VALUING FOREST RESTORATION AND RECREATIONAL BENEFITS OF A NATIONAL PARK IN ANDEAN COLOMBIA

By

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To my father.

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Protected areas provide several important goods and services to society, yet these goods and services are usually not traded in markets and their economic value is unknown. The non-marketable nature of protected areas creates a problem of undervaluation, which can result in the apparent superiority of alternate land uses relative to conservation. The travel cost and contingent valuation methods allow the estimation of recreational demand from survey data, thus shedding light on the economic value of non-market goods and services such as those provided by protected areas.

This study uses the travel cost and contingent valuation methods in a complementary manner to yield estimates of consumer surplus from recreational use of Los Nevados National Park (LNNP), located in the Andean region of Colombia. Park visitors were also surveyed regarding their willingness to pay (WTP) for ecological restoration of areas affected by wildfires that took place in 2006 and degraded 2,500 hectares (ha) of *paramo*.

The analysis consists of four travel cost models corresponding to four functional specifications of recreational demand, two models analyzing respondents' WTP for ecological restoration using a closed-ended dichotomous choice format and increased entrance fees as the

payment vehicle, and two models analyzing respondents' maximum WTP for restoration using an open-ended follow up to the dichotomous choice exercise.

Consumer surplus for recreational use of LNNP was found to be large relative to the budget of the Colombian parks service, which is responsible for 52 protected areas throughout the country. Respondents' WTP for ecological restoration was found to be positive and of a modest but significant magnitude.

These results suggest that LNNP is a significant contributor to social welfare in Colombia, and that protection of land for conservation and recreation are sound social investments. An increase in the entrance fee or some other fund collection mechanism could also provide important funds for improved management and restoration in LNNP.

CHAPTER 1
INTRODUCTION

A Brief History of Protected Areas

Humans have been protecting areas of land for different purposes for several centuries and for several reasons. In India, land was first set aside to protect natural resources about 2,000 years ago. Other examples of early protected areas are the Himas or protected grazing grounds of the Arabian Peninsula and the royal hunting grounds of Europe (Eagles et al., 2002). The modern protected area idea, however, did not emerge until 1872, with the designation of Yellowstone National Park in the American West. The British quickly followed suit with the establishment of other protected areas in what were colonies at the time but would soon become emerging nations: Canada, South Africa, Australia, and New Zealand (Eagles et al., 2002).

This initial wave of protected area establishment throughout North America and the British colonies followed policies with a distinct exclusionary purpose, namely to exclude local and generally non-western communities in order to ensure a purely "natural" landscape. The designation of Yellowstone, for instance, brought about the expelling of the Shoshone people from their ancestral land (Carey et al., 2000). Paradoxically, many of the newly established parks took the name of the ethnic group that was being excluded from their tribal land. This "Yellowstone model" of "fortress conservation" was the rule rather than the exception for conservation approaches during the rest of the 19th and most of the 20th Century.

The international community began recognizing the importance of protected areas early in the 20th Century. In 1933 the London Convention, otherwise known as the 1933 Convention Relative to the Preservation of Fauna and Flora in their Natural State, included clauses that called on signatory nations to establish protected areas. The New World counterpart to the London Convention, the 1940 Convention on Nature Protection and Wild Life Preservation in the

Western Hemisphere, also called for signatory nations to establish protected areas as a means to conserve biological diversity (Mulongoy and Chape, 2004). The London Convention was later replaced by the 1968 African Convention on Nature and Natural Resources, which contained similar clauses.

The idea of protecting large tracts of relatively undisturbed natural areas would soon find its way into nearly every country on the planet. The number of protected areas grew almost exponentially during the 20th Century and by 2002 there were nearly 44,000 officially designated protected areas covering nearly 10% of the Earth's land surface (Eagles et al., 2002). International non-governmental organizations (NGOs) such as the World Conservation Union (IUCN), the World Wildlife Fund for Nature (WWF), and United Nations agencies such as UNESCO have been extensively involved in the establishment and expansion of protected areas and protected area networks around the world. Today, protected areas are seen as an essential component of any biodiversity conservation strategy as well as maintaining some important social, cultural, and economic values (Carey et al., 2000).

Recently, the international community has tended to mobilize at a global rather than continental level. International treaties such as the World Heritage Convention and the Ramsar Convention have developed lists of sites that signatory governments have made commitments to protection under the convention. Most importantly, 189 nations signed the Convention on Biological Diversity (CBD) in 1992 during the Rio de Janeiro Earth Summit thereby committing to protect biodiversity within their borders using protected areas. The CBD, which operated under the United Nations Environment Programme, has established the Global Environment Facility, a major source of funding for conservation with a component that directly involves protected areas worldwide (Mulongoy and Chape, 2004).

The "fortress conservation" model of the Yellowstone era has given way to a more comprehensive approach, where the role and contributions of indigenous and other local communities are valued and acknowledged. This recent reformulation of conservation ideology has resulted in the emergence of a great array of Integrated Conservation and Development Programs (ICDPs) worldwide. The push for involvement of local communities in the management of natural resources can be traced back to efforts in Southern Africa to involve locals in the management of wildlife in communal areas, which in turn was brought about by the development of policies that emphasized the devolution of use rights for wildlife and other resources to dwellers of communal areas (Murphree, 1998; 2004). Many ICDPs actively involve local communities in the management of protected areas, as is the case with Brazil's extractive reserves (Mittermeier et al., 2005). In practice, however, most protected areas exist in a limbo between the fortress and the ICDP approach, with some protected area managers choosing to focus on one or the other. International NGOs and donor agencies are also partially responsible for setting the agendas of protected areas and they will commonly push for more of one or the other depending on their own goals or philosophy. The academic debate between these two approaches still endures, and the mixed results of ICDPs have given proponents of the Yellowstone model additional validation (Schwartzman et al., 2000; Terborgh, 2000; Wilshusen, 2002).

Some nations in the developed and developing world have found a source of national pride and economic opportunities in their systems of protected areas. American intellectuals in the late 19th and early 20th Century, for instance, relied on the American West's scenic beauty and the nation's emerging system of protected areas as a much needed proof of national greatness, comparable and maybe even superior to any European country (Runte, 1987). In the

developing world, Costa Rica's protected area system, considered to be one of the best in the world (Tangley, 1988), has served as a catalyst for an increase in international tourism and the portrayal of Costa Rica as the prime eco-tourism destination in the Western Hemisphere.

But even in places such as the United States and Costa Rica, where protected areas are lauded as sources of pride and economic opportunities, many of these parks are riddled by a myriad of problems including (but not limited to) low funding, lack of demarcation, lack of policing and enforcement of rules and regulations, lack of local recognition, and lack of outreach and educational activities. Protected areas in the developing world are increasingly experiencing "people-park conflicts" or encroachment by local people whose livelihoods depend on the wood, land, fisheries, or other resources within the park (Tangley, 1988). In some cases where there is a severe mixture of people-park conflicts and lack of enforcement, the "paper parks" phenomenon—parks that exist only in paper and lack management or enforcement—has emerged.

Benefits of Protected Areas

Protected areas (PAs) provide some important goods and services, thus making them an important contributor to social well-being. They are the cornerstone of all initiatives for biological diversity conservation worldwide, as they provide a space were ecological and evolutionary processes can continue, and are in many cases the only places were viable populations of large animals still remain. Some PAs are also inhabited by indigenous and local people whose traditional lifestyles can be maintained due to the existence of the protected area. Forested PAs provide important hydrological services such as flood mitigation, soil conservation, and provision of water for irrigation and consumption purposes. Marine PAs serve as spawning grounds for an astounding diversity of species that are harvested for subsistence and commercial purposes. Most PAs are also open for tourism and recreation, providing the public

with a space to relax and interact with nature (Carey et al., 2000). The importance of PAs is also reflected in the many international agreements and initiatives that call for the effective protection of ecosystems through their designation as protected sites.

Today, biodiversity conservation is perhaps the most widely publicized benefit stemming from the creation of PAs. Given the expansion of the world's human population and the corresponding increased pressure on land, water and other resources, many animal and plant species have become completely or at least heavily reliant on PAs for the provision of suitable habitat. The existence of large and relatively undisturbed tracts of land is also required for the maintenance of ecological and evolutionary processes, as well as for the preservation of genetic variation within species, which can act as a buffer against extinction (McNeely, 1995). Protection also ensures that the productive capacity of ecosystems is maintained.

Many indigenous groups also live inside PAs, where their traditional lifestyles are preserved and their autonomy is respected. The historic and cultural features of importance to them are maintained intact through the designation of the site as protected. Brazil's indigenous extractive reserves and India's sacred lakes are good examples of PAs where biodiversity conservation and preservation of cultural and religious heritage are complementary. Without the protection offered by the establishment of parks and reserves, many indigenous cultures would face possible disappearance as a consequence of resource pressures and assimilation into the mainstream culture.

Continued breakthroughs in biotechnology also depend on the maintenance and preservation of the genetic raw material that is present in the world's PAs. Continued improvements in crop yields depend at least in part on the availability of genetic material from the wild counterparts of our modern day crops. Advances in the field of medicine are also

dependent on the availability of wild plants and animals that create special compounds with medicinal qualities. Protected areas are essentially *in situ* gene banks that ensure the availability of the genetic diversity that powers improvements in agriculture, medicine, and other fields (McNeely, 1995).

The sustainable use of wild plants and animals is made possible by the provision of habitat suitable for reproduction and for completion of the life cycles of these organisms. Protected areas around the world offer this suitable habitat and are thus in part responsible for the feasibility of the sustainable use and exploitation of many plants and animals. Marine PAs, for instance, serve as spawning grounds for several species of fish, thereby ensuring the sustainability of some of the world's fisheries.

Forest and mountain PAs also play a vital role in the provision of fresh water for human consumption. A disproportionate amount of the world's drinking water comes from PAs, and a third of the world's 100 largest cities draw a substantial portion of their drinking water directly from PAs (Mulongoy and Chape, 2004). The forest cover present in many parks and reserves protects watersheds from phenomena like soil erosion and sedimentation.

Large tracts of forest, such as those present in parks and reserves, also create stable microclimates with regular rainfall and predictable temperatures. In coasts and estuaries the presence of mangrove forests and salt marshes, common in coastal PAs, can mitigate the impacts of severe weather events such as hurricanes and sea-level rise (Mulongoy and Chape, 2004). Forested areas near rivers can also prevent or mitigate floods. PAs also mitigate the effects of global climate change by sequestering atmospheric carbon in the form of biomass.

But PAs also provide intangible benefits, such as national pride and human inspiration. The landscapes and wildlife contained within parks and reserves enrich the human experience

through their beauty. They also provide opportunities for community development, education and training, scientific research, recreation and tourism (McNeely, 1995).

Some of the benefits of PAs are non-consumptive use values, which, like recreation, can be enjoyed by many people without diminishing the quality of the protected area. Carbon sequestration and hydrologic regulation create indirect-use values, as people benefit from these services even if they are not in contact with the park or reserve that creates these services. In the intangible realm, individuals may value the option of maintaining resources in a protected area for future use. Others may feel a benefit in the maintenance of a protected area to be enjoyed by future generations. Some individuals may even value the conservation of a protected area simply to know it exists, even if they do not plan to use or visit it at any point in time. PAs are common pool resources under public ownership that provide a wide array of products and services that contribute to human welfare in different ways.

Threats to Protected Areas

The IUCN defines a protected area to be "an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means" (Carey et al., 2000). Under this umbrella, IUCN defines six broad categories of PAs mostly on the basis of human presence and uses of the area in question. The six categories are summarized in Table 1-1.

These categories illustrate both the diversity of the world's protected area system and the wide range of objectives that these parks and reserves are intended to meet. While the IUCN classification system is used by governments and organizations worldwide, governments are in no way bound to use this system and in many cases sovereign governments will use different systems. The United Nations also designates some PAs as World Heritage Sites or Biosphere Reserves, and international agreements such as the Ramsar Convention on Wetlands and

Migratory Waterfowl also use a different set of criteria for definition of PAs. There is also considerable academic debate regarding the adequacy of the IUCN classification system.

Despite the growth in the number of PAs and their geographical extent throughout the world, relatively few are considered success stories. Conservation organizations around the world have recognized the overwhelming importance of these entities in biodiversity conservation, as is reflected in the conservation literature and in funding initiatives of international NGOs and multilateral donor agencies. Yet all these actors recognize that protected area management has fallen quite short of success; instead, most parks and reserves are plagued by encroachment from agriculture and mining, oil exploration and extraction, wildlife poaching, and fuel-wood gathering among other problems, resulting in environmental degradation and biodiversity loss (Reed, 2002).

Lack of adequate funding for the enforcement of PAs is often cited as the major difficulty that PA managers face (Carey et al., 2000; Schwartzman et al., 2000; Reed, 2002; Mulder and Coppolillo, 2005). This lack of funding is reflected in the understaffing of protected area authorities and the under-investment in proper infrastructure and community outreach activities. Given the wide breath of the goals and objectives of PAs, the lack of proper funding and staffing almost unavoidably results in dysfunctional and inefficient park agencies full of well-meaning and determined employees, all caught in a quagmire of problems and threats that are unsolvable due to their lack of institutional capacity.

Parks and reserves are in the public trust and are financed with government funds. Yet there is a very high opportunity cost on public expenditures, not only in the developing world but in the developed world as well, and conservation is usually low in the list of government priorities. Furthermore, the nature of some of the goods and services provided by these PAs

makes them virtually un-tradable in existing markets. Since governments cannot readily quantify the value of PAs, low funding on them is easily justified. Since these natural areas provide mostly 'non-market' values, those areas which are not under protection are generally lost to other forms of development (Barzetti, 1993). Areas that are under official protection but are lacking of enforcement can, however, also be susceptible to transformation into other land uses.

Nearly all PAs in the world, however, are under some form of threat. Some of these are minor or remote threats that do not necessarily endanger the existence or viability of the protected area in question. Other parks and reserves, however, are under major or more accentuated threats that could potentially undermine the existence of the protected area and the resources contained within it. WWF has identified four major categories of threats to PAs (Carey et al., 2000). These general categories do not relate specifically to events or activities, but rather to the overall effect that an event or a conglomerate of activities may have on a protected area.

The first major threat category is the removal of individual elements (plants, animals or other resource) from the PA without causing a major alterations in ecosystem structure or function. Some examples of practices that can be included in this category are traditional hunting by local communities, extraction of plants for use in the preparation of meals or traditional medicines, fishing and fuel wood collection. Given the close proximity of human settlements to many PAs, these threats are expected due to their long history of use and do not represent a serious threat to the existence or sustainability of the area. However, population increases due to immigration or improvements in health care can intensify these practices and turn them into more serious threats.

The second major threat category identified by WWF is the overall impoverishment of the ecology of the area, which is generally the result of long term interactions between human settlements and PAs. Air and water pollution, for instance, can diminish the quality of a protected area over time. Agricultural encroachment and urbanization, as well as constant poaching pressure, can also diminish the quality and overall ecological integrity of a park or reserve (Carey et al., 2000). A recent study has shown that many Amazonian vertebrates, for instance, are easily driven to extinction in local areas when both subsistence hunting and habitat fragmentation are present (Peres, 2001). Ecologists have also described what they call "edge effects"—radical changes to the structure and function of ecosystems at the edge of a continuous expanse of forest, which can result in a different composition of plants and animals, decreased humidity, and a higher incidence of fires. Some species of birds are known to avoid the forest edge and are unable to cross even small road clearings (Laurance et al., 2004).

Major conversion and degradation of the ecosystems due to the removal of vegetation for the construction of roads or major human settlements, and the introduction of mining activities to a protected area represent the third major threat category. The promise of increased revenues often pushes governments toward the opening of national parks and reserves to oil exploration and drilling, as was the case in Ecuador with the opening for drilling of Yasuni National Park, the largest protected area in the country. In the United States, the opening of the Artic National Wildlife Refuge (ANWR) in Alaska for oil exploration and drilling has been mentioned by the media and policymakers at several points in time, only to be strongly opposed by environmentalists (Waller, 2001). The construction of major infrastructure and the removal of a significant amount of vegetative cover from a protected area can imperil the existence of such area not only through the short-term destruction, but also through the long term dynamics that

follow the initial event. The construction of roads or settlements may open the way for increased immigration to the region, fragment the forest into smaller patches, and increase human access to areas that were previously inaccessible, thus increasing human pressure on the ecosystems. Forest fires can also dramatically change or completely remove the vegetative cover of an area, also opening the way for activities such as livestock grazing and farming, which will likely further reduce the quality of the protected area.

The fourth and most dramatic threat is the isolation of PAs by major changes in surrounding land or water use. Isolation works very slowly and usually takes a very long time to show the dramatic changes brought about by events such as fire or removal of vegetation. Isolation prevents the exchange of genetic material that is the backbone of evolutionary processes. Some species of animals, specially the larger ones, also require very large ranges to maintain viable populations. Isolation may also increase inbreeding among animals, which will in the long-term result in higher incidences of genetic predispositions to certain diseases. In the long term, some species will disappear from PAs that are not large enough or lack connectivity to other areas where other populations of that species are present (Mulder and Coppolillo, 2005). The effect of isolation on the integrity of ecosystems is the subject matter of Island Biogeography, an emerging field within conservation biology.

Economic Valuation of Protected Areas

The economic value of national parks and other PAs, especially in developing countries, is often overlooked in public debate. In many cases, conservation has consisted of "conserving that which conserves itself", not by being financially sustainable but by being economically marginal and having little utility and a reduced economic value (Wyngaarden 2002). In other words, areas that have been designated as protected often provide little if any losses in terms of perceived opportunity costs accruing to those who decide whether or not to designate the

protected area. Economic valuation of PAs is, therefore, an important source of information both for park managers and for society in general. Economically efficient resource management requires knowledge of the flow of park benefits and costs, and valuation can be used to measure the benefits derived from the existence of the park (Mathieu et al., 2003). The existence of public benefits derived from a PA in the form of environmental amenities and ecosystem services implies that the park contributes to public welfare and loss of the park or decline in park quality could result in a loss in welfare (Shah, 1995). Luckily, economists have designed empirical methods to estimate the economic values associated with PAs and other environmental amenities and services (e.g., Mathieu et al., 2003; Maharana et al., 2000; Whittington, 1998; Navrud and Mungatana, 1994).

The Travel Cost Method (TCM) and the Contingent Valuation Method (CVM) are widely accepted for non-market valuation of natural systems and amenities. The TCM uses travel costs to place minimum values on visits to sites for recreational purposes. The CVM asks the public to evaluate hypothetical scenarios involving changes to the environment that include the estimated costs. The CVM has been approved by the US Department of the Interior for implementing regulations under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 and its amendments of 1986. The CVM has also been accepted by US courts since a 1989 decision that allowed the inclusion of nonuse values generated through the CVM in the assessment of environmental damages from the Exxon Valdez oil spill in Alaska (Van Kooten and Bulte, 2000). The TCM was essentially sanctioned by the US government with a study on eliminating recreational use of the Hells Canyon by Resources for the Future; based on the results of the study, Congress voted to prohibit further development of Hells Canyon for generating electricity from hydropower (King and Mazzota, 2000).

To date, numerous travel cost and contingent valuation studies have been conducted on areas in the developing world to measure a diverse array of environmental benefits. In developing countries, studies initially focused on issues related to valuing water supplies and sanitation, recreation, and tourism, but the areas have expanded to include surface water quality, and biodiversity conservation (Whittington, 1998). Several studies concerning PAs in the developing world have estimated benefits and values accrued to foreigners rather than locals (Horton, et al., 2003), probably due to their higher incomes and consequently higher valuation estimates.

While there have been numerous TCM and CVM studies to measure environmental benefits in developed countries and some in developing countries, there appear to be very few studies that have used both non-market valuation methods – particularly on protected areas in developing countries and that have tried to capture valued held by its citizens. But using both methods provides an estimate of the recreational value of a site and the stated preferences of visitors with respect to changes in the site. The use of information from visitors ignores values held by non-users but also is expected to provide more realistic estimates since users have experience and knowledge of the site in question.

