing Research, 20*, 350-367.

MacArthur, R. H., & Wilson, E. O. (1969). *The Theory of Island Biogeography.* Princeton, New Jersey: Princeton University Press.

Mallawaarachchi, T., Blamey, R. K., Morrison, M. D., Johnson, A. K. L., & Bennett, J. W. (2001). Community values for environmental protection in a cane farming catchment in Northern Australia: A choice modelling study. *Journal of Environmental Management, 62*(3), 301-316.

Mallin, M. A., & Wheeler, T. L. (2000). Nutrient and fecal coliform discharge from coastal North Carolina golf courses. *Journal of Environmental Quality, 29*(3), 979-986.

Manning, R. E. (1999). *Studies in outdoor recreation: Search and research for satisfaction* (2nd ed.). Corvallis, OR: Oregon State University Press.

Margules, C. R., & Pressey, R. L. (2000). Systematic conservation planning. *Nature, 405*, 243-253.

Markwick, M. C. (2000). Golf tourism development, stakeholders, differing discourses and alternative agendas: The case of Malta. *Tourism Management, 21*(5), 515-524.

Mathieson, A., & Wall, G. (1982). *Tourism: Economic, physical, and social impacts.* New York, N.Y.: Longman.

McDonnell, M. D., Possingham, H. P., Ball, I. R., & Cousins, E. A. (2002). Mathematical methods for spatially cohesive reserve design. *Environmental Modeling & Assessment, 7*(2), 107-114.

McFadden, D. (1974). Conditional logit analysis of qualitative choice behaviour. In P. Zamembka (Ed.), *Frontiers in econometrics* (pp. 105-142). New York: Academic Press.

McGarigal, K., & Marks, B. J. (1995). *FRAGSTATS: spatial pattern analysis program for quantifying landscape structure* (Version 2). Corvallis, Oregon: Oregon State University.

McGarigal, K., & McComb, W. C. (1995). Relationships between landscape structure and breeding birds in the Oregon Coast Range. *Ecological Monographs, 65*(3), 235-260.

McKercher, B. (1993). Some fundamental truths about tourism: Understanding tourism's social and environmental impacts. *Journal of Sustainable Tourism, 1*(1), 6-16.

Miller, J. R., & Hobbs, N. T. (2000). Recreational trails, human activity, and nest predation in lowland riparian areas. *Landscape and Urban Planning, 50*(4), 227-236.

Miller, S. G., Knight, R. L., & Miller, C. K. (1998). Influence of recreational trails on breeding bird communities. *Ecological Applications, 8*(1), 162-169.

Miller, S. G., Knight, R. L., & Miller, C. K. (2001). Wildlife responses to pedestrians and dogs. *Wildlife Society Bulletin, 29*(1), 124-132.

Miller, W., Collins, M. G., Steiner, F. R., & Cook, E. (1998). An approach for greenway suitability analysis. *Landscape and Urban Planning, 42*, 91-105.

Mitchell, L. S., & Murphy, P. E. (1991). Geography and tourism. *Annals of Tourism Research, 18*(1), 57-70.

Montgomery, D. C. (2001). *Design and analysis of experiments* (5th ed.). New York, N.Y.: Wiley.

Morancho, A. B. (2003). A hedonic valuation of urban green areas. *Landscape and Urban Planning, 66*, 35-41.

Morey, E. R., Breffle, W. S., Rowe, R. D., & Waldman, D. M. (2002). Estimating recreational trout fishing damages in Montana's Clark Fork River basin: summary of natural resource damage assessment. *Journal of Environmental Management, 66*, 159-170.

Morey, E. R., Buchanan, T., & Waldman, D. M. (2002). Estimating the benefits and costs to mountain bikers of changes in trail characteristics, access fees, and site closures: Choice experiments and benefits transfer. *Journal of Environmental Management, 64*, 411-422.

Morey, E. R., Rossmann, K. G., Chestnut, L. G., & Ragland, S. (2000). *Modeling and estimating WTP for reducing acid rain deposition injuries to cultural resources: using choice experiments in a group setting to estimate passive-use values.*

Morrison, M., Bennett, J., & Blamey, R. (1999). Valuing improved wetland quality using choice modeling. *Water Resources Research, 35*(9), 2805-2814.

Musacchio, L. R., & Grant, W. E. (2002). Agricultural production and wetland habitat quality in a coastal prairie ecosystem: Simulated effects of alternative resource policies on land-use decisions. *Ecological Modelling, 150*(1-2), 23-43.

Naidoo, R., & Adamowicz, W. L. (2005). Biodiversity and nature-based tourism at forest reserves in Uganda. *Environment and Development Economics, 10*, 159-178.

Nalle, D. J., Arthur, J. L., & Sessions, J. (2001). Designing compact and contiguous reserve networks with a hybrid heuristic algorithm. *Forest Science, 48*(1), 59-68.

Needham, M. D., Wood, C. J. B., & Rollins, R. B. (2004). Understanding summer visitors and their experiences at the Whistler mountain ski area, Canada. *Mountain Research and Development, 24*(3), 234-242.

Neo, H. (2001). Sustaining the unsustainable? Golf in urban Singapore. *International Journal of Sustainable Development and World Ecology, 8*(3), 191-202.

Nicholls, A. O., & Margules, C. R. (1993). An upgraded reserve selection algorithm. *Biological Conservation, 64*(2), 165-169.

Niemela, J. (1999). Ecology and urban planning. *Biodiversity Conservation, 8*, 119-131.

Noss, R. F. (2000). Maintaining the ecological integrity of landscapes and ecoregions. In D. Pimentel & L. Westra & R. F. Noss (Eds.), *Ecological integrity: Integrating environment, conservation, and health* (pp. 428). Covelo, California: Island Press.

Odell, E. A., Theobald, D. M., & Knight, R. L. (2003). Incorporating ecology into land use planning: The songbird's case for clustered development. *Journal of the American Planning Association, 69*(1), 72-82.

Onal, H., & Briers, R. A. (2002). Incorporating spatial criteria in optimum reserve network selection. *Proceedings of the Royal Society of London Series B-Biological Sciences, 269*(1508), 2437-2441.

Opaluch, J. J., Swallow, S. K., Weaver, T., Wessells, C. W., & Wichelns, D. (1993). Evaluating impacts from noxious facilities: Including public preferences in current siting mechanisms. *Journal of Environmental Economics and Management, 24*, 41-59.

Pearce, D. (1989). *Tourist development* (2nd ed.). Essex: Longman Scientific & Technical.

Pearce, D. G. (1995). *Tourism today: A geographical analysis* (2nd ed.). New York: Longman Scientific & Technical.

Pleumarom, A. (1992). Course and effect: Golf tourism in Thailand. *The Ecologist, 22*(3), 104-110.

Pleumarom, A. (1995). Sport versus the environment: A case study of golf in Thailand. *World Leisure and Recreation, 37*, 32-37.

Priestley, G. K. (1995). Sports tourism: The case of golf. In G. J. Ashworth & A. G. J. Dietvorst (Eds.), *Tourism and spatial transformations*. Wallingford, Oxon: Cab International.

R.M.O.W. (1997). *Whistler 2002: Charting a course for the future*. Whistler, BC: Resort Municipality of Whistler.

R.M.O.W. (2002). *Whistler's Environmental Strategy*. Whistler, BC: Resort Municipality of Whistler.

R.M.O.W. (2003). *Create Whistler's future. Comprehensive backgrounder*. Whistler, BC: Resort Municipality of Whistler.

R.M.O.W. (2004a). *Whistler 2020 moving toward a sustainable future. Comprehensive Sustainability Plan.* (Vol. 3). Whistler, BC: Resort Municipality of Whistler.

R.M.O.W. (2004b). *Whistler 2020 moving toward a sustainable future. Comprehensive Sustainability Plan.* (Vol. 1). Whistler, BC: Resort Municipality of Whistler.

R.M.O.W. (2005a). *Resort Municipality of Whistler protected area network (draft).* Whistler, BC: Resort Municipality of Whistler.

R.M.O.W. (2005b). *Whistler 2020 moving toward a sustainable future. Comprehensive Sustainability Plan - Built Environment Strategy.* (Vol. 2.). Whistler, BC: Resort Municipality of Whistler.