Navrud and Mungatana's (1994) valuation of flamingo viewing in Kenya was one of the milestones of non-market valuation in the developing world. The study consisted of a survey of a random sample of 185 visitors to Laku Nakuru National Park in Kenya, a protected area that serves as a bird sanctuary and supports 1.4 million flamingos. The researchers interviewed 58 Kenyan residents and 127 foreign visitors to the park. Their questionnaire queried them about their travel costs and asked them some contingent valuation questions. The mean observed value per visitor per day was between $68 and $85 for the Kenyan residents and between $75 and $79

for non-resident tourists. The contingent valuation exercise yielded a willingness to pay (WTP) for a higher entrance fee for park management of $53.25, a WTP for flamingo protection of $19.44, a WTP for the setup of a WWF flamingo fund of $21.88, and a willingness to accept (WTA) of $86.97 for visiting if there were no flamingos in the park. The statistically significant variables with a p-value of 0.10 or lower were travel cost, income, education, and age, as well as an additional household income variable for Kenyan residents only.

Maharana et al.'s (2000) study of the sacredness value of a lake in the Sikkim Himalayan region of India consisted of surveys given to 50 members of the local community, 140 local pilgrims, 95 Indian tourists, and 75 international tourists. The mean observed value for visitors to the lake was $3.87 per visitor per day. The contingent valuation exercise yielded a mean WTP for the non-market commodity benefits of the lake of $0.88 for members of the local community, $2.16 for local pilgrims, $2.51 for Indian tourists, and $7.19 for non-resident tourists. The significant variables at a p-value of 0.10 or lower were travel cost, distance, age, sex, education, occupation, and income.

Mathieu et al.'s (2003) study of international tourists' willingness to pay to enter a marine park in the Seychelles consisted of a CV survey administered to 300 tourists at different hotels in the Seychelles who had not yet visited a marine park. The researchers tried to link expectations and motivations of the visitors to their WTP. The results showed that the average WTP for entering a marine park was $12.20 per person. Given that the existing entrance fee is $10, there is a $2.20 consumer surplus per person, which would amount to a total annual consumer surplus of $88,000. The significant variables at a p-value of 0.10 or lower were the diving motivation, the prevention of ecosystem destruction motivation, the conservation

principle motivation, country of origin, engagement in snorkeling, and visits to other parks in the Seychelles.

Valuation of a National Park in Andean Colombia

While the environmental valuation literature is strong, information on the economic value of PAs in developing countries is scarce, especially for residents in the developing country. The goal of the proposed study is an economic valuation of LNNP by Columbians using both the TCM and the CVM. The park, which is described in detail in Chapter 2, suffered wildfire damage in July 2006. The objectives of this study include: 1) estimating the recreational use value of the park for visitors and 2) estimating their willingness-to-pay (WTP) for restoration of the areas affected by the 2006 fires. More specifically, the study will discern which demographic variables affect visitors' WTP and which park attributes most affect people's values. The study will also test whether informing visitors of the ecological functions of the park affected their WTP. The underlying issue, however, is whether Colombians in general accrue a welfare gain (more benefits than costs) due to the existence of the park, which is information that could help the Ministry of the Environment justified continued expenditures on the park system.

This thesis is divided into five chapters. Chapter one introduced the concept of PAs by first outlining the history behind the establishment of parks and reserves, followed by a description of the benefits that society receives from the existence of these parks and the threats that modern parks and reserves now face. Some institutional problems of PAs were also identified. The importance of economic valuation in parks and reserves throughout the world were then discussed, followed by a brief overview of valuation studies that have used both the TCM and CVM to value PAs in a developing country, including those by its own residents.

Chapter 2 offers an introduction to Los Nevados National Park (LNNP) the site of this case study. The chapter begins with the history of LNNP, based mostly on the legislative documents

that created the park and the government agency in charge of its management. A summary of the management of the park and the park system as a whole is then provided. A short geographic description of the area is then given, including a description of the recreational visitation to the park. A section describing the future of the park in terms of main threats faced by LNNP is also discussed. The chapter ends with a brief overview of the financial future of the park.

Chapter 3 introduces the economic theory behind non-market valuation of natural assets. The first section introduces the concepts of utility and choice, central to all economic theory. A brief explanation of non-market goods and services is then followed by an introduction to the concepts of willingness to pay and total economic value. The travel cost and contingent valuation methods are then explained in more detail.

Chapter 4 describes the empirical application of the travel cost and contingent valuation methods in LNNP. An overview of the survey design is then followed by the descriptive results of the survey. A section describing the use of the travel cost methods and its results is then followed by a similar section describing the use of the contingent valuation method in this study.

Chapter 5 offers some concluding remarks, beginning with the implications of the results of the analysis of the travel cost and contingent valuation data. Some policy prescriptions are then offered, followed by a brief overview of the caveats and limitations of this study. The possible directions that this study may take in the near future are then discussed, followed by a brief overview of the future of non-market valuation of PAs in the developing world.

Table 1-1. List of protected area categories and their description (IUCN)

Cat.	Definition	Description
I	(a) Strict Nature Reserve; (b) Wilderness Area	(a) An area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species available primarily for research and/or environmental monitoring; (b) Large area of unmodified or slightly modified land and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition
II	National Park	A natural area of land and/or sea designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations; (b) exclude exploitation or occupation inimical to the purposes of the area; and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible
III	Natural Monument	An area containing one or more specific natural or natural/cultural feature which is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance
IV	Habitat/Species Management Area	An area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species
V	Protected Landscape / Seascape	An area with coast and sea, as appropriate, where the interaction of people and nature over time has produced an area with significant aesthetic, ecological and/or cultural value and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area
VI	Managed Resource Protected Area	An area containing predominantly unmodified natural systems managed to ensure long term protection and maintenance of biological diversity while providing at the same time a sustainable flow of natural products and services to meet community needs

CHAPTER 2
LOS NEVADOS NATIONAL PARK

The History of Los Nevados National Park (LNNP)

The emergence of protected areas (PAs) in Colombia has a utilitarian and grassroots basis: the first areas for conservation in the country emerged in the first half of the 20th Century as a means to protect the headwaters of rivers that fed municipal aqueduct systems. In 1938 a portion of the watershed of the Cali River was declared a "Forest Reserve Zone" and in 1943 an area surrounding the Muña River near Bogota was declared as protected and fishing and hunting were banned. Other municipalities followed suit, declaring "Areas of Flora and Fauna Conservation" in the headwaters of the rivers and streams that fed their aqueducts (Fundacion Gabriel Piedrahita Uribe, undated).

The national system of protected areas first emerged in 1948; the *Serrania de la Macarena*, a low-rising massif east of the Andes that is geologically part of the Guianan Shield (Franco et al., 2007) was declared a "Natural Reserve" in order to protect its biodiversity, which is markedly different than the biodiversity of the Eastern Andes. The history of National Parks in Colombia begins in 1959 with the Law on Forestry and Natural Renewable Resources, which created the institution of "National Natural Parks" with the objective of "conserving the national flora and fauna." In article 13 of what is known as the 2nd law of 1959 it is stipulated that the National Government – through the Ministry of Agriculture and with the consent of the Colombian Academy of Exact, Physical and Natural Sciences – was from that point on granted the authority and responsibility of establishing protected areas through executive decrees. The law allowed the establishment of PAs that included prohibitions on the granting or sale of lands for use as hunting, fishing and all industrial activity that involves livestock or agriculture. A paragraph at the end of this article declares "the *Nevados* and the areas around them" National

Natural Parks. It is unclear whether the legislators intended to create what is today known as Los Nevados National Park (LNNP), or whether they intended to create National Natural Parks in all areas where *Nevados*, or glacial peaks, are present. Article 14 of this law declares the areas designated as National Natural Parks as areas of public utility and allows for the expropriation of lands or private infrastructure that exists in those lands.

The official establishment of the first national park did not come until 1960 when Cave of the Guacharos National Park was designated. The park's main features are extensive Andean forests and a system of caves and underground formations that serve as nesting grounds for the *Guacharo,* a species of bird. More importantly, the park protects the headwaters of the Magdalena River, the most economically important waterway of Colombia. The establishment of Cave of the Guacharos National Park portrays the dual role of PAs in the Andean region of Colombia as reserves of flora and fauna and hydrographic reserves to protect the country's waterways.

Even though the legislative branch mandated the protection of the glacial peaks since 1959, the establishment of Los Nevados National Park—comprised of five glacial peaks—did not take place until 1973. The establishment of the park was preceded by the establishment of the Institute for the Development of Renewable Natural Resources (INDERENA) as an agency under the Ministry of Agriculture in 1968 that would consequently manage and create National Parks and other PAs. In March 1973 INDERENA designated a 38,000 hectare area as Los Nevados National Park (LNNP), with the objective of conserving the flora, fauna and natural scenic beauties, and with scientific, educational, recreational, and aesthetic uses.

In the same decree used to create the park, INDERENA delineates the borders of the park using trails, roads, creeks, and rivers as markers. The language used in the border delineation

sheds some light into the arbitrariness of the process, as it seems that the only instrument used to establish the borders of the park was a topographic map of the area. It also seems that at the time INDERENA was not worried about the landholders that would be affected. The decree uses the same language prohibiting activities in the areas designated as National Park that was used in the 2nd law of 1959. Today, LNNP is comprised of 58,300 ha, over 20,000 ha more than its initial size. The growth of the park's size has been the result of consequent designations of more protected land. The written record for these designations is, however, lacking.

The statute of reservations of the National Parks System, established in 1971, delineates the following eight general objectives of the park system:

- Technical oriented management and use of the reserves that make up the system.
- Protect and study the wild fauna and flora of the nation.
- Conserve and administer the natural values of the country.
- Reserve representative areas that allow the perpetuation of the respective primary ecosystems.
- Establish natural gene banks.
- Promote the development of new and improved techniques for the conservation and use of natural renewable resources.
- Restore wildlife.
- Research the values of the natural renewable resources of the nation.

Given that INDERENA was established to fulfill these objectives through the creation of PAs, it is reasonable to assume that the protected areas that were established after the creation of INDERENA—such as LNNP—had the same objectives. Also, even though not mentioned in the official decree of 1971, the Colombian Parks Unit prides itself in protecting a majority of the hydrographic centers of the country (Franco et al., 2007) and the protection of the headwaters of many rivers could be taken to be another one of the Parks System's objectives.

Management of LNNP

In 1993 INDERENA disappeared with the creation of the Ministry of the Environment, a result of the new constitution of 1991. The Special Administrative Unit of the National Natural Parks System (UAESPNN) was created under the Ministry of the Environment with the task of managing existing PAs and designating new ones. A 1996 decree from the Ministry of the Environment emphasized that the UAESPNN also assumed the power of expropriating and negotiating land for the establishment of PAs. A 1995 decree from the same Ministry allows the UAESPNN use of police powers to protect national parks and other reserves.

The park includes an area commonly used for livestock grazing and some of the areas that today are under protection used to be grazing grounds utilized by the same group of people who own the land around the park and who currently use the buffer zone that surrounds the park. This creates a conflict that sometimes results in cattle being found within the core area of the park. Pastoralist fires outside the park and in the buffer zone are very common (Wyngaarden and Fandino-Lozano, 2002). Therefore, the UAESPNN personnel in the park spend considerable time and effort driving cattle out of the core area and monitoring the area for fires. Typically, however, there are less than 10 UAESPNN employees covering the 58,300 hectares of the park. Several of the people employed by UAESPNN in Los Nevados are locals that have been working at LNNP for a long time and their commonly held view is that the arbitrariness of the process by which the park was declared is the source of much discontent among those living near the park (Jairo Villanueva, pers comm.).

In 2006 the management of the park experienced a drastic change. A concession contract was signed between the UAESPNN and a union between several private and semi-private entities that includes a tourism agency for the management of the eco-tourism aspects of the park. The contract included a clause that mandates the investment of $600 million pesos (about

$300,000 USD) in infrastructure that would become the property of the park at the end of the 10 year agreement, if it were not to be extended. The investment plans include the construction of new cabins for tourists and an aqueduct that would supply drinking water to the old and new cabins. It also allows the limited personnel of UAESPNN to concentrate on park management instead of looking after the over 60,000 annual visitors that the park receives.

The main LNNP office, which houses the park director and the rest of the executives and office staff, is located in Manizales, the closest major urban center. The park has about 25 employees, of which 10-13 are housed in the Manizales office and very few of them visit the park on a regular basis (Jorge Lotero, program director for LNNP, pers. comm.). The rest of the employees work in the field and are housed inside the park during the periods in which they are working. Generally, field employees work three consecutive weeks and get one week off before their next work period. This implies that at any given point in time there may be somewhere between 8-12 field employees stationed inside the park.

The System of Protected Areas of Colombia

The Colombian Protected Area System (Unidad Administrativa Especial del Sistema de Parques Nacionales Naturales de Colombia - UAESPNN) is currently composed of 53 protected areas that include both "National Natural Parks" and "Sanctuaries of Flora and Fauna." The parks system gets its funding from two main sources. Most of the budget is covered by direct transfers from the Ministry of Environment, which covers both operational costs and some funds for capital investment projects. Investment funds primarily come from FONAM, the National Environmental Fund. FONAM is an independently managed system of bank accounts set by the Ministry of Environment designed to complement environmental projects included in the National Development Plan or projects taking place inside the areas that make up the Colombian PA System. The external (foreign) funding that the parks receive comes through the Ministry of

Environment first, then to the central office of the Protected Area System and then to the individual parks, but is usually earmarked for specific projects rather than for normal expenditures. All proceeds from entrance fees and other funds collected by the individual parks are sent back to the Ministry, which then allocates the money back to the parks.

Every year the central office of the parks service presents compiled lists of all expenditures made by all of the 53 PAs. This process implies that there is little autonomy in financial decision making at the field level as spending petitions must go through the bureaucratic chain, usually taking a long time to be accepted or may even be denied. Furthermore, the organizational structure of the UAESPNN (Figure 2-1) dictates that the finances are completely separated from the executive directors, which are under the Territorial Directors. In Figure 2-1, the LNNP management would be under the "Norandina" Territorial Directorship (Direcciones Territoriales), while all the finances of the UAESPNN are managed under the Administrative and Financial Sub-directorship (Subdireccion Administrativa y Financiera).

Given that the PAs system's finances are centralized, an individual financial assessment of LNNP is not possible. However, an analysis of the expenditures of the system as a whole is useful. Figure 2-2 shows the trends in expenditures for the entire park system from 2004 through 2007. As shown, 2007 is the first year in which total investment in the parks will exceed operational costs.

Not only is 2007 a great improvement in the finances of parks in Colombia with the increase in investment relative to operational costs compared to the recent past, or in the adjudication of concessions to manage the eco-tourism aspects of certain parks—including LNNP—but also in the prospects of an increasing budget for 2008. Next year, UAESPNN's

budget will increase from about 13 billion pesos to about 53 billion pesos. This drastic increase seeks, among other goals, higher presence of the parks service in all PAs and more effective management. Nowadays, many of Colombia's PAs do not have any presence of the UAESPNN at all, and are instead sites of violent conflict between illegal armed groups and the Colombian army, which routinely sprays roundup in an attempt to cut down on the production of illegal drugs (Carranza, 2005). While most of the increase in the budget will very likely go to parks in conflict zones, some improvements in the finances at LNNP can be expected as it still remains one of the most socially important protected areas in the country.

Geographic Characteristics of the Area

Tropical Andean ecosystems are the richest biotic communities on Earth, topping the list of the world's biodiversity hotspots (Myers et al., 2000). In Andean ecosystems, diversity of ecological communities is enhanced by distinct altitudinal gradients over relatively short distances, with changes in elevation of over 5,000 meters (m) over distances of less than 50 kilometers (km), which are common at equatorial latitudes (Van Der Hammen et al., 1983).

The Central *Cordillera*—or mountain range—of Colombia is a prime example of the extremely diverse biotic systems that the Andes can harbor. On the Western slope, the *Cordillera* receives the moist oceanic winds streaming in from the Pacific, resulting in ample rainfall throughout the year. On the Eastern slope the predominant winds are continental in character, resulting in a much drier climate with pronounced wet and dry seasons (Van Der Hammen et al., 1983).

Los Nevados National Natural Park is representative of the Central *Cordillera* both from an economic and an ecological standpoint (Figure 2-3). Several rivers originate within LNNP, among them the Otun, Quindio, Campoalegre, and Chinchina on the Western slope and the Totare, Lagunillas, Recio, Guali, Cajones, and Guarino on the Eastern slope (Van Der Hammen

et al., 1983). Within and around LNNP all possible altitudinal variations can be observed: from the year-round glaciated areas above 4,600 m, the *paramos* above 3,800 m, to the warm equatorial savannas and valleys under 700 m. The predominant ecosystem in LNNP is the *paramo*, a high altitude grassland that is unique to the neotropics (tropics in the Americas). The most notable species in the park include the Andean bear and the Andean condor, but other tropo-montane flora and fauna are present. Land use around LNNP is characterized by exploitation of the altitudinal and topographic gradients. In the valleys of the Magdalena and Cauca rivers, mechanized agriculture of rice, cotton, sorghum, and sugarcane is predominant. The country's most important and best known coffee area is located between 1,000 m and 2,000 m. Above 2,000 m, livestock and tuber crops dominate land use (Van Der Hammen et al., 1983). The four urban centers in the area (Manizales, Pereira, Armenia and Ibague), with populations between 200,000 and 500,000 each, are located in the coffee belt, between 1,000 m and 2,000 m.

Given that LNNP falls within the historical range of the Andean condor—the national bird of Colombia—but had been driven out of the area in the earlier part of the 20th Century, the UAESPNN, along with CORPOCALDAS (the regional environmental authority) and with the support of other national and international organizations, initiated the "Andean Condor Project," with the goal of establishing a healthy population of condors in the park. The project began in 1989 and ended with the freeing of 14 captive-bred condors in 1997 (CORPOCALDAS, undated). The UAESPNN and CORPOCALDAS continue monitoring the birds today but the success of this initiative is still uncertain.

A recent study by Franco et al. (2007) addresses the success of LNNP with respect to biodiversity conservation. The study compares the potential ranges of avifauna with the actual records of avifauna occurring within National Parks in Colombia. The study found that more

than 80% of the bird species whose potential range includes LNNP are actually found within the park today. This is the second highest presence of potential species in National Parks in Colombia, after the Sierra Nevada de Santa Marta National Park.

Historical Visitation

The recent history of LNNP is marked by the November 13th, 1985, eruption of the *Nevado del Ruiz* Volcano. Previous to this volcanic eruption the main glacier in the park, which stretched from the summit of *Nevado del Ruiz* at 5,389 m to areas as low as 4,500 m, provided opportunities for snow skiing and similar activities. A majority of the glacier melted upon contact with the hot pyroclastic flows erupting from the summit of the mountain, creating a disastrous mudflow that leveled the town of Armero, Tolima, resulting in over 20,000 deaths. Due to the extent of the disaster, perhaps the worst in Colombian history, authorities decided to close LNNP to all visitors.

The park reopened some years later under the management of INDERENA, but entrance to the park required special permits. Visitation during this time was relatively low, as INDERENA's permit processing was costly and time consuming for prospective visitors. With the creation of the Ministry of the Environment and the UAESPNN, the permit requirement was eliminated. Visitation to LNNP after 2000 has more than doubled, from 23,593 visitors in 2000 to 58,659 in 2006, peaking in 2004 with close to 80,000 annual visits (Figure 2-4). A map of Colombia showing the states of origin of the majority of visitors is shown and discussed in Chapter 4.

Tourism in LNNP is seasonal. Its most important attraction, *Nevado del Ruiz*, is located less than an hour drive from Manizales, one of the major urban centers in the area. The majority of visits occur in the month of January, when the world famous Manizales City Fair is held. Visitation also peaks in the month of April when many Colombians take a week off work to

celebrate Easter. In general, visitation is highest during the months of June, July, and August when many schools and universities are not in session. The highest daily visitation in 2007 was recorded on July 20th, Colombia's Independence Day, and the most important national holiday.

Visitation has been increasing dramatically since the turn of the Century and it is likely that the annual number of visits will increase in the future. The increase is in part due to president Alvaro Uribe's "Love Colombia, Travel Around Her" program, which advertises in-country road travel as a key strategy in the fight against the Fuerzas Armadas Revolucionarias de Colombia (FARC) guerrillas. It is very likely that this program will continue for several years.