R.M.O.W. (2005c). *Whistler 2020 moving toward a sustainable future. Comprehensive Sustainability Plan - Natural areas Strategy.* (Vol. 2.). Whistler, BC: Resort Municipality of Whistler.

Rempel, R. S., & Carr, A. P. (2003). Patch Analyst extension for ArcView (Version 3). Thunder Bay: Lakehead University.

Riebsame, W. E., Gosnell, H., & Theobald, D. M. (1996). Land use and landscape change in the Colorado Mountains I: Theory, scale, and pattern. *Mountain Research and Development, 16*(4), 395-405.

Riitters, K. H., O'Neill, R. V., Hunsaker, C. T., Wickham, J. D., Yankee, D. H., Timmins, S. P., Jones, K. B., & Jackson, B. L. (1995). A factor analysis of landscape pattern and structure metrics. *Landscape Ecology, 10*(1), 23-39.

Roster, C. A., Rogers, R. D., Albaum, G., & Klein, D. (2004). A comparison of response characteristics from web and telephone surveys. *International Journal of Market Research, 43*(3), 359-373.

Rothley, K. D. (1999). Designing bioreserve networks to satisfy multiple, conflicting demands. *Ecological Applications, 9*(3), 741-750.

Ruliffson, J. A., Haight, R. G., Gobster, P. H., & Homans, F. R. (2003). Metropolitan natural area protection to maximize public access and species representation. *Environmental Science and Policy, 6*, 291-299.

Saaty, T. L. (1992). *Multicriteria decision making - the Analytical Hierarchy Process*. Pittsburgh: RWS Publications.

Saura, S., & Martinez-Millan, J. (2000). Landscape patterns simulation with a modified random clusters method. *Landscape Ecology, 15*(661-678).

Saura, S., & Martinez-Millan, J. (2001). Sensitivity of landscape pattern metrics to map spatial extent. *Photogrammetric Engineering and Remote Sensing, 67*(9), 1027-1036.

Schwanke, D. (1997). *Resort development handbook.* Washington, DC: Urban Land Institute.

Scott, T. A., & Sullivan, J. E. (2000). The selection and design of multiple-species habitat preserves. *Environmental Management, 26*(Supplement 1), S37-S53.

Shelby, B., Vaske, J. J., & Heberlein, T. A. (1989). Comparative analysis of crowding in multiple locations: Results from fifteen years of research. *Leisure Sciences, 11*, 269-291.

Siitonen, P., Tanskanen, A., & Lehtinen, A. (2003). Selecting forest reserves with a multi-objective spatial algorithm. *Environmental Science & Policy, 6*(3), 301-309.

Soule, M. E., & Sanjayan, M. A. (1998). Ecology-conservation targets: Do they help? *Science, 279*(5359), 2060-2061.

Stone, B. J. (2004). Paving over paradise: How land use regulations promote residential imperviousness. *Landscape and Urban Planning, 69*, 101-113.

Swait, J. (1994). A structural equation model of latent segmentation and product choice for cross-sectional revealed preference choice data. *Journal of Retailing and Consumer Services, 1*(2), 77-89.

Swallow, S. K., Opaluch, J. J., & Weaver, T. F. (1992). Siting noxious facilities: An approach that integrates technical, economic, and political considerations. *Land Economics, 68*(3), 283-301.

Swallow, S. K., Weaver, T., Opaluch, J. J., & Michelman, T. S. (1994). Heterogeneous preferences and aggregation in environmental policy analysis: A landfill siting case. *American Journal of Agricultural Economics, 76*, 431-443.

Tanner, R. A., & Gange, A. C. (2005). Effects of golf courses on local biodiversity. *Landscape and Urban Planning, 71*(2-4), 137-146.

Taylor, A. R., & Knight, R. L. (2003). Wildlife responses to recreation and associated visitor perceptions. *Ecological Applications, 13*(4), 951-963.

Terman, M. R. (1997). Natural links: naturalistic golf courses as wildlife habitat. *Landscape and Urban Planning, 38*(3-4), 183-197.

Theobald, D. M., Miller, J. R., & Hobbs, N. T. (1997). Estimating the cumulative effects of development on wildlife habitat. *Landscape and Urban Planning, 39*, 25-36.