The Future of LNNP

In the past, field employees were responsible for the management and operation of all aspects relating to the park, including tourism. The situation changed drastically in 2006 with the signing of a concession contract that gave the eco-tourism rights to a semi-private entity to be managed as a private business. This freed up the human resources of the park, as park rangers can now devote their time to park management instead of tending to tourists. It is important to note that any given day, the semi-private concession, which is devoted only to the eco-tourism aspects of the park and is not involved in any activity occurring outdoors, has more employees inside the park than the actual park management, since the number of concession employees at the park ranges from 10 to 15 for weekdays and weekends, respectively.

The ability of a government agency to compile the expenditures made by all of the 53 PAs in any given year provides a basis for accountability in expenditures, but also reflects a heavy centralization in spending by the agency. Employees at LNNP have expressed their dissatisfaction with the difficulties of getting the funds to carry out minimum expenditures like changing light bulbs or fixing the motorcycles that the rangers use for transportation (Jairo

Villanueva, pers. comm.). These difficulties reflect the inefficiencies that result from having long bureaucratic chains designed to create accountability in spending.

Wildfires, which start off as pastoralist fires within or around the park, have become a constant threat to the ecological integrity of the park, and fire scouting has become a daily activity for park rangers. These fires are a common practice in the *paramo* where locals use it to boost the productivity of the grass and graze more livestock. This is because many locals and absentee ranchers view the park as a commons and ignore the legal protection of the park, choosing to graze their cattle within the borders of the park. In a survey with park rangers, fire was identified as the main threat to LNNP (Wyngaarden and Fandino-Lozano, 2002).

In July 2006, a series of wildfires swept through the park, burning close to 2,500 ha of *paramo*. It is very likely that these fires began as small pastoralist fires but got out of control. The event was heavily covered in the regional media and a program for the recovery of the area affected by the fire was proposed by the Ministry of the Environment. Park managers now emphasize fire prevention as one of the most important management goals.

The future promises a four-fold increase in funding to the entire system of 53 parks in Columbia with the majority to combat illegal production activities. While this effort may reduce the chance of future wildfires, information is needed on how Columbians value their parks and park restoration. This is because national sources of funding are scarce and parks in particular need ways to justify the continued expenditures, including any increases that might improve the ecological services they provide.

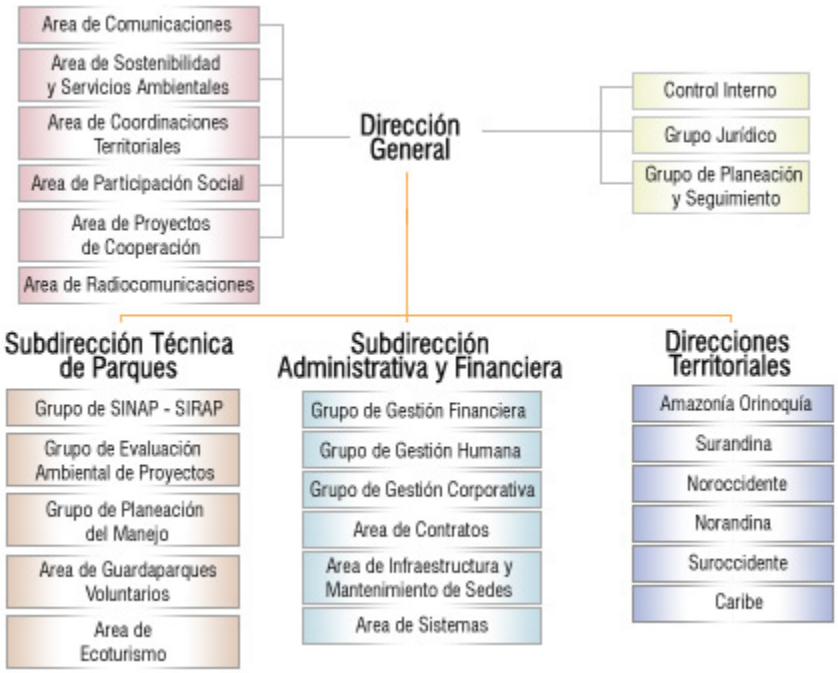

Figure 2-1. Organizational chart of the UAESPNN

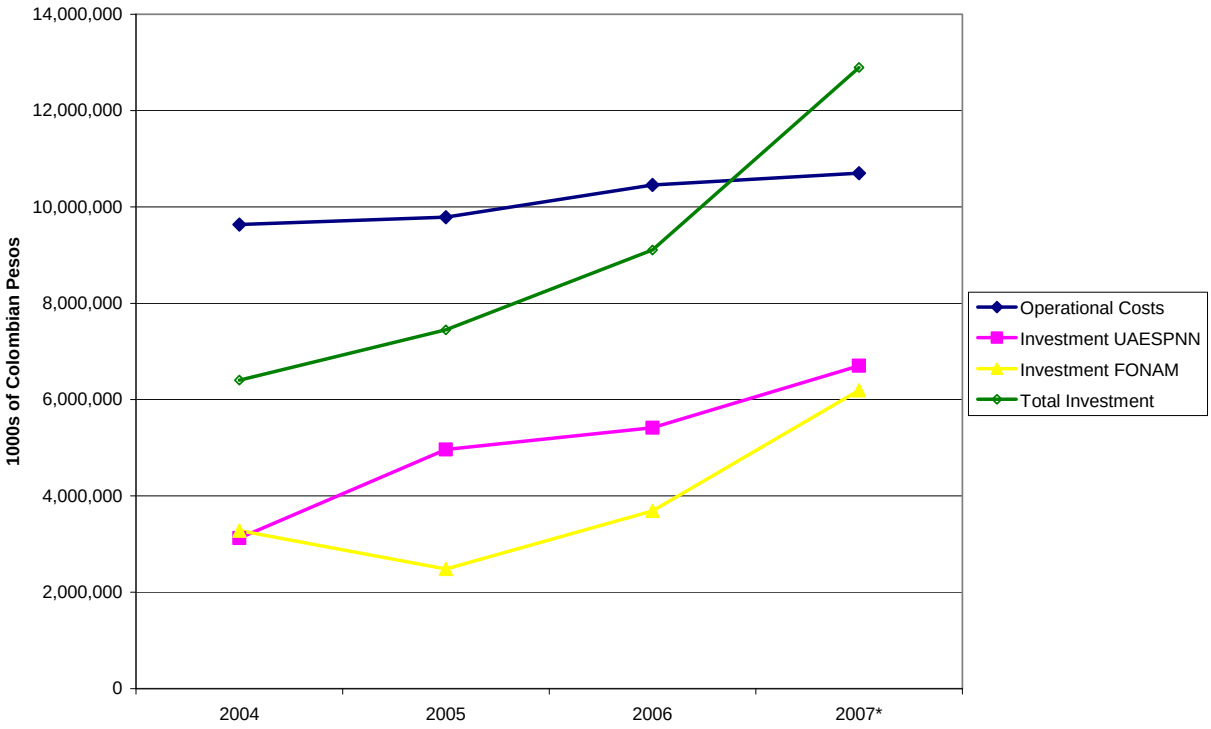

Figure 2-2. Budget of the UAESPNN in nominal COP, 2004-2007

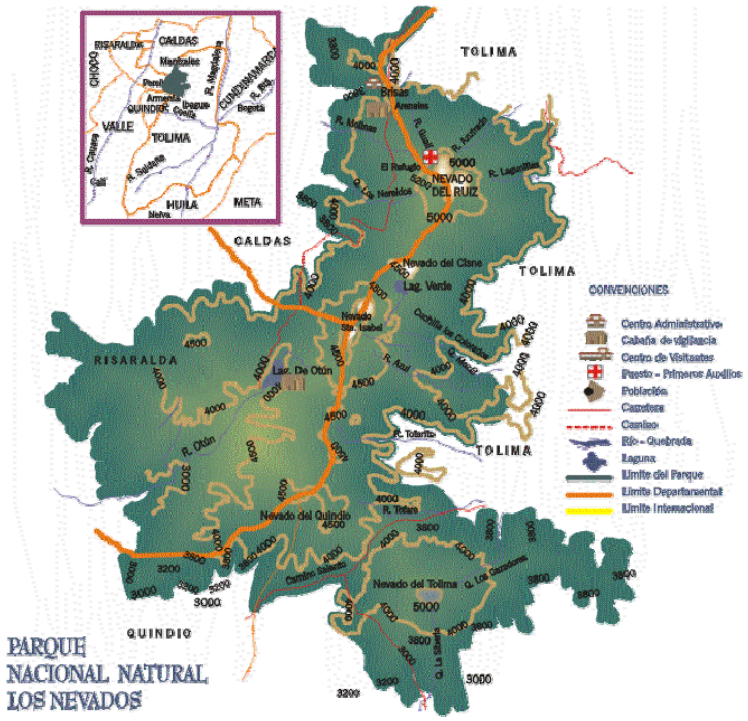

Figure 2-3. Map of Los Nevados National Park (LNNP)

Source: UAESPNN, undated. Available online at http://www.parquesnacionales.gov.co/

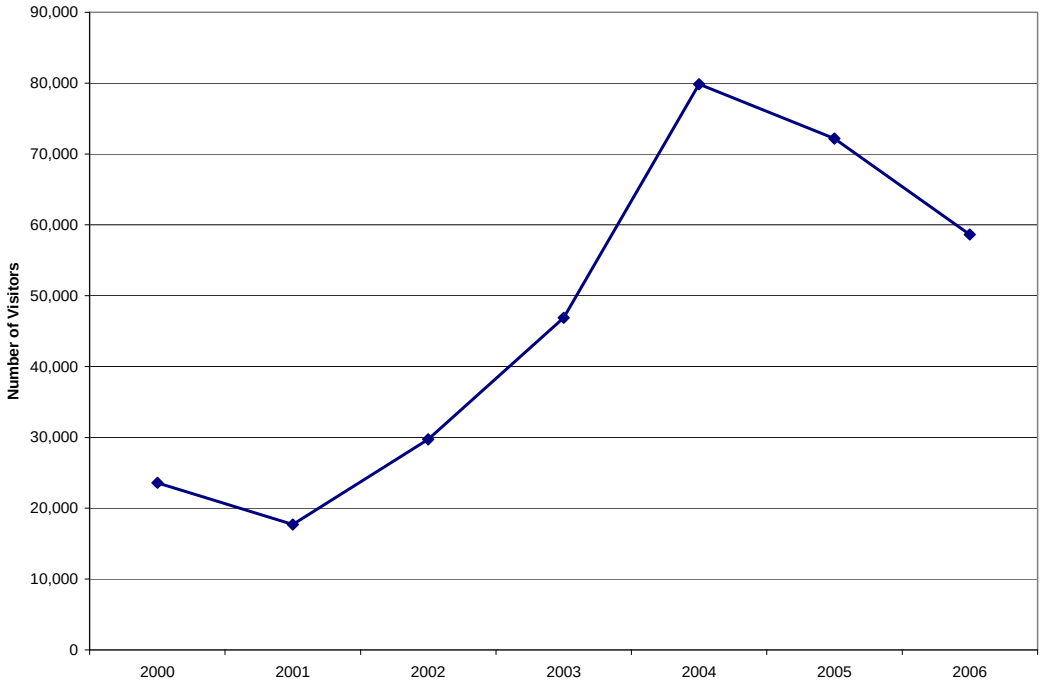

Figure 2-4. Annual visitation to LNNP (2000-2006)

CHAPTER 3
NON-MARKET VALUATION: THEORY AND TECHNIQUES

Utility and Choice: The Basis of Economic Value

Central to economic theory is the notion that people's choices are made in a way that maximizes their happiness and well-being, or utility, as Bentham and Mill would refer to it (Farber, 2002). Carl Menger, founder of the Austrian School of Economics, first proposed that the intensity of desire—or utility—for one additional unit of a good declines with consumption or use of successive units (Farber, 2002). This diminishing marginal utility can be illustrated with a hypothetical situation in which a person is consuming chocolate-coated strawberries. The first strawberry brings a large amount of satisfaction—or utility. The second strawberry still brings more satisfaction, but not as much as the first (Figure 3-1). By the time the person has eaten the seventh strawberry the point of satiation has almost being reached, and eating an eight strawberry brings hardly any extra satisfaction at all.

More recently, economists have come to recognize that people receive utility from consumption due to the characteristics of goods, rather than by the goods themselves. Multi-attribute utility theory holds that total utility is a function of the characteristics of goods and services (Farber, 2002); hence the utility (U) received by the consumption of chocolate coated strawberries is a function of the freshness of the strawberries, S, the quality of the chocolate, Q, and the temperature of the chocolate, T, such that:

$$U = f(S, Q, T) \quad . \tag{3-1}$$

In order to maximize utility, individuals must allocate their use or consumption among several goods in such a way as to equate their marginal utility for consumption or use of each good (Farber, 2002). If individuals are interacting in a well-functioning market and are facing an income constraint (I), they will allocate their expenditures among different goods such that:

$$\text{Max } U = f(X_1, X_2, \ldots X_n) \text{ subject to } \sum P_i X_i \leq I \tag{3-2}$$

where X_i is a good that can be bought for price P_i. When consumers interact in a market they choose to spend some of their income in the purchase of a good or service and so they are expressing a positive preference for it. This allocation of income towards the purchase of goods which bring consumers utility forms the basis of the economic value of these market goods. The solution to the problem expressed in equation 3-2 is characterized by a situation in which the last unit of each and every good purchased brings them the same utility. In other words, the marginal utility of X_i just equals the marginal utility provided by X_j (where $i \neq j$). Mathematically, this is expressed as:

$$\frac{\partial U(X)}{\partial X_i} = \frac{\partial U(X)}{\partial X_j} \tag{3-3}$$

The marginal utilities are just the change in utility, which is measured as the slope of the utility function.

Non-Market Goods and Services

Most, if not all of the markets in existence today, are trading mechanisms for private goods and services. However, not all the goods and services consumed by individuals are private in nature. Public goods and services, such as environmental service flows, are enjoyed by all individuals, yet there is no effective mechanism for allocating them. In this case, people may value a clean environment such as clean air or, more specifically, air with lower levels of different types of harmful particulates. Some public goods and services, such as national defense, which are produced by human enterprises, have costs that are readily available.

In the case of private goods there is an economic value over and above the price paid to acquire the good, which is known as consumer surplus. In this manner, the total utilitarian value of a good is the sum of its price—or paid benefits—and its consumer surplus—or unpaid

benefits. For example, if 100 units of strawberries were sold for $10 each, total revenue is $10 times 100or the area of the darkest box in Figure 3-2. When all individuals are represented, these areas under the demand—or willingness to pay (WTP)—curve are readily identified. In other words, the total WTP is the sum of the total revenue from all sales and the associated consumer surplus from these individuals whose willingness to pay exceeded the amount that was actually paid (Pearce and Turner, 1990). In Figure 3-2, this is the shaded area under the demand curve up to 100 units. The same is true for environmental goods and services, whose demand is not expressed in markets, but through the political process. The extent to which such demand gets represented, however, is a function of the regulatory and democratic processes that facilitate their expression (Kiker and Lynne, 1997).

Even though consumer surplus gives us an easily understandable measure of welfare or well-being, when it comes to measuring it in a non-market scenario—as in the provision of public goods like environmental service flows and amenities—it is no more than an ambiguous measure (Van Kooten and Bulte, 2000). However, two similar concepts, compensating surplus and equivalent surplus, are valid when it comes to measuring the value to consumers of certain goods and services not traded in markets. The difference between these two measurements is that one measures losses in value due to decreased levels of the public good while the other measures gains in value due to increased levels of the same good. Compensating surplus is measured by finding the amount that individuals would be willing to pay to increase the level or quantity of the public good in question. Conversely, equivalent surplus is measured by finding the amount that individuals would be willing to accept as compensation to forgo the higher level of the public good or to accept the reduction in level or quantity of the good (Van Kooten and Bulte, 2000). These two measures allow for the tracing of a demand or willingness to pay curve.

What is sought in benefit measurement is then a measure of the areas under the demand curves (Pearce and Turner, 1990).

Total Economic Value

The willingness to pay or demand curve arises due to the existence of economic values held by the individuals who interact in the market. More explicitly, consumers demand a certain good or service because of the economic values they place on the given good or service. In the case of environmental goods and services, there are two categories of economic values: use values and passive-use values, which are sometimes referred to as 'intrinsic' or non-use values. Use values derive from actual use of the environment and can take the form of consumptive or direct use values (e.g., farming, fishing, hunting), non-consumptive or indirect use values (e.g., wildlife viewing, ecosystem services), or option values. Option values are complex in that they represent a preference toward preservation for a non-specific use (consumptive or non-consumptive) sometime in the future (Pearce and Turner, 1990).

Passive-use values are more problematic in that they do not involve direct use or benefit by the individual, yet the individual exhibits a positive WTP towards the good or service in question. There are two main categories of passive-use values: bequest values and existence values (Sharp and Kerr, 2005). Bequest values relate to the idea of leaving a supply of natural environments to one's heirs or to future generations in general, hence people's willingness to contribute towards land trusts that will protect land from development indefinitely, even if they do not plan to see or use the land in any way. Existence values relate to knowing that the resource simply exists and will continue to exist, hence people's willingness to contribute to the protection of blue whales, even though they will probably never see one.

In thinking about protected areas as economic entities, it is helpful to define them as a conglomerate of various resources and ecological processes that provide a variety of goods and

services, rather than as one individual public good. An individual receives different kinds of benefits from these different resources and processes and values them accordingly. However, the individual only values those benefits of which he is aware of. Therefore, the individual will value those goods and services that are used directly in a more coherent manner than those which are used indirectly or not used at all. This can be described as a problem of 'tangibility' of benefits. Direct-use of a resource—fishing for instance—is easily perceived by the individual who is fishing, and so the value for this direct-use is very tangible. Less direct benefits of protected areas that accrue to individuals at a global scale—such as carbon sequestration—are more difficult to perceive by the individual, hence the valuation process occurs in a less coherent manner. Values for indirect-use or passive-use of resources are therefore less tangible.

Most direct-use values are accrued by individuals at the local level and are expressed in markets for commodities like timber, food, and recreation. The existence of markets for these goods and services imply that they are mostly private goods. In the case of LNNP, park visitors accrue most of the direct-use values in the form of recreation, but the park management only captures a portion of that value via entrance fees. Capturing refers to receiving a monetary compensation for the supply of a good or service; hence those who sell private goods are able to capture some of the value of that good. When the good is based on a natural resource, the value above the cost, where value is represented by the demand (willingness to pay) and the costs are measured as opportunity costs, is referred to as the "resource rent." The para-statal concession that has recently acquired the tourism-development rights of LNNP also captures a portion of the recreational value of the park by offering tour packages to the park and by running small shops within the park. Some locals also capture a portion of that value (i.e., resource rent) through sales of food and souvenirs along the road that leads to the park entrance. Recreation is very

important for protected areas because it is a non-consumptive service that can be provided to private individuals without diminishing the quality of the park. Other direct-use values that accrue to locals from consumptive activities include grazing, hunting, and fishing within the borders of the park, though both grazing and hunting inside the park are considered illegal.

Indirect-use values transcend the local realm by providing benefits at a regional, national and global scale. Most of the rivers in the coffee region of Colombia originate in LNNP, hence the hydrological services of LNNP offer a stream of benefits at a regional scale. The value of the hydrologic services of the park is widely recognized and is one of the factors that influenced the creation of the park. However, there is no existing mechanism for capturing these benefits. By acting as a carbon sink, LNNP offers benefits at a global scale as well but the park management receives no compensation for the provision of this service. The problem that emerges with goods and services that benefit individuals at scales greater than the local level is that the value derived by these benefits is almost never captured by the park management; this phenomena is referred to as "lost rents" or "rent dissipation" if improper management results in the failure to generate or capture resource rents. Specific use and passive use values that have been identified as being provided by LNNP are summarized in Figure 3-3.

Measuring Non-Market Values

Overview of Non-Market Valuation

Modern societies are forced to make choices regarding the use and protection of the natural environment on a regular basis. The public decision-making process is inherently linked to society's valuation of that environment (Costanza, 1997). Monetary valuation of these ecosystems is, however, rarely made explicit as most of the goods and services provided by them are public or common in nature and not traded in markets. This problem often leads to under-valued natural systems (i.e., a "market failure" to economists) whose protection is often seen as a

decrease in national economic growth, and loss of these ecosystems through inefficient public decision-making is a common outcome. This is especially true in developing countries, where environmental protection is at the bottom of a list of government priorities that includes such necessities as public housing, health, food security and education.