Tinker, D. B., Resor, C. A. C., Beauvais, G. P., Kipfmeuller, K. F., Fernandes, C. I., & Baker, W. L. (1998). Watershed analysis of forest fragmentation by clearcuts and roads in a Wyoming forest. *Landscape Ecology, 13*(3), 149-165.

Train, K. (1998). Recreation demand models with taste differences over people. *Land Economics, 74*, 230-239.

Tress, B., & Tress, G. (2003). Scenario visualisation for participatory landscape planning - a study from Denmark. *Landscape and Urban Planning, 64*(161-178).

Turner, B. L., & Meyer, W. B. (1994). Global land-use and land-cover change: An overview. In W. B. Meyer & B. L. Turner (Eds.), *Changes in land use and land cover: A global perspective*. New York: Cambridge University Press.

Tyler, C. (1989). A phenomenal explosion. *Geographical Magazine, 61*(8), 18-21.

Vermund, J. K., & Magidson, J. (2003). Latent GOLD Choice user's manual. Belmont, MA: Statistical Innovatins Inc.

Vriens, M., Loosschilder, G. H., Rosenbergen, E., & Wittink, D. R. (1998). Verbal versus realistic pictorial representations in conjoint analysis with design attributes. *Journal of Product Innovation Management, 15*, 455-467.

W.E.C.D. (1987). *Our common future (Brundtland Report)*. New York: Oxford University Press.

Warnken, J., & Thompson, D. (2001). Golf course development in a major tourist destination: Implications for planning and management. *Environmental Management, 27*(5), 681-696.

Wedel, M., & Kamakura, W. A. (2000). *Market segmentation: Conceptual and methodological foundations*. Boston: Kluwer Academic Publishers.

Westphal, M. I., Field, S. A., Tyre, A. J., Paton, D., & Possingham, H. P. (2003). Effects of landscape pattern on bird species distribution in the Mt. Lofty Ranges, South Australia. *Landscape Ecology, 18*, 413-426.

White, D., Minotti, P. G., Barczak, M. J., Sifneos, J. C., Freemark, K. E., Santelmann, M. V., Steinitz, C. F., Kiester, A. R., & Preston, E. M. (1997). Assessing risks to biodiversity from future landscape change. *Conservation Biology, 11*(2), 349-360.

Whittington, J., St Clair, C. C., & Mercer, G. (2005). Spatial responses of wolves to roads and trails in mountain valleys. *Ecological Applications, 15*(2), 543-553.

Williams, J., & Lawson, R. (2001). Community issues and resident opinions of tourism. *Annals of Tourism Research, 28*(2), 269-290.

Williams, J. C., ReVelle, C. S., & Levin, S. A. (2004). Using mathematical optimization models to design nature reserves. *Frontiers in Ecology and the Environment, 2*(2), 98-105.

Winter, J. G., Dillon, P. J., Paterson, C., Reid, R. A., & Somers, K. M. (2003). Impacts of golf course construction and operation on headwater streams: Bioassessment using benthic algae. *Canadian Journal of Botany-Revue Canadienne De Botanique, 81*(8), 848-858.

Winter, J. G., Somers, K. M., Dillon, P. J., Paterson, C., & Reid, R. A. (2002). Impacts of golf courses on macroinvertebrate community structure in Precambrian Shield streams. *Journal of Environmental Quality, 31*(6), 2015-2025.

Wyllie, R. W. (1998). Hana revisited: Development and controversy in a Hawaiian tourism community. *Tourism Management, 19*(2), 171-178.

Yalden, P. E., & Yalden, D. W. (1990). Recreational disturbance of breeding golden plovers *Pluvialis apricarius. Biological Conservation, 51*, 243-262.

Yamada, I., & Thill, J.-C. (2003). Enhancing stated preference surveys in transportation research: The contribution of geographic information systems. *Transportation Planning and Technology, 26*(5), 377-396.

Zhang, L. Q., Wu, J. P., Zhen, Y., & Shu, H. (2004). A GIS-based gradient analysis of urban landscape pattern of Shanghai metropolitan area, China. *Landscape and Urban Planning, 69*(1), 1-16.