Economic theory conceptually provides several methods to quantify the value that individuals place on these natural systems in monetary terms. In the case of protected areas, which are often used as outdoor recreation sites, the idea of measuring the economic value of recreational use through the expenditures in complementary market goods, such as transportation to the site, was first proposed by Harold Hotelling in a letter to the director of the U.S. National Parks Service in 1947. This use of observable choices to estimate a monetary measure of changes in individuals' utility that would come with a change in a non-market amenity is now known as the Travel Cost Method (Smith, 1996).

There is an alternative approach, the Contingent Valuation Method (CVM), that can also be used to elicit values for non-market goods. The CVM is the only approach that can be used to capture non-use values. The CVM elicits individual behavior by developing a hypothetical market (such that all observed behavior is 'contingent' on the fictional market) and having individuals participate in that market. This approach can capture the WTP for a whole suite of non-market values. If applied with a TCM framework, this approach would entail use of individual information on travel costs and hypothetical choices. Each modeling approach will be discussed in turn.

The Travel Cost Method (TCM)

As was noted above, the TCM consists of using individual's observable choices in the form of their actual payment of some of their income for environmentally-based recreation as a basis for estimating the value of a non-market good if it had been available in a well-functioning

market (Clawson and Knetsch, 1966). In the case of recreation in public areas such as National Parks, users usually pay a minimal fee or no fee at all; hence park revenue is a poor indicator of recreationists' WTP. This is because outdoor recreationists usually incur costs in travel and time that could have been used for other purposes (Clawson and Knetsch, 1966).

A recreation demand curve can conceptually be developed using observations on visitation and expenses incurred during these visits, that is, by determining how visitation rates vary with total travel expenses. Conceptually, visitation is then a function of travel costs, such that:

$$V_j = f\,(TC_j) \tag{3-4}$$

where V_j is the visitation rate of zone j and TC_j is the average travel cost from zone j to the recreational site. Given that entrance fees to these parks are minimal or non-existent, most of the variation in travel expenditures will be due to the distance travelled, as individuals travelling from farther away can be expected to spend more on their travel than individuals travelling from areas closer to the park in question. The opportunity cost of people's time must also be factored into the travel cost calculations as time spent in recreational activities implies an income tradeoff, since the individual has chosen recreation instead of work. Theoretically, as distances and incomes (i.e., travel costs) increase, less people will travel to the site or they will do so less often. Differences in people's incomes are also an important source of variation since people with higher incomes are expected to spend more on recreational activities. Hence, it is assumed that recreation is a normal good. This variation in travel cost and visitation rates forms the basis of the downward sloping outdoor recreation demand curve (Clawson and Knetsch, 1966). Assuming a linear functional form, equation 3-4 could be estimated as:

$$V_j = \beta 0 - \beta 1\ TC_j + \varepsilon_j\ , \tag{3-5}$$

which shows that at zero travel costs, visitation would equal β0 and for each increase in one dollar of travel costs, visitation will fall by β1. If the error term is well-behaved (i.e., no heteroskedasticity due to differences between zones), then equation 3-5 can be estimated with an ordinary least squares procedure that minimizes the sum of the squared variance to find the parameter estimates.

The zonal TCM—also known as the Clawson and Knetsch approach (Bowes and Loomis, 1980)—divides the visitation observations into zones or areas based on their location relative to the site and uses historical records of visits per capita within each zone as the measure of visitation to the site. While the zonal approach has several difficulties, the estimates can be improved by extending the analysis to include more comprehensive factors affecting values, such as population characteristics. The opportunity cost of time can be included in the calculations by either collecting a large sample of surveys that include detailed information regarding people's income or by including the socio-economic census data from each zone as a proxy for a sample of detailed individual information.

Given that many outdoor recreation areas keep track of the number of visitors they receive and their places of origin, the zonal TCM can be used to easily quantify the economic benefits of these areas (Clawson and Knetsch, 1966). Thus, its use is wider in scope than more complex and costly (albeit more precise) valuation techniques (Bowes and Loomis, 1980). This is especially true in developing country contexts, where the necessity of conducting non-market valuation studies is ignored due to the prohibitive costs of more comprehensive studies. National Parks in particular are known for their visitor record keeping such that the use of this relatively simple technique in these PAs can be a fruitful area of research and an important source of information for public policy makers. The TCM is particularly well-suited to valuing

recreational areas that draw international visitors and those that visit multiple times each year. This is because in order to construct a demand curve the data needs to include a wide variation in the travel cost and visitation numbers.

Some problems with the zonal TCM approach have been discussed in the literature. Bowes and Loomis (1980) point out that the differences in population size across the different zonal definitions naturally results in heteroscedasticity due to the grouping of observations. When the recreational demand curve is estimated using Ordinary Least Squares (OLS) regression, the estimated number of visits at a zero entrance fee and the observed number of visits at a zero entrance fee are different. To solve this problem they propose an estimation of recreational demand using the Generalized Least Squares (GLS) regression instead such that the GLS estimators will have the same variance and possibly improve the statistical properties of the estimates.

Moeltner (2003) also points out that aggregation of the zonal observations will ignore the natural heterogeneity present within the populations, as it is assumed that income within each zone is constant. This problem makes zonal TCM models susceptible to aggregation bias and makes their results questionable. Some of the heterogeneity of individual visitors can be captured by incorporating distributional information on per capita income within the zones, usually available from census sources. The incorporation of income distribution within zones — in addition to using GLS—thus reduces the likelihood of aggregation bias and increases the reliability of the model and resulting predictions.

One of the notable limitations of the TCM approach in measuring the non-market benefits of environmental amenities is its limited scope. Since it relies on observations of choices incurred through the use of a recreational area, it is limited to measuring only direct use

values and ignores the rest of the area's economic values, which could include passive use, option, bequest, and or existence values. While some of these benefits will accrue to park visitors and they are likely to have a positive WTP to maintain or improve these benefits, their travel expenditures will not provide a measure of that positive WTP. Thus, the TCM will produce conservative estimates of park benefits if non-use values by visitors and non-visitors are positive.

This shortcoming can, however, be addressed in part through structured conversations in which hypothetical markets and situations are created and visitors (and potentially non-visitors) are asked to evaluate them. This practice, known as the Contingent Valuation Method (CVM) is the subject of the following section.

The Contingent Valuation Method (CVM)

As mentioned earlier in this chapter, individuals accrue utility by the consumption or use of goods and services (via their characteristics) and they are expected to allocate their limited income among different goods in such a way as to maximize total utility. The use or enjoyment of some goods and services does not require income expenditures by individuals, yet these individuals do receive utility through the enjoyment or use of these public or common goods. Since the use of such non-market goods and services does not require income expenditures, there is no discernible behavioral trail left by their consumption or use (Smith, 1996). This does not mean that individuals would not be willing to spend some of their income or make some tradeoffs towards the eventual purchase of these goods or services. Under this premise, economists have devised structured conversations or surveys in which a hypothetical scenario is set in such a way as to present the respondent with the choice of paying for the maintenance or improvement of a good or service that is currently 'free'—that is, a non-market good or service. Conversely, respondents could be asked for their willingness to accept compensation to forgo a

benefit for which they currently have a right. Conceptually, an individual's WTP for an environmental good or service is a function of the price of the good or service (P), the individual's income (I), and other characteristics (O) such that:

$$WTP = f(P, I, O) \tag{3-6}$$

Assuming a linear functional form, an estimable equation would be as:

$$WTP_i = \alpha + \beta P_i + \gamma I_i + \sum_{j=1}^{J} \omega_j O_{ij} + \varepsilon_i \tag{3-7}$$

where i identifies each individual; α, β, γ, and the j ω's (associated with different characteristics of the individual) are parameters to be estimated; and ε_i is the error term.

This method, known as the Contingent Valuation Method (CVM) is perhaps the most widely used of all the non-market valuation mechanisms, and its application in the literature ranges from public projects in urban areas to the protection of vast and isolated areas of tropical forest (e.g., Whittington, 1998; Horton et al., 2003). When it comes to the question of restoration of ecological goods or services, the majority involve valuing the restoration of river flows and riparian ecosystems (e.g., Loomis et al., 2000; Ojeda et al., 2008). The restoration of native land ecosystems has also been investigated in the United Kingdom (MacMillan and Duff, 1998). However, only one of the restoration studies (Ojeda et al., 2008) was conducted in a developing country. Similar studies have, however, estimated values for improving the conditions of a park or the protection of a species in a developing country using the CVM approach (e.g. Navrud and Mungatana, 1994; Mathieu et al., 2003; Jabarin and Damhoureyeh, 2006).

Several problems with the CVM have been identified throughout the literature and most of them result from the hypothetical nature of the approach. The idea of placing a monetary

value on environmental goods or services is unfamiliar to respondents as they seldom think of these goods or services in monetary terms. Respondents may also perceive the same good or service very differently, and their conceptualization of the good or service in question may be divergent from that of the researcher. When these differences in conceptualization exist, the information given by the researchers via the questionnaire may affect respondents' answers, resulting in information bias. Furthermore, respondents have difficulty in valuing parts of an ecosystem separately from the entire ecosystem, thus creating an embedding effect. If respondents are asked to value items from a list, the order in which the items are listed can also affect the responses. The choice of payment vehicle may result in protest responses as individuals may be unwilling to pay not because they do not value the good or service but because they dislike the payment vehicle chosen (e.g., taxes). Some respondents may also feel good when answering positively to contingent valuation questions, which results in their WTP being overstated, a phenomenon known as the "warm glow" effect. Respondents may also answer positively to questions, thinking that positive answers are what the interviewer expects. If respondents are prompted for their WTP through a bidding game, the initial bid will also affect their final response (King and Mazzota, 2000).

Another difficulty with the CVM is the difference between the WTP and WTA values for the same goods and the same individuals. This phenomenon, known as 'cognitive dissonance,' has been exposed empirically by psychologists who have concluded that individuals get attached to the positions that they hold at the beginning of the experiments, as if that position belonged to them by right. Consequently, their willingness to pay to secure a benefit is usually not as high as the willingness to accept to forego the same benefit, and the willingness to pay to prevent a loss is usually not as high as the willingness to accept to tolerate that same loss (Pearce and Turner,

1990). While all these problems are still sources of concern for researchers, improvements in questionnaire design have partially or completely addressed most of these problems.

In the more recent CVM studies, for example, a single bound dichotomous choice format has been used to address some of these concerns. With this approach respondents go through a dichotomous choice experiment in which they are asked whether or not they would be willing to pay a given amount for the good or service in question, followed by a single bound experiment in which they are asked to elicit their maximum willingness to pay (Ojeda et al., 2008). This format allows researchers to first confront the survey respondents with a situation similar to the one they usually encounter when purchasing market goods in which a price is given by the supplier and the respondent has the choice to either make the purchase or not. The process also elicits the respondent's maximum WTP, which would be a more precise estimate of each individual's true WTP, or the point on the demand curve for the non-market good in question. In the closed-ended dichotomous choice portion, different respondents are confronted with different prices, which allows for variation in the price levels. Conceptually, this process should result in a downward sloping demand curve as more respondents are expected to respond positively to low prices and vice versa for the normal non-market good in question.

The common practice to analyze the data from these CVM studies is to use a maximum likelihood estimation method for the probability that a respondent answers the dichotomous choice portion in a positive manner (Jabarin and Damhoureyeh, 2006; Ojeda et al., 2008). This is usually accomplished using a logit or probit model. For example, a probit model is defined as:

$$\Pr(Y = 1 \mid X) = \Phi(X\beta) \tag{3-8}$$

which specifies that the probability that Y = 1 (in this case that an individual said "yes" to being willing to pay the proposed fee increase) is contingent upon the vector of explanatory variables,

which is here generically represented by X. Furthermore, equation 3-7 also states that this probability equals the standard cumulative normal probability distribution, Φ, and $X\beta$ is the probit score. The resulting general log-likelihood function for a probit is

$$\ln L = \ln\Phi(X\beta) + \ln(1-\Phi(X\beta)) \quad . \tag{3-9}$$

The result is an S-shaped curve that runs from zero to one, which is usually very similar to that produced by the logit procedure. The probit procedure is preferred usually because it can be used to more easily extract the affect of each variable on the probability.

The follow-up maximum WTP question is analyzed using a least squares regression model since the dependent variable is quantitative and continuous in nature (Ojeda et al., 2008). This was shown in equation 3-7. The choice of estimation technique will depend on the assumptions made about, or results of tests on, the properties of the error term.

Using TCM and CVM for LNNP

The human experience is one filled with decision-making moments in which individuals make choices that imply tradeoffs. The free market has become an efficient and widely used forum for the expression of human wants and needs and the interaction between the wants and needs of many individuals. These choices are motivated by individuals' preferences, which are in turn molded by their values and value systems (Farber, 2002).

While non-market valuation is not a panacea for all the problems and threats faced by protected areas, the relation between many of these problems to the chronic underfunding that plagues them hints at the possibility that researching their economic values will provide an important piece of information. In the specific case of LNNP, the people-park conflict also indicates that the park is not only underfunded, but that its conservation value is perceived by some local peasants as inferior to its value as grazing grounds for cattle. Furthermore, some of

the objectives delineated by the Colombian government for LNNP and the other PAs of the nation (Chapter 2) may be fulfilled in part by a non-market valuation study of LNNP.

Traditionally, the CVM and TCM models have been viewed primarily as substitute valuation techniques. In more recent times, however, the CVM and TCM have been successfully combined to estimate welfare measures for ecosystem valuation. This has produced a more comprehensive picture of preferences than what would be available from using either method separately (Kling, 1997). This is the approach that is used in this paper.

The zonal TCM in particular fits the context of LNNP, as park users only visit once a year on average. The existence of secondary data on visitation also provides an excellent source of information for a zonal TCM analysis. Unwillingness on the part of Colombians and foreigners visiting Colombia to share information regarding their income also make an individual TCM analysis very difficult to complete. While the zonal TCM approach may have some problems, the specific context of LNNP makes it not only feasible but also appropriate.

The wildfires that took place in 2006 provide an excellent opportunity to value visitors' WTP for ecological restoration through the use of a CVM framework. The possibility of having a self-funding mechanism in which funds are transferred from visitors into an ecological restoration program provides an explicit and believable scenario in which park visitors can be asked to elicit their WTP for restoration.

Use of the TCM and CVM in LNNP is therefore relevant and feasible. The following hypotheses are then set forth as the base of the non-market valuation study in LNNP using the CVM and TCM:

- LNNP has significant recreational value.
- Visitors to the park will exhibit a positive WTP for restoration of the damaged areas.

- Visitors with knowledge of the environmental and hydrological services produced by the park will exhibit a higher WTP for restoration.

- Demographic and socioeconomic characteristics of the visitors are largely responsible for the differences in their WTP for restoration.

- Respondents who express pro-environmental preferences (donations and membership to environmental organizations, visits to other environmental amenities, etc.) will have a higher WTP for restoration.

These hypotheses will be tested using the empirical results of the TCM and CVM analysis, which is conducted in the following chapter.

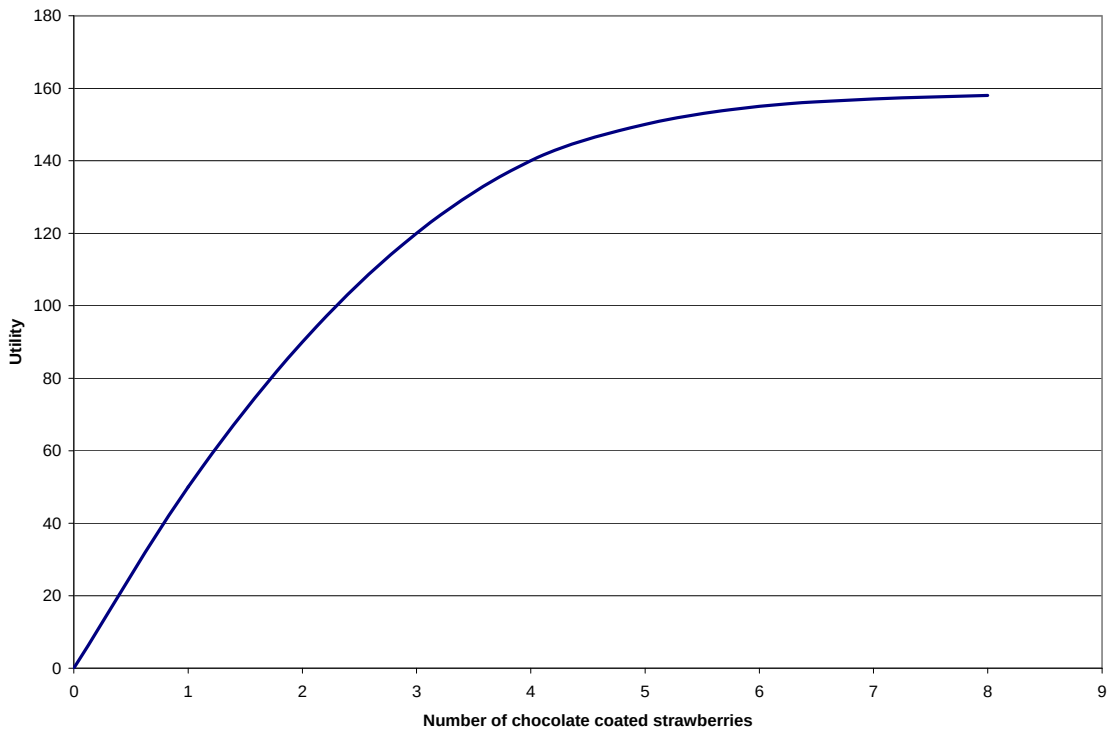

Figure 3-1. Example of utility function that shows diminishing marginal utility

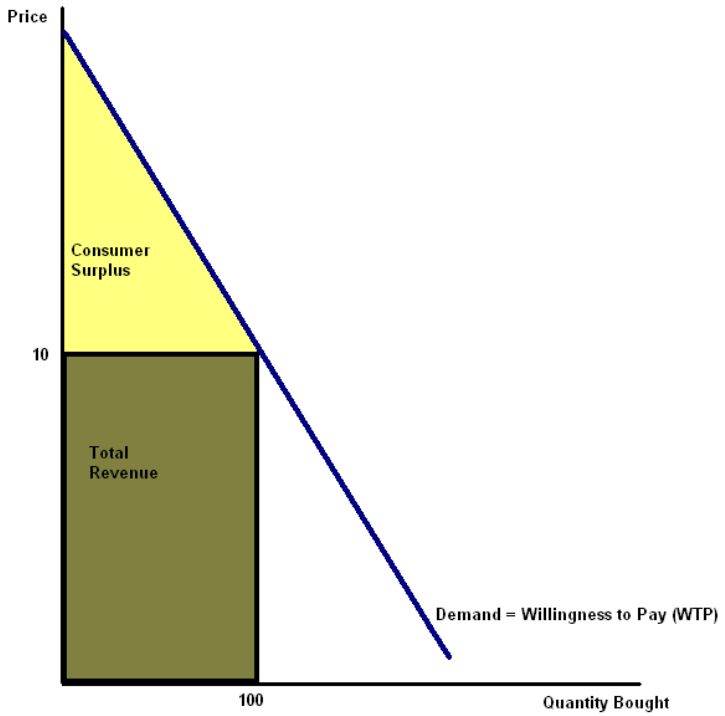

Figure 3-2. Total value of 100 units

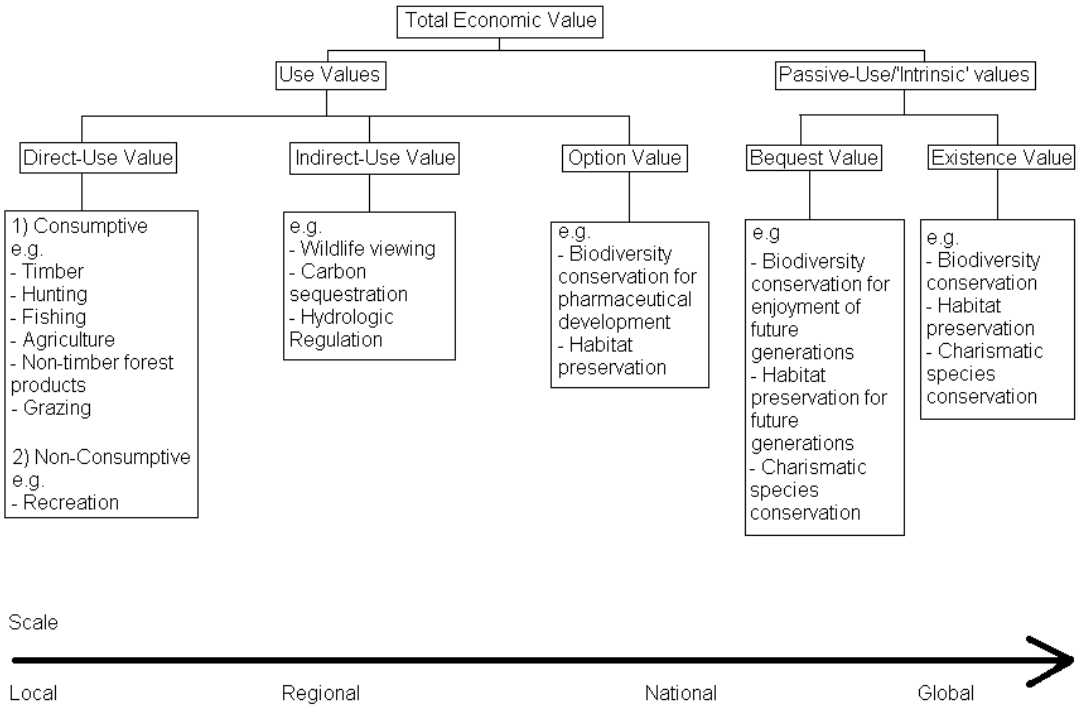

Figure 3-3. Components of total economic value of Los Nevados National Park

CHAPTER 4
EMPIRICAL APPLICATION

Survey Design and Methods

Data Collection

Both primary and secondary data were used in this study to value the recreational benefits of LNNP and visitors' demand for restoration following wildfires that took place in 2006. The primary data was obtained from 66 interviews with park visitors during three weeks in July and August 2007. The interviews were completed at the park's main entrance and all interviews were conducted by the author. All visitors to LNNP are required to attend a mandatory session in which park rangers explain the possible health hazards of high altitudes and low temperatures. Visitors then purchase their ticket to enter the park. The visitors were approached while they were waiting for the beginning of the information session and were asked to participate in a joint study between the University of Florida and the Colombian Parks service. All of those approached either accepted the invitation to participate or asked another member of their group to participate. However, from a total of 69 attempted interviews, only 66 were completed as three respondents were foreign visitors that were reluctant to disclose information concerning their income or their travel costs. Of the remaining respondents, only two were international visitors. Given the extremely small number of interviews completed with foreign visitors, they were also excluded from the analysis leaving 64 completed surveys all of which were Colombian visitors.