Zhang, Y. (1999). Using the internet for survey research: A case study. *Journal of the American Society for Information Science, 51*(1), 57-68.

APPENDICES

Appendix A. Intercept Survey

Designing Whistler's Future

Interviewer: ____________________ **Time:**
Date: ____________________ ☐ < 12 ☐ 2-3 ☐ 5-6
Day of Week: ____________________ ☐ 12-1 ☐ 3-4 ☐ 6-7
Location: ____________________ ☐ 1-2 ☐ 4-5 ☐ 7-8+

Hi my name is [*your name*] and I am conducting research with Simon Fraser University to better understand what visitors think about future changes needed for Whistler to become more environmentally sustainable. Would you be willing to take 2 minutes to answer a few questions? [*If needed*] Which one of you is celebrating your birthday next and is also over the age of 19?

1. Have you already participated in this survey by Simon Fraser University? ☐N ☐Y *[terminate]*

2. Are you a <u>full-time</u> resident of Whistler or do you work in Whistler? ☐N ☐Y *[terminate]*

We will be conducting an Internet survey in the fall. By completing this survey, you will be helping to shape Whistler's future. You will also be eligible to win prizes such as native artwork or a free weekend in Whistler that includes accommodation and ski passes. Do we have your permission to contact you by email in late September to complete this Internet survey? <u>All personal information will be used for the purposes of this study only, and will not be released to any other individual or organization.</u>

3. Email: ______________________________ ***[double check!!]***

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

Thank you. At this time, I have just 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 time to Whistler?
☐Y ☐N

5. Is the primary purpose of this trip business or leisure?
☐ Business ☐ Leisure

6. Are you a day visitor or are you staying overnight?
☐ Night ☐ Day *[If day visitor then skip to #9]*

7. How many nights are you staying in total?
___ nights

8. Are you staying in paid accommodation, at the home of friends or relatives, or a second home?
☐ paid accommodation
☐ home of friends and family
☐ second home
☐ other: ____________________

9. Where are you from? Country: ____________________
Province *[if CAN]:* __________ State *[if USA]:* __________
City *[if BC]:* ____________________

10. How did you travel to Whistler from your place of residence or from the airport/ferry?
☐ Automobile ☐ Bus ☐ Other: ____________________