The travel cost section of the interview asked respondents to list their expenses for transportation, lodging, equipment rental, and guidance, and respondents were given the option to answer either as an individual or as a group. Group responses were later divided by group size to determine travel costs per person. The contingent valuation section of the interview began by

asking respondents how familiar, if at all, they were with the wildfires that occurred during 2006. Then, they were informed about the magnitude of the wildfires (i.e., number of acres burned) and were confronted by a scenario in which the park authorities are considering an increase in the park admission fee to cover the expenses of restoration of the areas affected by the wildfire. A card with the proposed fee increase (one of four values) was then shown to the respondent, followed by the question:

> Please consider how much you spend on recreation each year and for this trip. Would you have been willing to pay this extra amount per person during this visit?

The four fee increase levels were 25%, 50%, 75%, and 100% increases of the existing entrance fee of 8,000 Colombian Pesos (COP, which equals approximately $4USD). Regardless of their response, respondents were then asked to identify their maximum willingness to pay an increased fee as an open-ended question.

The questionnaire also included a section that asked respondents about their knowledge of the ecological services provided by the park. This portion of the questionnaire was administered before the CV exercise in half of the interviews and after the CV exercise in the other half. Respondents were also asked about their knowledge or awareness of ecological services provided by the park, regular visits to natural areas or other national parks, membership or donations to environmental organizations, and general concern for the condition of the environment in Colombia. The rest of the questionnaire consisted of questions regarding past visits to the park, the current visit to the park, and other demographic information.

Demographics

Of the 64 interviews completed with Colombian nationals, 40 (62.5%) were completed with men and 24 (37.5%) were completed with women. While this gender distribution is not reflective of the overall population of either Colombians or visitors to LNNP as the proportion of

males is too high, it is the result of heads of household (which are predominantly male) being the ones responding to the interview. Similar male-bias has been encountered in other non-market valuation surveys conducted in Latin America (e.g., Shrestha et al., 2002).

Since Colombia is the site of a decades-long military and civil conflict in which kidnappings and extortion are commonplace, some reluctance on the part of Colombian nationals in disclosing their incomes or expenditures was expected. To avoid the possible reluctance to answer the most important portions of the questionnaire, the Colombian government's socio-economic stratification system was used as a proxy for income. Under this system, residential properties are grouped into different strata for taxing purposes, with stratum one representing the lowest tax rates (poorest neighborhoods) and stratum six representing the highest tax rates (wealthiest neighborhoods). Respondents were, therefore, asked in which stratum their home was located instead of directly asking them for their annual income. Even though socio-economic strata may not be as accurate in reflecting income differentials as full disclosures of annual income, and the calculations of the opportunity costs of respondents' time cannot be calculated on an individual basis, using the stratification system was considered the most reliable way of asking about income—a critical piece of information when estimating non-market values—in a country like Colombia.

While respondents indicated origins from all income strata, the highest frequency of response was associated with stratum 3, which can be considered lower-middle class. It was surprising to observe the same number of visitors from the wealthiest portion of the population as from the second poorest portion of the population, and that there was some visitation by the poorest segment of the population (Figure 4-1). This finding is in contrast to previous studies that have concluded outdoor recreation in developing countries is a luxury enjoyed only by the

wealthiest portions of the population and by international tourists (e.g., Shrestha et al., 2002; Navrud and Mungatana, 1994).

All of the survey respondents had completed the equivalent of a high school degree, and a large number had completed college (46.9%) or graduate school (18.7%) (Figure 4-2). This is a bit surprising given that the income distribution discussed earlier shows that visitors are spread throughout the socio-economic landscape; thus, income strata for tax purposes and education are not directly correlated among the sample respondents in this study. However, the high educational attainment of park visitors may reflect the high literacy rates of the Colombian population in general.

The majority of survey respondents were either single (45%) or married (45%). The remaining respondents (10%) were divorced, widowed, or in a free union (i.e., a Colombian legal term for non-marriage civil unions). The age distribution of the adult respondents (i.e., at least 18 years of age) shows that a large percentage of the visitors were relatively young; 62.5% were less than 40 years of age and 60 years was the maximum age among the respondents (Figure 4-3). While it is possible that outdoor recreation in Colombia is enjoyed by most by younger people, LNNP is not a good example of the average Colombian National Park since there is a health hazard posed by the potential for hypoxia in high altitudes that can prevent young children and older people or people with cardiovascular ailments from visiting.

Awareness and Preferences for Environmental Amenities and Services

To better understand visitors' preferences toward PAs in general and LNNP in particular, respondents were asked a series of questions about their visitation to other natural areas and their concern for their environment. Respondents were also asked how much they knew about the wildfires that had taken place the previous year, as well as about their knowledge of the environmental and ecological services provided by the park in particular.

Overall, respondents were not too familiar with the 2006 wildfires. Although many respondents seemed to recall hearing about the park in the news, most 76.5% did not know that a massive wildfire had occurred. Only 23.0% knew that a fire had taken place in the previous year. This was somewhat surprising, as the events were covered in the regional and national media. Only 6.3% of the respondents were familiar enough to be able to describe the fire in physical dimensions.

Most respondents were knowledgeable of the ecological services provided by the park. While most of the publicity concerning the park emphasizes its role as a source of many rivers and one of the main hydrologic regulators in the country, there was a higher awareness for the biodiversity conservation role of the park; 76.5% were aware of biodiversity conservation and 70.3% were aware of hydrologic regulation (Figure 4-4). Carbon sequestration awareness was the lowest among the three services that respondents were asked about (68.7%), perhaps because most people associate large trees such as those in the Amazon with carbon sequestration rather than the small shrubs and grasses that are present in LNNP's dominant *paramo*.

A large portion of respondents stated a relatively high level of concern about environmental issues in Colombia. More than two-thirds of survey respondents (71.9%) have a concern of 8 or higher in a 0 to 10 scale where 0 represents no concern and 10 represents very concerned (Figure 4-5). While there were several lower responses, it is important to note that there was only one response below a 5 or medium level of concern, indicating that an overwhelming majority of visitors to LNNP are at least mildly concerned with the environment. It is likely that the "warm glow" phenomenon explains this result.

Despite their reported concern for environmental issues, most survey respondents are not members or have not donated money to environmental organizations (85.9%). Thus, this

variable might be a better reflection of environmental concern than asking respondents about their environmental concern directly. That said, paying memberships might not be a good indication either since although there are several international environmental NGOs active in Colombia, very few of them target Colombian citizens for membership or donations. Alternatively, a majority of respondents visit national parks or other natural areas with some regularity (59.3%), perhaps indicating that frequency of visitation to natural areas—and payment of a nominal entry fee—could be a better indicator of preferences for environmentally based non-market goods.

Park Visitation

To better understand the patterns of visitation to LNNP, respondents were asked a series of questions about this visit and other visits to the park they had made in the past. Seventy three percent of respondents had never visited the park in the past and only 12% of respondents had visited the park in the previous year. The average number of annual visits to LNNP is 1.05, indicating that this is a site that is normally visited only once a year.

The current visit to LNNP was the primary purpose of their trip for a majority of respondents (81.0%). A large proportion of respondents were visiting the park for only one day (87.5%). This is the common form of visitation to the park, given the lack of infrastructure and accommodations and the harsh temperatures and hypoxia. The average length of each visit in our sample is 1.21 days per visit; 3.1% visited for two days and 9.4% visited for three days, the maximum reported.

The number of sampled visitors from each state is shown in Figure 4-6, where LNNP appears in red and only the names of the states with respondents are labeled. Given that the park routinely collects basic data on all visitors, it is possible to compare the origins of visitors from the official visitation data with that from the sample of 64. Secondary data obtained from the

Parks Service and the Concession include detailed information on park visitors for October and November 2006, and January, February, March, April, and May of 2007, totaling 26,246 observations that include cities of origin from visitors in the 13 states modeled in this paper; these observations account for 94.5% of all recorded visits during that period even though the states included account for only 73.6% of the population of Columbia. Thus, the exclusion of the other states will not have a significant effect on the calculated visitation rate. Conversely, the exclusion of 5 of the 12 months is expected to downward bias the visitation rate by at least half given total visitation in recent years.

Figure 4-7 shows a comparison between the zonal visitation reported in the sample and that obtained from the secondary data. The graph shows that the visitor population and the sample population contain the same—relatively large share—of visitors from the same four states. This similarity implies that there is a high correlation between the proportion of visitors from each individual state in both the sample and the visiting population. Given that the secondary data contains additional information on the visitor population, it is possible that additional analysis can be conducted to further assess how representative the sample is of the population.

Travel Cost Responses

Respondents were initially queried about their group size, city of origin, and transportation method used to reach the park. They were then asked about their expenses in the current trip for transportation, lodging, equipment rental, and guidance costs, and all these values were aggregated to yield a total cost. Respondents were allowed to report their expenses either individually or by group according to their own preference. If the respondent had purchased an all-inclusive package, this was noted on the questionnaire, and only the amount paid for the all inclusive package was reported. If the respondent had not purchased an all-inclusive package

and had chosen to report trip expenses as a group, the total cost reported was divided by the number of individuals in the group when the data was coded. If the respondent had chosen to report expenses individually, the total costs were not manipulated. The mean travel costs per person (COP) from each of the 13 states with information obtained from the surveyed visitors are reported in the first column of Table 4-1.

Visitors to LNNP use a variety of transportation methods, including small motorcycles, cars, tourist buses, and chartered buses. This characteristic of travel model creates high variability in travel costs within and among zones as compared to similar analyses (e.g., Navrud and Mungatana, 1994; Mathieu et al., 2003; Fleming and Cook, 2007), as evidenced by the relatively high standard deviations (Table 4-1).

The travel costs used in this study are biased downward since they exclude the opportunity cost of time. Future analysis can choose to augment the reported data with the average daily income associated with each stratum in each state, which would increase the consumer surplus estimates and the estimated value of the LNNP.

Contingent Valuation Responses

Respondents were read a statement that informed them of the fire events and the magnitude of the resulting devastation to ecosystems in the park. The statement also informed them that the park management authorities were considering an increase in the existing entrance fee, and that the extra money would be used to restore the areas affected by the fires. They were then asked to consider their expenditures for this trip and for recreation in general, and were asked whether or not they would be willing to pay the amount shown in a card held by the researcher. The payment cards included fee increases of 25%, 50%, 75%, or 100% over the existing entrance fee of $8,000 COP. Overall, 81% of respondents (81%) indicated they would be willing to pay that additional amount for the restoration of the areas affected by the wildfires.

The responses by the level of fee increase are shown in Figure 4-8. As expected, the percentage of individuals that are willing to pay is reduced as the proposed fee is increased. Across all respondents, the average WTP for restoration was $3,969 COP ($1.98 USD).

Several authors have emphasized the importance of information in the molding of preferences and the resulting WTP in contingent valuation experiments (e.g., Pearce and Turner, 1990; Smith, 1996; MacMillan and Duff, 1998; King and Mazzota, 2000; Loomis et al., 2000). To test whether or not the information given to respondents about the ecological functions of the park influenced their WTP, two sets or versions of the survey were developed. In version 1, the portion of the questionnaire that asks respondents about their awareness of the ecological services provided LNNP was asked *after* the contingent valuation experiment. Conversely, in version 2, the portion of the questionnaire regarding the ecological services provided by the park was asked *before* the contingent valuation experiment. Roughly the same number of version 1 (51.6%) and version 2 (48.4%) surveys were completed.

In the follow-up question, respondents were asked their maximum WTP for restoration as an open-ended question. Of the total respondents, 89% expressed appositive WTP amount that can be used in a regression analysis. This higher share of respondents indicates that some who said no to the amount they were first presented with were willing to pay a lower amount. Conversely, some who said yes, were willing to pay more. Results are summarized in Figure 4-9, which indicates that the WTP values ranged from 0 (those who declined the first price increase and were not willing to pay anything in response to the follow-up, 12.5% of respondents) up to $30,000 COP ($15USD). Across all respondents, the average of the maximum reported WTP amounts was $6,638 COP ($3.32 USD), which represents a 67% increase in the WTP by using the open-ended question format following a closed-ended dichotomous choice format.

TCM Analysis and Results

Recreational Demand

Recall that the individual-based TCM involves data on the number of trips in the previous year and the cost per trip to calculate annual recreational demand. The survey data show a mean number of annual trips per respondent of 1.05, so there would be no tradeoff between trip cost and demand on an annual basis across individuals. Use of the zonal approach to capture visitation was, thus, necessary since this park is typically visited just once per year. With the zonal TCM approach, secondary visitation data (assumed to be a census of visitors with home location identified) is first used with population data to estimate visitation rates by zone.

The political division of Colombia into mutually-exclusive states was used for the definition of distinct geographic zones. The latest census figures were used to obtain the population of each state included in the sample population from the survey (13 in total) and the number of visitors from each state over a 7-month period was calculated using the secondary data from the park; this information is summarized by state in Table 4-1. Visitation rates were calculated using a zonal approach (Navrud and Mungatana, 1994; Fleming and Cook, 2007) with the following equation:

$$V_j = (USERS_j/POP_j), \qquad (4\text{-}1)$$

where V_j = visitation rate for zone j; $USERS_j$ = total number of users from zone j as obtained from the monthly visitor counts (N = 26,246); POP_j = Population of zone j from the 2005 census. Using the reported visitor counts accounts for only a seven month period (and only for the 13 states represented by survey respondents) and, thus, generates a demand for only that period and those states covered in the study; the visitation rate (V_j) is an underestimate of the annual demand of all Columbians. It would be possible to extrapolate to an entire year using the reported 2006 overall visitation; it would be more difficult to extrapolate to the remaining states

since travel cost data are unavailable (although as mentioned earlier, the exclusion of the remaining states is less of an issue since the 13 states included account for nearly 95% of total visits). If travel costs (including the opportunity cost of income) are found to be correlated by distance, these states could be included in the future and/or the opportunity costs of time could be included directly.

Economic theory suggests that the quantity purchased of any good is a function of its price. Given that the zonal TCM uses visitation rates as a proxy for quantity purchased and travel cost as a proxy for price, equation 3-5 proposed a linear demand specification. Prior to estimation, the mean travel costs were plotted against the visitation rates from each state (Figure 4-10). The scatter plot suggests a non-linear relationship between travel costs and visitation and suggests a logarithmic form may better fit the data. In order to identify the best fitting model, a series of models with different functional forms were estimated; notably the use of a logarithmic form as in previous studies. All the models were estimated using a generalized likelihood method (GLM) as suggested by Bowes and Loomis (1980), thereby eliminating the natural heteroscedasticity inherent in the analysis of heterogeneous states. The results are summarized in Table 4-2. It should be noted that all models use the data at the state level from Table 4-1. This is because the relatively high standard deviation of the travel costs within each state – likely due to those individuals traveling by tour bus – precluded the estimation of a model with acceptable explanatory value and statistically significant parameter estimates. Attempting to weight the observations by the variance estimations, as has been suggested, did not improve the models in this study due to a lack of observations.

All four forms of the recreational demand estimation yield parameter estimates whose signs support economic theory. In all four cases the estimates for the intercept term β_0 are

positive, indicating that the visitation rate will be positive when there are no travel costs. The demand curves estimated for models 1-4 are shown in Figures 11-14, respectively. Recall that the actual annual visitation has ranged from more than 45,000 to nearly 80,000 visits for the last four years (Figure 2-2).

The parameter estimates for the travel cost variation β_1 are all negative, indicating that as travel costs increase, fewer visits to LNNP are predicted. Even though all models follow the expectations of economic theory—which indicate that the recreational services provided by LNNP are a normal good—functional specification 3 exhibits a better fit than the other three with the highest R-squared value. Model specification 3 is selected as the most accurate since it has the best fit and provides the most conservative estimate of recreational demand for LNNP and, thus, is used in subsequent analysis.

Consumer Surplus Estimation

The recreational benefits of an environmental amenity can be estimated by quantifying the area under the demand curve and above the price paid for purchase of the amenity, also known as the consumer surplus. Consumer surplus is the willingness to pay over and above the price of the trip paid by the consumer (Maharana et al., 2000). The zonal consumer surplus value can then be expressed mathematically as:

$$CS = \sum_{\forall j} \sum_{ATC_j}^{C} [(\widehat{\beta_0} + \widehat{\beta_1} TC_j) POP_j] \tag{4-3}$$

where CS is this the consumer surplus that is calculated from the summation of the consumer surplus from each zone j (i.e., the second summation that operates on the term in brackets). The consumer surplus from each zone is calculated in increments of $1,000 COP (i.e., $0.50 USD) beginning at the average total cost from each zone (i.e., ATCj as reported in Table 4-1) and increasing to the choke-off price (C), which is the total cost that produces the lowest demand

(i.e., zero). Above the choke-off price, which is different for each model, demand (visitation) is zero. In other words, the calculations measure the area above the average cost but below the demand using a step-wise approach. Note that the calculations first predict the visitation rates (Vj) at each increment of travel costs using the four empirical models shown in Table 4-2, which are then multiplied by the population in each zone (POPj) to derive the predicted number of visitors from zone j ($USERS_j$).

The estimates of consumer surplus for each model specification and each of the zones included in the analysis are shown in Table 4-3 in 2007 nominal values. The total consumer surplus accruing the citizens of the 13 states included in the study due to the existence of LNNP ranges between a conservative 2.2 billion COP, the equivalent of 1.1 million USD or about 3 cents per person, to a high estimate of 9.2 billion COP or 4.6 million USD or about 14 cents per person. It is possible that the unusually high estimates from model specification 4 are the result of the existence of a horizontal asymptote at TC = 0. However, the consumer surplus estimation for model specification 4 was only carried out from TC = 1,000 COP (1,000 COP = 0.50 USD) as the starting point in order to reduce the possible overestimation produced by the presence of this mathematical problem (Figure 4-14).

CVM Analysis and Results

Closed Ended: Dichotomous Choice (WTP) Model

A linear model was specified for this problem in equation 3-8 and followed by a description of a probability model (equation 3-9) and resulting log-likelihood function for a probit model (equation 3-10) to allow estimation of the probability that a respondent would be WTP the increased entry fee for restoration. This model is specified as follows:

$$WTP_i = \beta 0 + \beta 1\ VERSION_i + \beta 2\ FIRSTVIS_i + \beta 3\ CHILD_i + \beta 4\ PRIMPURP_i + \beta 5\ FIREAWARE_i + \beta 6\ PRICE_i + \beta 7\ ECOAWARE_i + \beta 8\ MEMBER_i + \beta 9\ RVISIT_i +$$

$$\beta 10\ AGE_i + \beta 11\ INCOME_i + \beta 12\ GENDER_i + \beta 13\ TOURBUS_i + \varepsilon_i \quad (4\text{-}4)$$

where WTP_i takes on a value of 1 if the respondent answered yes to paying a higher fee or a value of 0 if they were not willing to pay the additional fee. The fee is one of four amounts and is included as an explanatory variable; $PRICE_i$ is the proposed increase fee that respondent *i* was asked to consider.

There are a total of 11 binary explanatory variables in the model. Each of these variables takes on the value of one if the characteristic is present or zero if not. $VERSION_i$ is a binary variable that takes a value of 1 if respondent *i* was asked about his/her knowledge of the ecological services provided by the park *after* the WTP question; $FIRSTVIS_i$ is a binary variable that takes a value of 1 if the current visit is respondent *i*'s first visit to LNNP; $CHILD_i$ is a binary variable that takes a value of 1 if there was a child present in respondent *i*'s group; $PRIMPURP_i$ is a binary variable that takes a value of 1 if respondent *i*'s primary purpose of travel was the visit to LNNP; $FIREAWARE_i$ is a binary variable that takes a value of 1 if respondent *i* was somewhat or very aware of the fire events that had taken place the previous year; $ECOAWARE_i$ is a binary variable that takes a value of 1 if respondent *i* was aware of the hydrological, biodiversity conservation, and carbon regulation services provided by LNNP; $MEMBER_i$ is a binary variable that takes a value of 1 if respondent *i* was a member or donated money to an environmental organization; $RVISIT_i$ is a binary variable that takes a value of 1 if respondent *i* visits national parks or natural areas in general with regularity; AGE_i is a binary variable that takes a value of 1 if respondent *i* is older than 40; $INCOME_i$ is a categorical variable that takes values between 1 and 6 according to the socioeconomic strata in which respondent *i*'s home is located; $GENDER_i$ is a binary variable that takes a value of 1 if respondent *i* is male; and

$TOURBUS_i$ is a binary variable that takes a value of 1 if respondent *i* traveled to the park in a chartered or other tour bus.

Discussion of Explanatory Variables

Respondents were asked how many children they were traveling with. Given that some respondents were traveling in large groups (over 30 individuals), there was a high variability of responses. This created a problem in the estimation of the relative importance of the presence of children for a respondent's WTP for restoration. To solve this problem, the dummy variable CHILD was created to indicate the presence of at least one minor in the respondent's group.

The distribution of the age variable was also problematic as it was skewed toward younger respondents. To solve this problem, a dummy variable was created to differentiate the young from older respondents. The threshold of 40 years of age was selected for two reasons. First, the oldest respondents in our study were in late fifties and early sixties. Visits to LNNP can be dangerous for very old people and very young children, as the low oxygen conditions of high altitudes can exacerbate cardio-respiratory ailments, and park personnel ask older people and young children from abstaining to enter the park. The age distribution of respondents has a minimum of 19 and a maximum of 60, preventing the separation of young and old into adults and senior citizens. Second, the threshold at age 40 then creates a potential differentiation between those who travel in mostly small groups of single and recently married individuals without children and those traveling in larger groups that contain one or several families. While this separation is somewhat arbitrary, it provided a solution to the problems inherent in the sample.

The questionnaire also contained three possible answers to the question regarding awareness of the wildfires that had taken place the previous year. Theoretically, knowledge or awareness of the fires will influence a respondent's WTP for restoration of the areas affected by

those fires. Respondents were asked if they were very, somewhat or not familiar at all with the fire events. For analysis, the very and somewhat familiar responses were clumped into the dummy variable FIREAWARE, which differentiates whether the respondent had some knowledge of the fire events or none at all.

A series of questions concerning respondents' awareness of the ecological services provided by the park were also asked. The respondents were asked if they had previous knowledge of the hydrologic regulation services provided by the park, its importance for the conservation of specific endangered and threatened species, and its role as in carbon storage and atmospheric carbon dioxide sequestration. The dummy variable ECOAWARE was then created to differentiate respondents who had previous knowledge of all three ecological services from those who did not or who did not know of at least one of these services.

The ordering of the contingent valuation exercise and the questions concerning the respondent's awareness of the ecological services provided by the park varied so as to determine the effect that the information given through the survey had on individual's WTP for restoration. Economic theory suggests that information helps mold people's preferences, and the information given to respondents in the form of questions may well affect their WTP. The dummy variable VERSION indicated whether the CV exercise was carried out before the respondent was asked about his/her awareness of the ecological services provided by LNNP.

One of the most surprising things encountered during the data collection period was the variability in transportation methods chosen by visitors to LNNP. The method of transportation inherently affects the group size of the respondent, as people traveling in tour buses will be traveling in larger groups than those traveling in privately owned cars and motorcycles. The initial analysis included group size as an explanatory variable, but the large range of responses,

which included groups as small as a single individual and as large as an entire busload, created a problem for the analysis. The dummy variable TOURBUS was created to indicate whether the respondent was traveling in a chartered bus and hence was part of a large group. Summary statistics of all the variables used in the analysis are shown in Table 4-4.

WTP Model Estimation Results

The WTP responses were analyzed using two probit models in which the probability of responding positively to the dichotomous choice experiment was analyzed as a function of the independent variables identified earlier. Two models were estimated to account for two possible functional forms assumed by the PRICE variable. Given the small number of observations used and the relatively small variation among prices (only four price levels were used), there was no a priori information regarding the correct functional specification for these models. The first model assumed that the relationship between probability of answering positively to the experiment and proposed fee increase (PRICE) was linear, while the second assumed that the relationship is logarithmic, and the natural logarithm of PRICE was used instead. The results of the analysis are summarized in Tables 4-5 and 4-6, respectively.

While not all the variables included in the analysis were statistically significant, there were several variables that were consistently statistically significant in both models. Following economic theory, PRICE was statistically significant at a 5% level in both models, and both the parameter estimate and the marginal effect have a negative sign, implying that as the proposed entrance fee hike shown to survey respondents increased, they were less likely to agree to pay the extra money for ecological restoration. The marginal effect shows the estimated change in the probability of responding positively to the WTP question with a 1 unit increase in the independent variable, starting from a corresponding value of the independent variable, shown in tables 4-5 and 4-6 as the column labeled “x” (Gujarati, 2004). Probit models are based on the

probability of a certain outcome, and changes in one independent variable will not only bring changes to the dependent variable but are also inherently accompanied by changes in the relative effect of the other independent variables. Marginal changes are therefore shown along with the 'base values' with which they were calculated.

The parameter estimate for the variable indicating whether the visit to LNNP was the primary purpose of the respondent's trip, PRIMPURP, was statistically significant at a 10% level and had a positive sign, but its marginal effect was not statistically significant. This indicates that while respondents who indicated that the visit to LNNP was the primary purpose of their trip have a higher probability of being WTP than those who did not, this effect is either weak or was weakened in the analysis due to the small number of observations used.

Contrary to expectations, those respondents who were knowledgeable about the ecological services provided by the park (ECOAWARE) exhibited a lower probability of being WTP for ecosystem restoration, as indicated by negative and statistically significant parameter and marginal effect estimates at a 5% level. This seems counterintuitive as individuals more familiarized with the services provided by an ecosystem are expected to value that ecosystem more than those who are not. However, more knowledge regarding the services provided by an ecosystem may also be an indication of more knowledge about this particular ecosystem or about ecology in general. Individuals familiarized with ecological science may have more understanding of the self-restoration capacities of ecosystems and, hence, may exhibit a lower probability of being WTP than those who do not understand these processes since they expect nature to play its course and heal itself. Also, those individuals more familiar with the services provided by LNNP may know more about LNNP and take into account that the 2,500 hectares or so affected by the wildfires are a small area compared to the more than 58,000 hectares under

protection within the park, or they may know that fires are common in *paramo* ecosystems and are arguably a natural component of the disturbance regimes that maintain the integrity of the system. These more informed respondents may also be aware of the human dynamic of pastoralist fires and do not believe that a higher entrance fee would solve the problem, and may in fact believe that increased management activities could potentially result in more conflict and more fires.

Respondents who expressed that they are regular visitors to other National parks or other natural areas (RVISIT) exhibited a higher probability of being WTP for restoration than those who did not, as the positive and statistically significant parameter and marginal effect estimates indicate. Regular visits to natural areas may indicate environmentalist preferences, which can be expressed as willingness-to-pay for restoration of damaged ecosystems. Regular users of natural amenities also have more concrete direct-use values that stem from actual use and enjoyment of these amenities, as opposed to more 'esoteric' passive-use, option, or bequest values held by individuals who do not use these amenities, and this is reflected in the WTP for restoration exhibited by regular users of environmental amenities.

The negative and statistically significant parameter and marginal effect estimates associated with the GENDER variable show that men are less likely to respond positively to the WTP question. There is no obvious reason for the higher willingness by women to pay for restoration, and this issue deserves more attention.

Survey respondents who were traveling in tour buses, most of whom were traveling in large groups, exhibited a higher probability of responding positively to the dichotomous choice question, as evidenced by the positive and statistically significant parameter and marginal effect estimates associated with the TOURBUS variable. It was initially expected that respondents

travelling in large groups would be less likely to be willing to pay an extra amount on top of the entrance fee, as they were told that the given amount would be charged on top of the entrance fee of each of the members of the group, hence making it a large sum when the respondent was responsible for paying the surcharge for his entire family, for instance. However, tour travel may also reflect an individual's desire to be part of a group that is interested and concerned with nature thereby resulting in a higher probability of being WTP.

Open Ended CV: Maximum WTP Estimation Results

A follow-up question to whether respondents would be WTP the fee proposed to them asked respondents directly to provide their maximum willingness to pay for restoration. The question was asked regardless of whether the respondent had agreed to pay the amount shown in the card, but the format of the question changed to accommodate the previous response. If the response had been positive, then the question read: "If your response was yes, what is the maximum amount you would be willing to pay for restoration of the areas affected by the wildfires?" Conversely, if their response had been negative, the question read: "If your response was no, what is the maximum amount you would be willing to pay for restoration of the areas affected by the wildfires, if anything?"

The answers were given in Colombian pesos and coded as the MAX_WTP variable. They were analyzed using an Ordinary Least Squares regression in which the dependent variable was regressed against the same variables used in the dichotomous choice analysis, plus a variable to account for their initial response. Four different models were regressed in order to accommodate different functional forms taken by the MAX_WTP and the PRICE variable. The models follow the following form:

$$\text{MAX\_WTP} = \beta 0 + \beta 1\ \text{VERSION} + \beta 2\ \text{WTP\_YES} + \beta 3\ \text{FIRSTVIS} + \beta 4\ \text{CHILD} + \beta 5\ \text{PRIMPURP} + \beta 6\ \text{FIREAWARE} + \beta 7\ \text{PRICE} + \beta 8\ \text{ECOAWARE} + \beta 9\ \text{MEMBER} + \beta 10\ \text{RVISIT} + \beta 11\ \text{AGE} + \beta 12\ \text{INCOME} + \beta 13\ \text{GENDER} + \beta 14\ \text{TOURBUS} \quad . \qquad (4\text{-}5)$$

Equation 4-5 shows the linear specification used in model 1. In model 2 a semi-log specification was used in which the response variable was the natural logarithm of MAX_WTP (Ln MAX_WTP) instead of a linear specification. In model 3 a linear-log specification was used where by the linear explanatory variable price, PRICE, was replaced with its natural logarithm (Ln PRICE). In model specification 4, a double-log specification was used in which the dependent variable MAX_WTP and the explanatory variable PRICE were both included after taking the natural logs.

The results of the analysis are summarized in Table 4-7. At a first glance it can be noted that the intercept terms in two of the models have positive signs while on the other two the sign is negative. This anomaly can be attributed to the use of the logarithmic expression as the response variable, as in the two models where the response variable is linear the intercept estimate is negative, while in the two models that use the logarithmic expression as the response variable the intercept estimate is positive.

The parameter estimate associated with the VERSION variable was positive and statistically significant in all four models. This indicates that respondents who went through the contingent valuation exercise *before* they were asked about their awareness of the ecological services provided by the park exhibited a higher WTP. It was expected that respondents who were asked about their awareness of the ecological services provided by the park—and thus informed or reminded about these services—before going through the contingent valuation exercise would exhibit a higher WTP, as they had more information and would value these services that they had just been informed about. The results, however, show the opposite, which are contrary to previous studies that have tested for information bias. Not only was information bias not a problem, but it's possible that respondents perceived that extra information about

ecological services as a blatant attempt to increase their willingness to pay such that they resisted the notion of paying for what is commonly considered a public good.

Both the PRICE and WTP_YES variables, which are included to account for the anchoring effect, were found to be positive and statistically significant in all models. Respondents who agreed to pay the amount shown to them during the dichotomous choice exercise exhibited higher WTP values than those who did not. Higher prices or amounts used in the closed ended exercise also helped elicit higher maximum WTP values, as respondents had a positive and non-zero baseline from which they were asked to go as high as they were willing.

The variable indicating if the respondent was visiting the park for the first time was associated with a positive and statistically significant coefficient in all four models, indicating that repeat visitors experience diminishing marginal utility. Respondents who were traveling with children also exhibited a higher WTP than those who did not, as evidenced by the positive and statistically significant parameter estimate associated with the CHILD variable. This result could be an indicator of bequest values.

The coefficient associated with the MEMBER variable was found to be positive and statistically significant in all of the models, indicating that individuals who are members or donate money to environmental organizations have a higher WTP for ecological restoration than those who do not. This is not a surprising result as these individuals are currently expressing their non-market environmental preferences by another mechanism.

Survey respondents younger than 40 were found to exhibit higher WTP values for restoration of the areas affected by the wildfires than older individuals, as evidenced by the negative and statistically significant parameter estimates associated with the AGE variable in all models. Environmentalism is a relatively recent phenomenon, especially in the third world, were

conventional wisdom places environmental concerns at the bottom of the list of policy priorities. Older individuals may also be more skeptical that the additional fees collected would be used for restoration of LNNP since that would require the funds to be given back to the LNNP instead of retained and redistributed by the Ministry of the Environment.

Income – as proxied by the tax stratum of their home – was also found to be positively related to maximum willingness to pay for restoration, echoing the theoretical notion that higher incomes result in higher demand for goods and services. Individuals with higher incomes have more disposable income that can be spent in recreation or ecological restoration, for instance. The positive parameter estimates associated with INCOME do not reflect a new finding but rather reinforce the validity of economic theory and previous empirical results.

Discussion of Empirical Results

The per capita consumer surplus estimates associated with reported visits over a 7-month period from October 2006 through May 2007 from the TCM analysis range from a low of 70 COP or 3 USD cents to a high of 293 COP or 14 USD cents, which are very small amounts. However, once aggregated over the entire population of the country these small individual amounts sum to a considerable total relative to park system expenditures. Recall that the UAESPNN's annual budget for 2007 (Figure 2-4) shows that both investment in Colombia's parks and reserves and operational costs for all parks and offices of the park service amount to 23.5 billion COP or about 12 million USD. The most conservative estimate of total consumer surplus, at 2.2 billion COP, is equivalent to 9.4% of the entire Colombian parks system budget. Since this figure was based on visitation data from just 7 of 12 months (58.3%), it might seem reasonable to extrapolate the findings to an entire year (which is the traditional unit of measure) in which case the lowest value found was approximately 3.8 billion COP ($1.9 million USD).

Respondents were found to have, on average, a positive willingness to pay for restoration of the areas affected by the 2006 wildfires. The closed-ended dichotomous choice exercise received a positive response rate of 81%, indicating that a wide majority of respondents were willing to incur the higher entrance fee that they were confronted with. The open-ended follow up exercise produced an even higher average WTP as several individuals that responded yes, provided even higher values and some that responded no provided lower amounts than they were originally confronted with (but higher than zero).

The average willingness to pay for restoration elicited through the closed-ended dichotomous choice exercise was found to be 3,969 COP, or about $2 USD per person. The average WTP for restoration elicited through the open ended exercise was found to be 6,742 COP or about $3.50 USD. If these average values are representative of the visitor population and visitation in 2007 remained at 2006 levels, park management authorities could have raised between 238 and 405 million pesos, or between $119,000 and $202,000 USD for ecological restoration in 2007.

These figures indicate that ecological restoration is valuable enough to the visiting public to be financed directly by visitors through higher entrance fees or some form of suggested donation mechanism. The overwhelming positive response shows that a wide majority of respondents are willing to pay for restoring the ecological integrity of the park, and while the annual estimates of WTP may not be high enough to finance a one-time investment to restore 2,500 hectares of paramo, these sums could be used to finance an ongoing small-scale restoration program in LNNP.