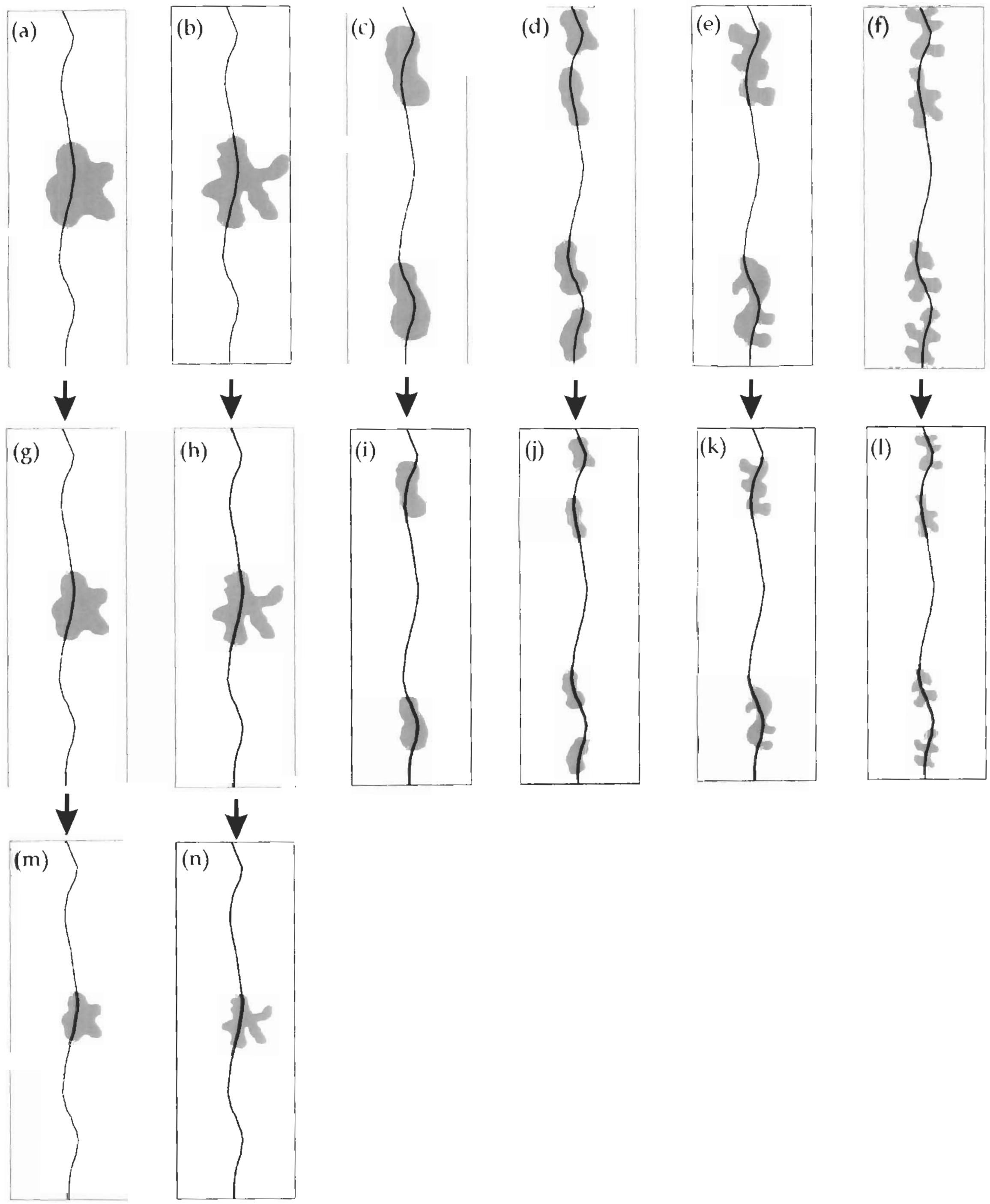
Thank you for your time. You can expect to receive an email from Simon Fraser University in late September or early October. Please accept this pin as a token of our appreciation. Have a nice day.

Appendix B. Creation of Developed Area Base Maps

Each map had a central developed patch (200, 400, or 600ha), which was located adjacent to and partially surrounding the village (i.e., development close). The size and appearance of the village was held constant in the survey because Whistler is not proposing any future changes to the village and because it would have been difficult to represent different village scenarios at the scale chosen for the maps. Two-thirds of the maps had an additional 350 ha or 700 ha of development outside of the core, which was either divided into two or four separate developed patches (i.e., development far). Close and far patches were either smooth and approximately round, or convoluted and irregular. The round patches had a mean shape index (MSI) of 1.2 ± 0.05 and the convoluted patches had a MSI of approximately 1.78 ± 0.05, which is approximately equivalent to the current Whistler situation. All far developed patches were roughly centred on the road.

In order to maximize the efficiency and consistency of map generation, maps with the greatest amount of development close and far for each combination of number of nodes and shape were created in separate themes in GIS (Figure B-1, a-f). The remaining base maps were created by simply "shrinking" the polygons contained within these original six maps down to the next level of development close and far, keeping the shape of the polygons the same (Figure B-1, g-n). The shrunken polygons were then placed so that their centroids were in the same location as the original polygon. In total, 14 different development base maps were created (six for development close and eight for development far).

Figure B-1. Fourteen base maps for developed areas



Appendix C. Creation of Protected Area Base Maps

The technique used to create the base maps for protected areas was similar to the approach used to create the development base maps. Six base maps were created in different GIS themes by crossing the three fragmentation levels with the two variability levels for a total of 35% protected area (Table C-1, Figure C-1, a-f).[25] To create two distinct levels of patch size variability, maps were created with patches that were very similar in size (i.e., equal sized patches) and with patches that were very different in size (i.e., unequal sized patches). The variability in sizes of patches was measured using an index called patch size coefficient of variation (PSCov). Maps containing unequal sized patches[26] had PSCov of 69-70, whereas maps with equal sized patches had a PSCov of less than one. [27] An additional six base maps (Table C-1, Figure C-1, g-l) were created by taking the patches in the version A base maps and simply varying the placement and orientation of the protected area patches. It should also be noted that all protected area base maps were created so that there was at least 250 m of space between the protected area patches and the nearest developed area patches in any combination of protected area and developed area base maps (i.e., protected areas were buffered from development). In order to create the maps in which some protected areas were adjacent to developed areas, approximately one third of the patches were moved to be adjacent to the developed areas following the rules described in Table 3.3.

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25 Other important considerations in the creation of the protected area base maps included minimizing the variation in the amount of protected area on each side of the road and creating patches with consistent shapes and orientation. With respect to shape, the maps were as consistent as possible (e.g. 1/3 of the patches linear, 1/3 round, and 1/3 average). The average shape of the patches for each map, as measured by the mean shape index (MSI), was fairly consistent (MSI = 1.45-1.50). The only exceptions were maps with three even-sized patches, which had a MSI of 1.62-1.69. To make the maps look more 'natural,' the orientation was designed to be irregular so that some patches were horizontal while others were vertical.

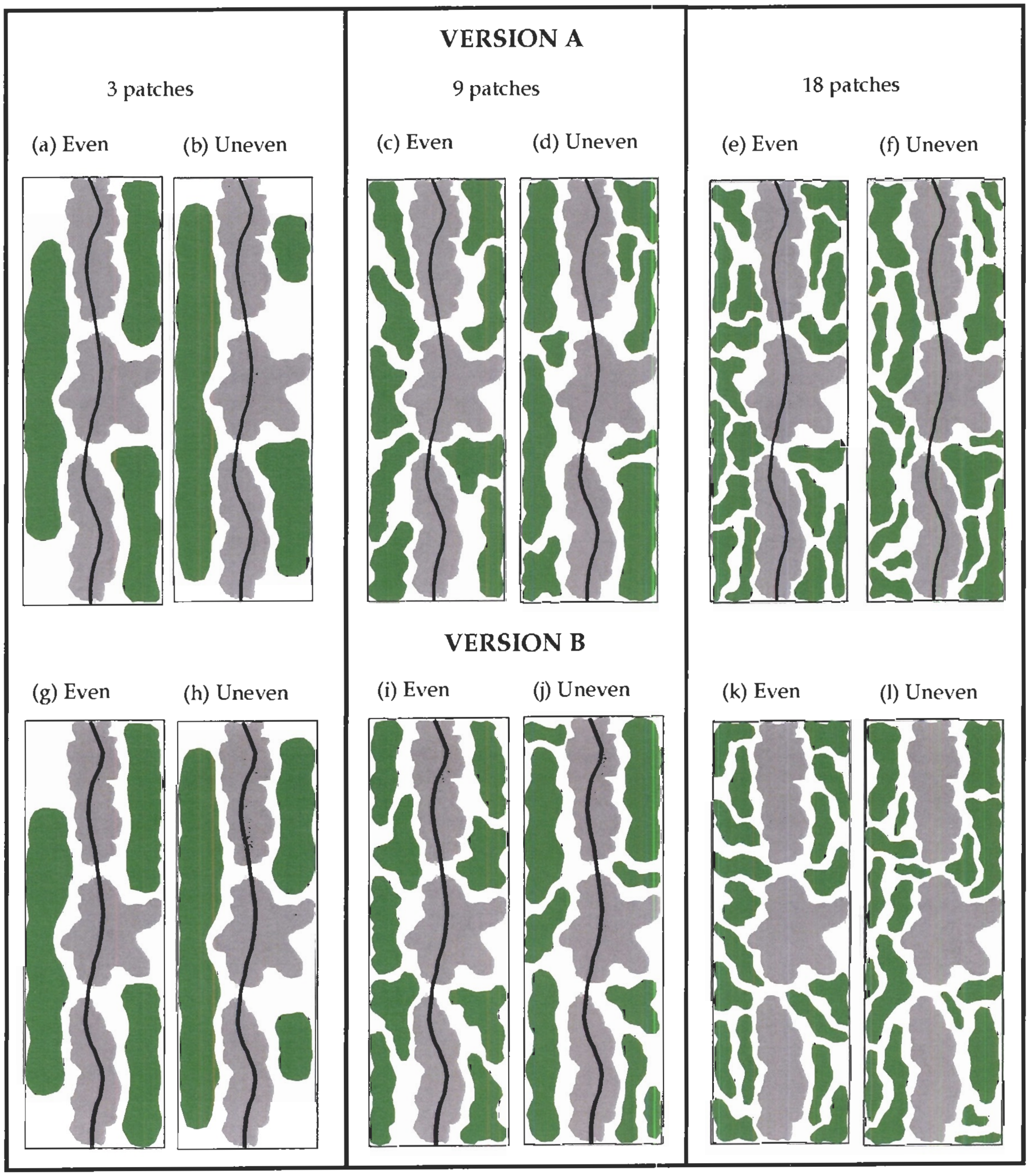
[26] In maps with patch size variability, 1/3 of the patches comprised 10% of the total area, 1/3 comprised 25% of the total area, and the remaining 1/3 comprised 65% of the total area.