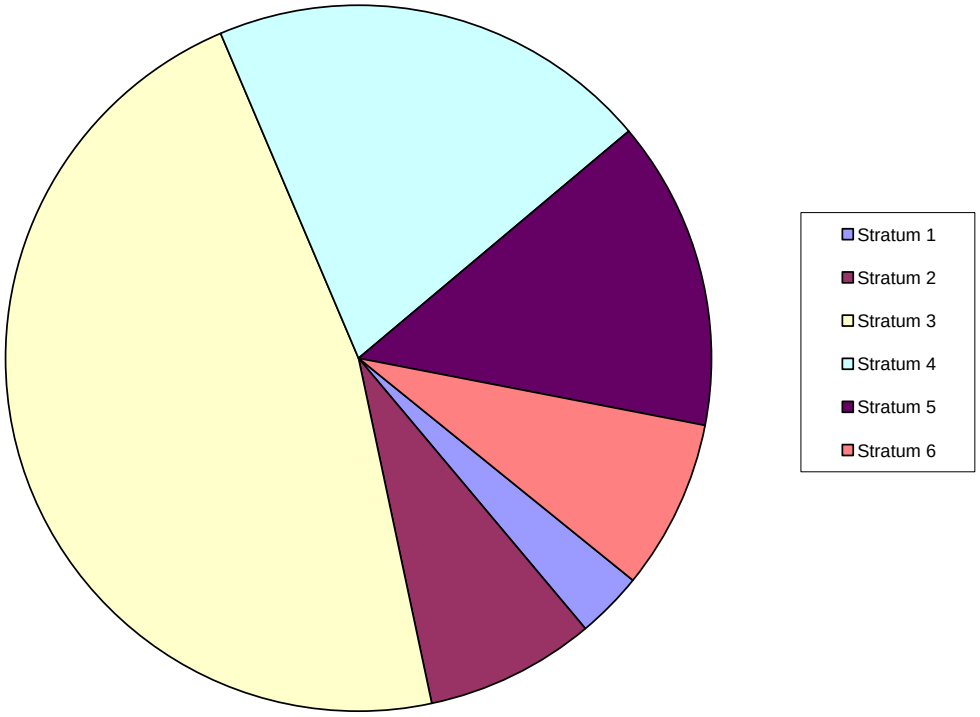

Figure 4-1. Income of respondents by socio-economic strata

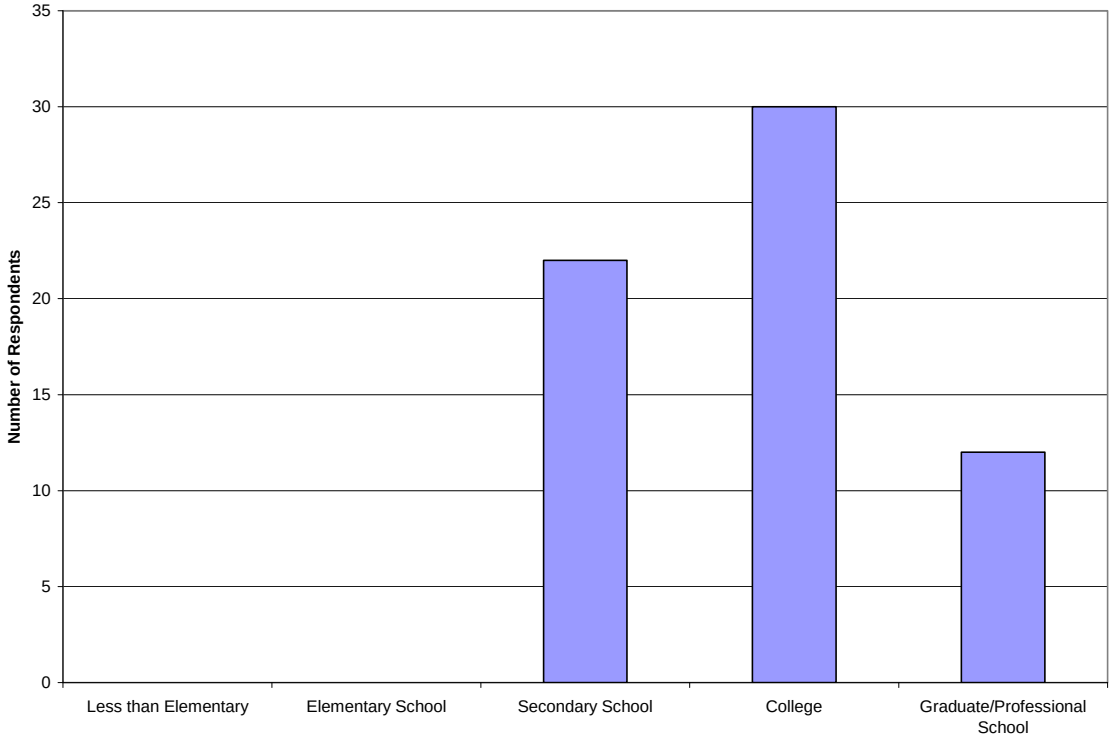

Figure 4-2. Educational level of respondents

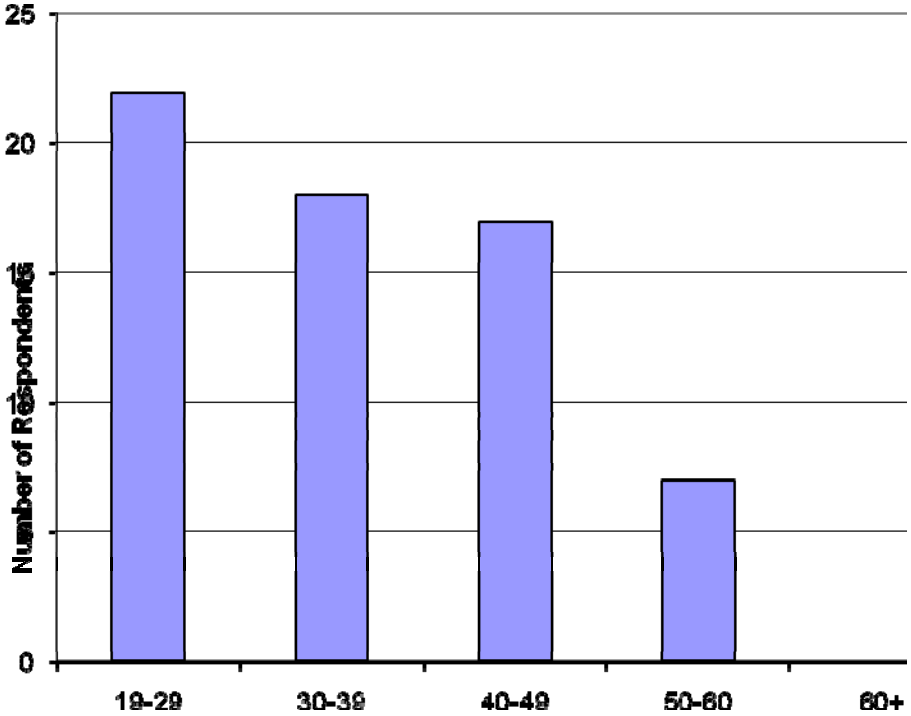

Figure 4-3. Age distribution of respondents

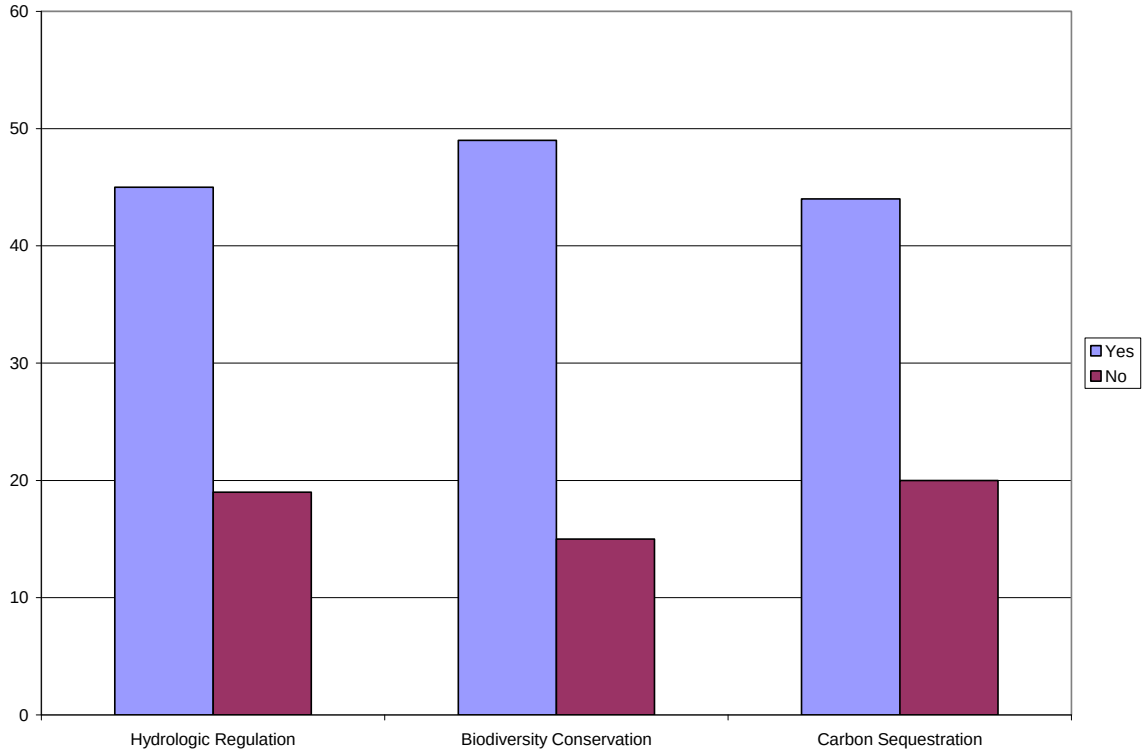

Figure 4-4. Respondents' awareness of the ecological services provided by LNNP

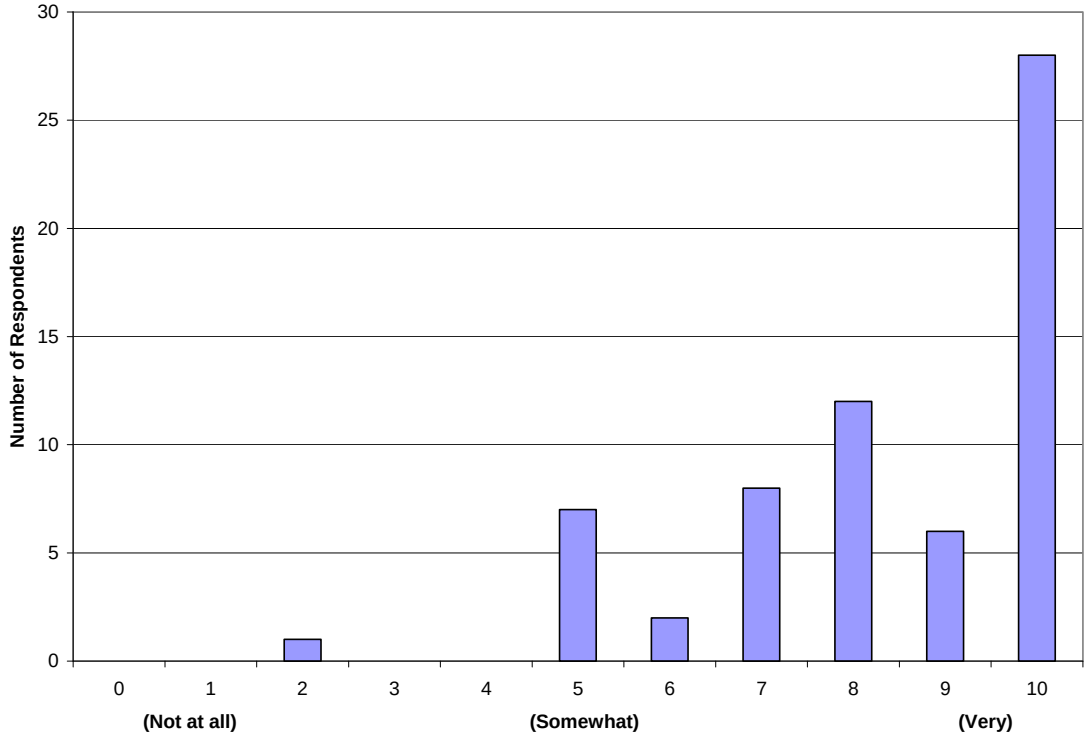

Figure 4-5. Concern for environmental issues in Colombia among respondents

Figure 4-6. Location of LNNP (in red) and number of visitors in sample by state

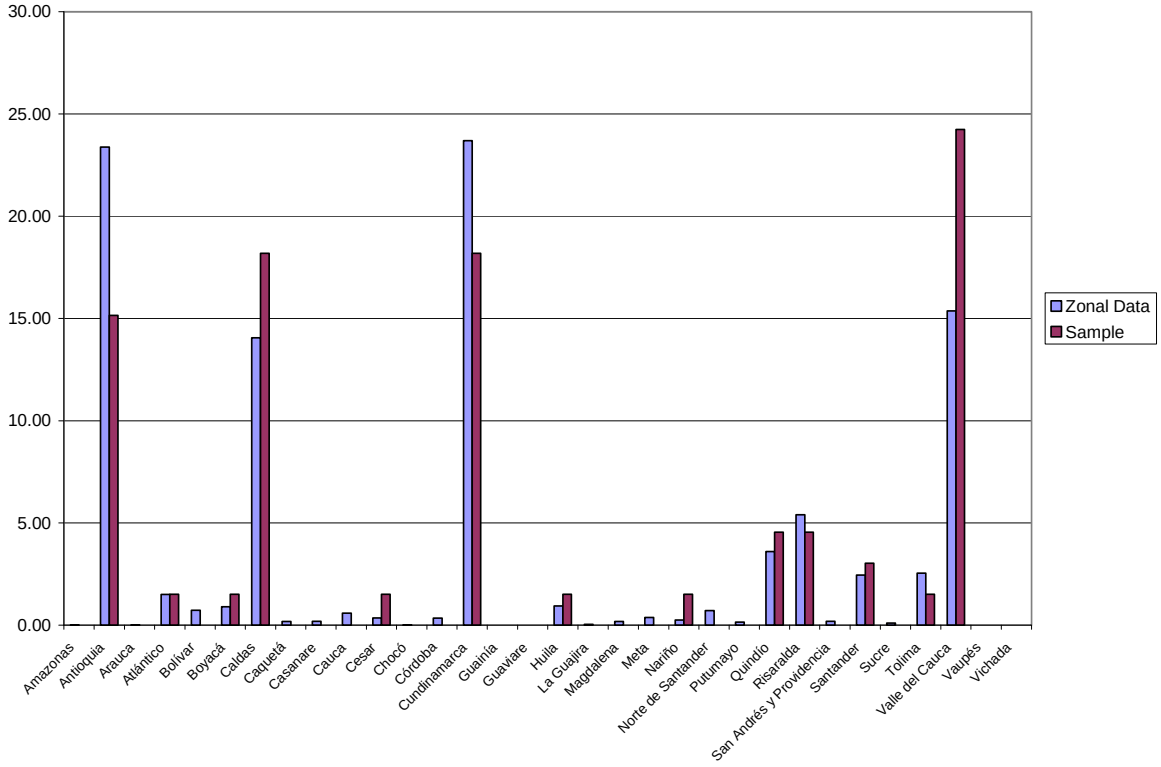

Figure 4-7. Distribution of visitation data and survey respondents by state

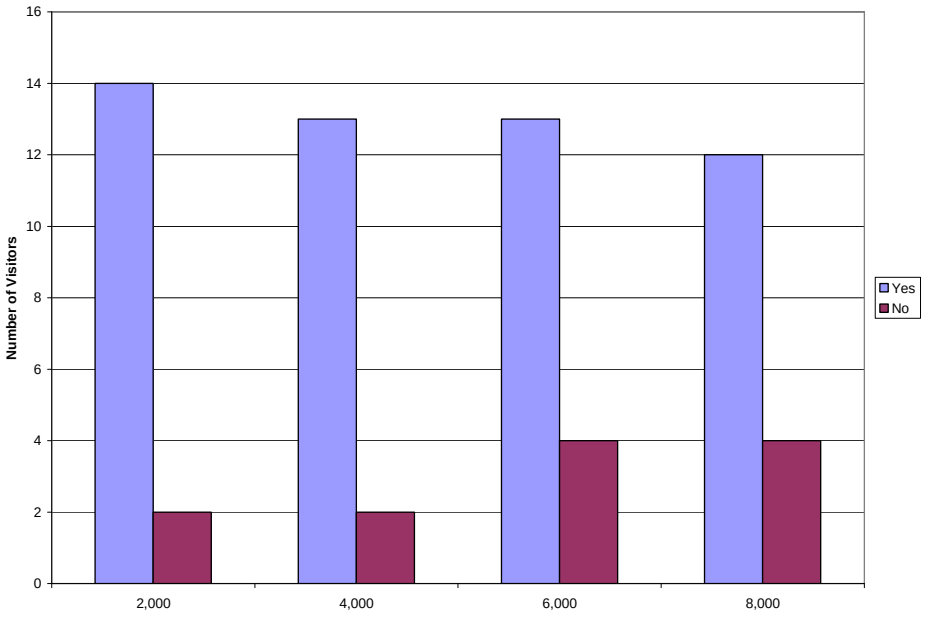

Figure 4-8. Dichotomous choice responses by card

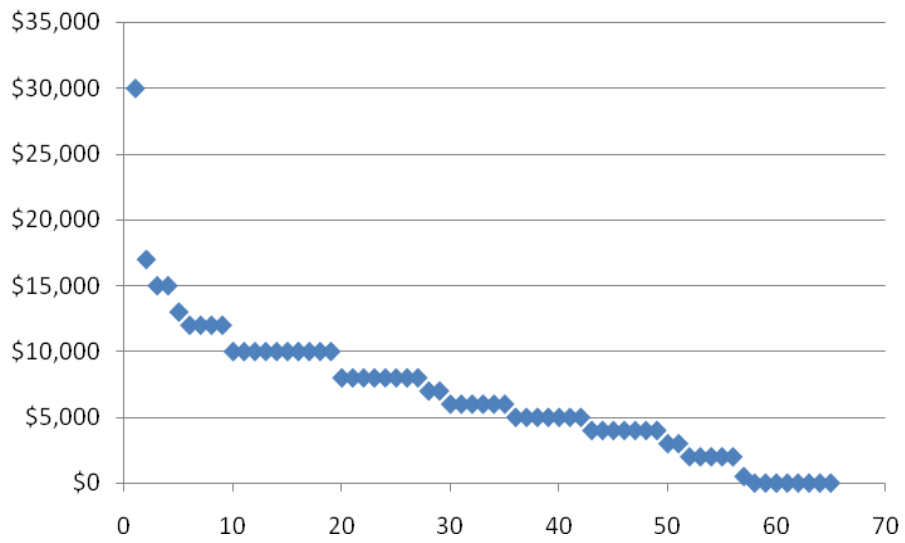

Figure 4-9. Summary of WTP responses from the open-ended inquiry

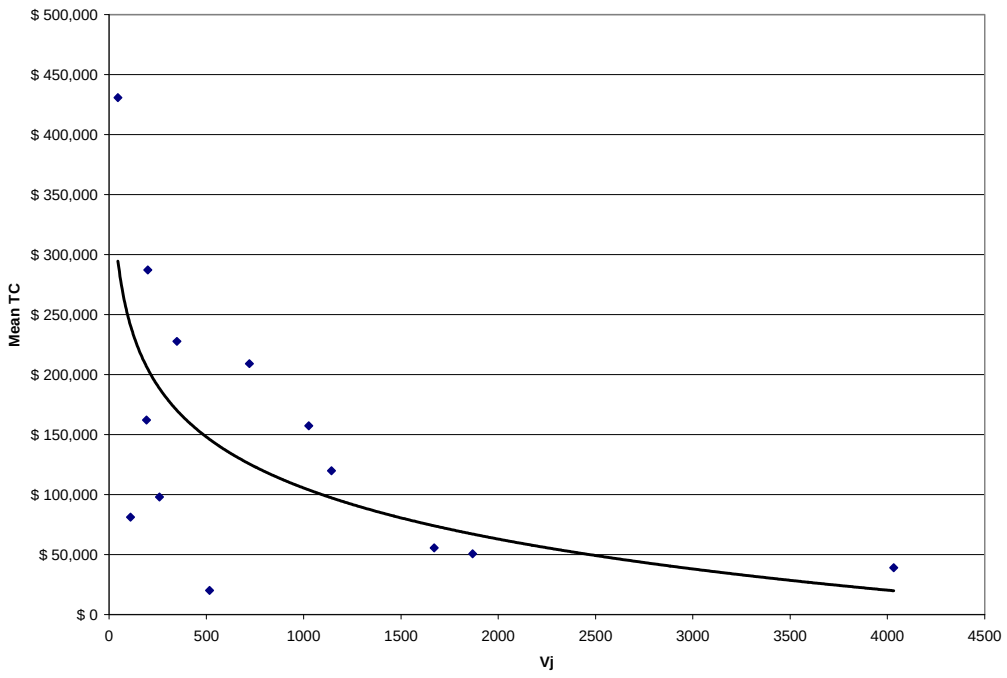

Figure 4-10. Scatter plot and trend line of mean travel costs and visitation rates