[27] Maps with three equal sized patches and 35% protected areas (PSCov=35) could not meet this standard due to spatial constraints caused by the narrow dimensions of the map and the location of the road and development.

Table C-1. Summary statistics of the protected area base maps

Template Name	Map Version	Fragmen-tation	Varia-bility	Total Area (ha)	East/west proportions	PSCov	MSI
(a) 3_equal_35	A	3 patches	Equal	2205	50% / 50%	35	1.61
(b) 3_unequal	A	3 patches	Unequal	2205	65% / 35%	70	1.49
(c) 9_equal	A	9 patches	Equal	2206	56% / 44%	<1	1.46
(d) 9_unequal	A	9 patches	Unequal	2209	55% / 45%	70	1.45
(e) 18_equal	A	18 patches	Equal	2206	56% / 44%	<1	1.47
(f) 18_unequal	A	18 patches	Unequal	2207	54% / 46%	70	1.46
(g) 3_equal_35	B	3 patches	Equal	2204	50% / 50%	35	1.6
(h) 3_unequal	B	3 patches	Unequal	2206	65% / 35%	70	1.50
(i) 9_equal	B	9 patches	Equal	2205	56% / 44%	<1	1.43
(j) 9_unequal	B	9 patches	Unequal	2207	55% / 45%	69	1.44
(k) 18_equal	B	18 patches	Equal	2205	56% / 44%	<1	1.42
(l) 18_unequal	B	18 patches	Unequal	2207	54% / 46%	69	1.45

Figure C-1. Twelve base maps for protected areas



Appendix D. Email Cover Letter

Dear «Firstname»,

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

This survey has been designed to find out what you think about different aspects of mountain resorts like Whistler and will take 15-20 minutes to complete. As a thank you for taking the time to complete the survey, you will be entered in a draw to win a two-night ski holiday to Whistler, First Nations artwork, and other great prizes. Be sure to get your responses in by December 12, 2004 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.whistlerstudy.rem.sfu.ca/?SS=yes&pw=«Password»&di=«LoginID»

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

LoginID: «LoginID»
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 and Tourism 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,

Krista Englund & Joe Kelly
Graduate Students
School of Resource and Environmental Management
Simon Fraser University
Burnaby, B.C. Canada

Appendix E. Reminder Email Cover Letter

Dear «Firstname»,

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 the survey. We are sending you this one reminder email because your complete response is important for us to obtain representative results that can help improve future planning decisions at Whistler and other mountain resorts.

The web survey asks about your preferences for recreation, development, transportation, and environmental initiatives at mountain resorts. The survey will take about 20 minutes and requires no special knowledge to complete. Please submit your responses by Sunday, December 12, 2004 to be entered in the draw for a weekend ski trip to Whistler and other great prizes. 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 SURVEY:
http://www.whistlerstudy.rem.sfu.ca/?SS=yes&pw=«Password»&di=«LoginID»

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

LoginID: «LoginID»
Password: «Password»

Please be assured that you will not receive any further emails regarding this survey. Thank you for your time and cooperation.

Sincerely,

Krista Englund & Joe Kelly
Graduate Students
Centre for Tourism Policy and Research at the School of Resource and Environmental Management School of Resource and Environmental Management
Simon Fraser University
Email: whstudy@sfu.ca