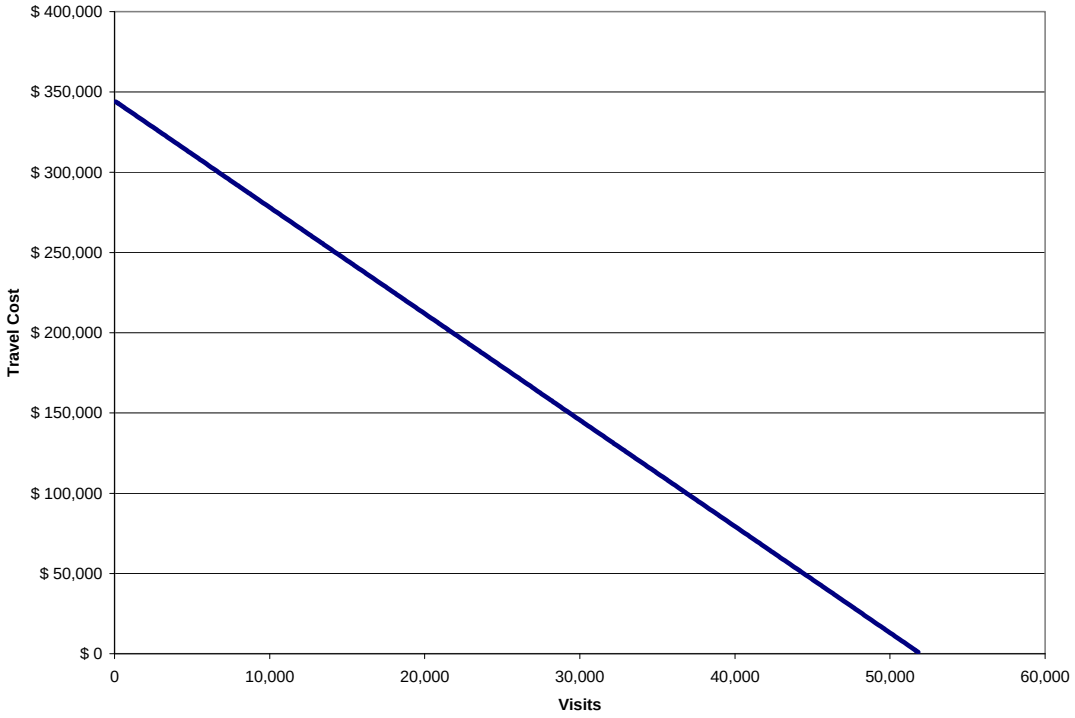

Figure 4-11. Predicted values for travel cost model (in COP) for specification 1

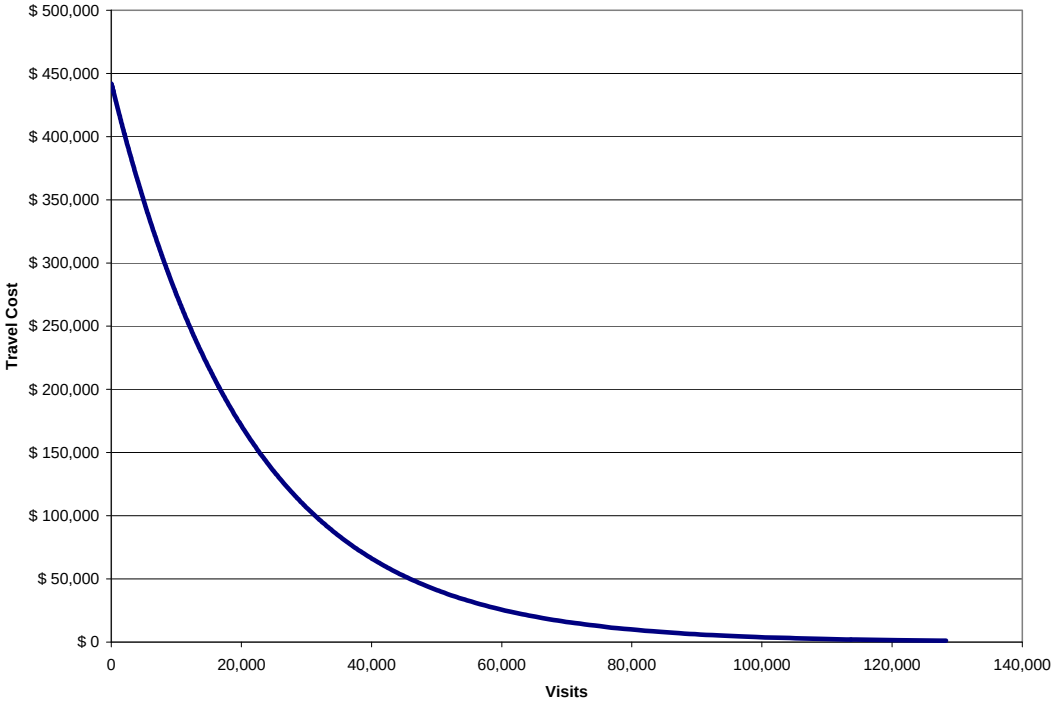

Figure 4-12. Predicted values for travel cost model (in COP) for specification 2

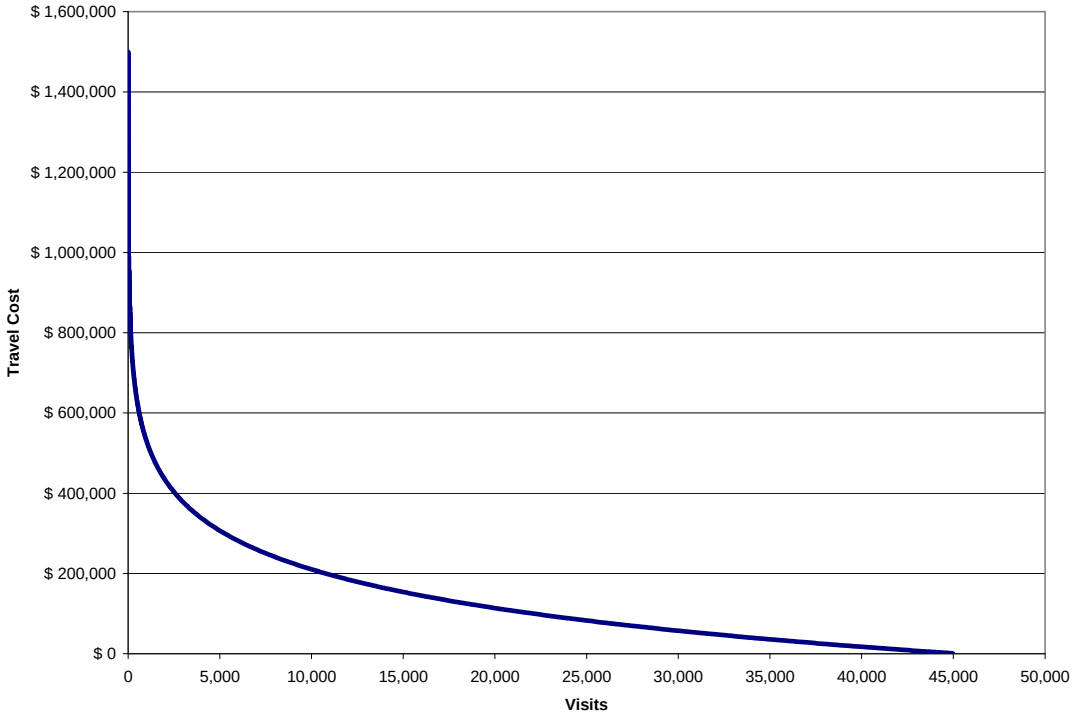

Figure 4-13. Predicted values for travel cost model (in COP) for specification 3

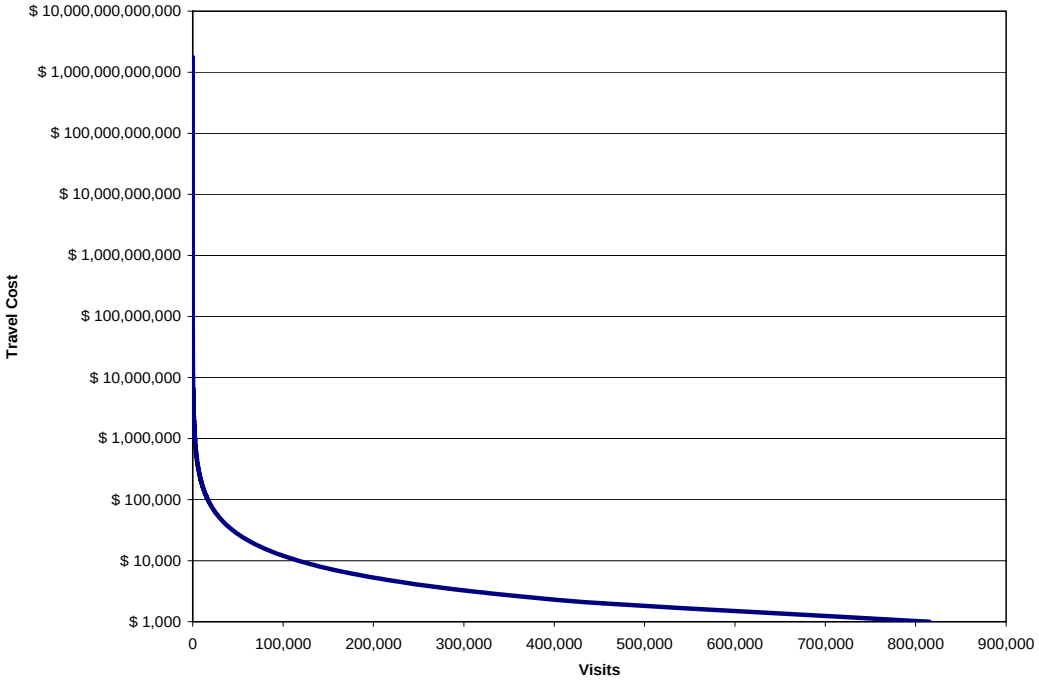

Figure 4-14. Predicted values for travel cost model (in COP) for specification 4

Table 4-1. Per capita travel cost information and 7-month visitation rates by state

State	Travel Cost Mean (1,000 COP)	Travel Cost Std. Dev.	Total Visits, USERSj	Population, POPj (1,000)	Visitation per mil. (Vj)
Antioquia	$119.9	$60.2	6,496	5,682	1,143.2
Atlántico	$162.1	$0.0	418	2,166	193.0
Boyacá	$287.2	$0.0	251	1,255	199.9
Caldas	$39.0	$27.7	3,906	969	4,032.0
Cesar	$81.2	$0.0	100	903	110.7
Cundinamarca	$209.2	$125.9	6,585	9,120	722.0
Huila	$98.0	$0.0	263	1,011	260.0
Nariño	$430.9	$0.0	71	1,542	46.0
Quindío	$50.6	$11.7	999	535	1,868.8
Risaralda	$55.6	$25.7	1,500	898	1,671.3
Santander	$227.7	$229.6	682	1,958	348.3
Tolima	$20.0	$0.0	705	1,365	516.3
Valle del Cauca	$157.3	$115.2	4,270	4,161	1,026.1

Sources: The travel cost information is from the survey, the visitation data are from the selected months between October 2006 and May 2007 from the park service, and the population data are from the 2005 census.

Table 4-2. Travel cost model results

Functional Form	Intercept Est. of β_0	Intercept p-value	Slope Est. of β_1	Slope p-value	R^2
1) Vj = β0 + β1(TC)	1646.571***	0.0043	-0.005*	0.0779	0.256
2) Vj = β0 + β1(Ln TC)	8671.510**	0.0417	-666.996*	0.0637	0.279
3) Ln Vj = β0 + β1(TC)	7.269***	<.0001	-7.18E-5**	0.0133	0.441
4) Ln Vj = β0 + β1(Ln TC)	15.989***	0.0025	-0.844**	0.0361	0.341

Notes: Triple, double and single asterisks indicate statistical significance at the 0.01, 0.05, and 0.10 level, respectively.

Table 4-3. Consumer surplus estimates by state, in thousands COP and USD

State	Model 1	Model 2	Model 3	Model 4
Columbian Pesos:				
Antioquia	$687,045	$632,052	$481,219	$1,738,630
Atlántico	$171,332	$169,611	$134,707	$625,650
Boyacá	$10,060	$26,423	$32,039	$320,053
Caldas	$216,696	$200,466	$146,783	$351,178
Cesar	$150,378	$135,585	$101,225	$295,225
Cundinamarca	$402,645	$469,938	$407,589	$2,501,745
Huila	$147,386	$133,400	$100,316	$320,498
Nariño	$0	$207	$14,092	$352,915
Quindío	$111,130	$101,554	$74,844	$187,532
Risaralda	$180,310	$164,093	$121,227	$310,729
Santander	$65,054	$84,164	$76,885	$527,349
Tolima	$344,530	$330,020	$237,122	$535,160
Valle del Cauca	$351,220	$342,846	$270,182	$1,210,861
Total (COP)	*$2,837,787*	*$2,790,356*	*$2,198,230*	*$9,277,525*
U.S. Dollars:				
Antioquia	$344	$316	$241	$869
Atlántico	$86	$85	$67	$313
Boyacá	$5	$13	$16	$160
Caldas	$108	$100	$73	$176
Cesar	$75	$68	$51	$148
Cundinamarca	$201	$235	$204	$1,251
Huila	$74	$67	$50	$160
Nariño	$0	$0.10	$7	$176
Quindío	$56	$51	$37	$94
Risaralda	$90	$82	$61	$155
Santander	$33	$42	$38	$264
Tolima	$172	$165	$119	$268
Valle del Cauca	$176	$171	$135	$605
Total (USD)	*$1,419*	*$1,395*	*$1,099*	*$4,639*

Note: The estimation was conducted using COP then values were converted to USD assuming 1 USD = 2,000 COP. The exchange rate ranged from 1,950 – 2,080 COP for 1 USD during the time of the study but 2,000 was used to simplify the conversions.

Table 4-4. Summary statistics of variables in the contingent valuation analysis

Variable	N	Mean	Std. Dev.	Min.	Max.
WTP_YES	64	0.813	0.393	0	1
MAX_WTP (in 1,000)	64	6.742	5.080	0	30.0
Ln (MAX_WTP)	57	8.739	0.677	6.2	10.3
VERSION	64	0.516	0.504	0	1
FIRSTVIS	64	0.703	0.460	0	1
CHILD	64	0.469	0.503	0	1
PRIMPURP	64	0.813	0.393	0	1
FIREAWARE	64	0.234	0.427	0	1
PRICE (in 1,000)	64	0.503	0.225	2.0	8.0
Ln (PRICE)	64	8.402	0.523	7.6	9.0
ECOAWARE	64	0.531	0.503	0	1
MEMBER	64	0.141	0.350	0	1
RVISIT	64	0.594	0.495	0	1
AGE	64	0.375	0.488	0	1
INCOME	64	3.578	1.166	1	6
GENDER	64	0.625	0.488	0	1
TOURBUS	64	0.281	0.453	0	1

Table 4-5. Results of the dichotomous choice CV experiment, model 1

	Parameter		Marginal Effect		
Variable	Estimate	p-value	(dy/dx)	p-value	x
INTERCEPT	0.290	0.810			
VERSION	0.469	0.225	0.0719	0.283	0.516
FIRSTVIS	0.581	0.321	0.1039	0.403	0.703
CHILD	-0.373	0.413	-0.0579	0.413	0.469
PRIMPURP	0.999*	0.062	0.223	0.122	0.813
FIREAWARE	0.693	0.259	0.081	0.153	0.234
PRICE (1,000)	-2.397**	0.048	-0.036**	0.030	5.031
ECOAWARE	-1.211**	0.028	-0.183**	0.029	0.531
MEMBER	0.711	0.331	0.075	0.179	0.141
RVISIT	1.225**	0.021	0.222**	0.019	0.594
AGE	0.752	0.281	0.101	0.167	0.375
INCOME	0.218	0.213	0.033	0.295	3.578
GENDER	-0.972	0.104	-0.128*	0.083	0.625
TOURBUS	0.804*	0.082	0.097	0.098	0.281

Notes: Double and single asterisks indicate statistical significance at the 0.05 and 0.10 level, respectively.

Table 4-6. Results of the dichotomous choice CV experiment, model 2

	Parameter		Marginal Effect		
Variable	Estimate	p-value	(dy/dx)	p-value	x
INTERCEPT	7.497	0.081			
VERSION	0.4807	0.210	0.075	0.265	0.516
FIRSTVIS	0.560	0.329	0.100	0.408	0.703
CHILD	-0.305	0.501	-0.047	0.499	0.469
PRIMPURP	0.973*	0.068	0.218	0.132	0.813
FIREAWARE	0.687	0.261	0.083	0.16	0.234
LN(PRICE)	-0.994*	0.057	-0.152**	0.042	8.402
ECOAWARE	-1.165**	0.032	-0.1785**	0.031	0.531
MEMBER	0.628	0.388	0.070	0.240	0.141
RVISIT	1.213**	0.016	0.223**	0.021	0.594
AGE	0.687	0.302	0.095	0.208	0.375
INCOME	0.208	0.246	0.032	0.312	3.578
GENDER	-1.008*	0.083	-0.135*	0.074	0.625
TOURBUS	0.825*	0.086	0.100*	0.086	0.281

Notes: Double and single asterisks indicate statistical significance at the 0.05 and 0.10 level, respectively.

Table 4-7. Results of the open-ended willingness to pay models

Variable	Model 1 Parameter Est. (p value)	Model 2 Parameter Est. (p value)	Model 3 Parameter Est. (p value)	Model 4 Parameter Est. (p value)
INTERCEPT	-8,748.12**	5.872***	-30,849.00***	1.262
	(0.021)	(<.0001)	(0.021)	(0.272)
VERSION	2,708.89**	0.460***	2,627.55**	0.445***
	(0.019)	(0.001)	(0.003)	(0.001)
WTP_YES	4,101.87**	1.168***	4,060.66*	1.163***
	(0.047)	(<.0001)	(0.025)	(<.0001)
FIRSTVIS	2,545.53*	0.250*	2,637.31**	0.271*
	(0.052)	(0.085)	(0.054)	(0.075)
CHILD	2,202.21*	0.227*	2,058.95*	0.200
	(0.056)	(0.076)	(0.077)	(0.129)
PRIMPURP	737.32	0.072	808.40	0.088
	(0.64)	(0.068)	(0.615)	(0.630)
FIREAWARE	-650.04	-0.044	-541.91	-0.022
	(0.605)	(0.755)	(0.672)	(0.878)
PRICE	0.79***	0.0002***	3,072.39***	0.637***
	(0.003)	(<.0001)	(0.007)	(<.0001)
ECOAWARE	709.31	0.029	558.75	0.0005
	(0.588)	(0.840)	(0.675)	(0.997)
MEMBER	5,203.03***	0.494**	5,341.50***	0.528***
	(0.003)	(0.011)	(0.003)	(0.010)
RVISIT	-659.05	-0.233*	-683.23	-0.235*
	(0.581)	(0.085)	(0.576)	(0.096)
AGE	-4,295.87***	-0.513***	-4,101.63***	-0.478***
	(0.002)	(0.001)	(0.004)	(0.003)
INCOME	1,344.82**	0.182***	1,386.17***	0.189***
	(0.010)	(0.002)	(0.009)	(0.002)
GENDER	58.67	0.070	211.81	0.101
	(0.960)	(0.589)	(0.858)	(0.454)
TOURBUS	-1.56	-0.055	-21.63	-0.061
	(0.999)	(0.687)	(0.986)	(0.670)
Model Statistics:				
R^2	0.52	0.71	0.50	0.68
Adj. R^2	0.36	0.61	0.33	0.57

Notes: Triple, double and single asterisks indicate statistical significance at the 0.01, 0.05, and 0.10 level, respectively. Model 3 uses LN(PRICE).

CHAPTER 5
CONCLUSION

Implications

The results of this study show that conservation is not only socially valuable but that it has the potential to pay for itself. Our estimates of consumer surplus from the recreational use of LNNP by Colombian nationals are high relative to the operational costs of the entire network of PAs financed by the central government. The existence of LNNP as a viable land use is then fully justified as its recreational benefits outweigh the costs. The high ratio of recreational benefits to operational costs also suggests the possibility that expansion of the protected area network in general and LNNP in particular can be a sound social investment.

The evidence also suggests that recreational users are willing to pay for the restoration of areas affected by the 2006 wildfires in LNNP. While the annual sums raised may not cover a one-time investment, some form of ongoing suggested donation mechanism may fund a continuing effort to maintain and improve the ecological integrity of LNNP. Heavy involvement of local communities in such a program may also bring about improvements in other problematic areas, such as livestock grazing and pastoralist fires within the borders of the park. Expansion of the park's existing outreach programs, involvement of local schools, and co-management of grasslands and grazing areas are some possible ways to involve local communities in park management in a potentially beneficial manner.

Furthermore, the data and analysis compiled in this study provide information to a country where little or no information regarding the economic value of recreation in PAs exists. Most problems of PAs in general are in one way or the other the result of undervaluation of parks and reserves as national and social assets which in turn results in alternate land uses being valued more highly and opening the way for environmentally destructive practices. However, these

results suggest that conservation and recreational use of PAs are a high-value land use, but that the conservation value of land is not always as evident as it can be for more intensive uses of land. New and creative mechanisms that allow the capturing of the values of PAs will undoubtedly result in decreased park-people conflicts.

The statutes that created LNNP and the UAESPNN mandate, among other objectives, the conservation and administration of the natural *values* of Colombia as well as the investigation of the *values* of the natural renewable resources of the nation. The information gap filled in part by this study is not only an important academic exercise; it is the first study to my knowledge that fulfills two of the objectives delineated by the Colombian legislature at the time of the creation of the nation's parks and reserves.

There are a total of 53 PAs under the UAESPNN's authority, most of which are larger than LNNP. If the consumer surplus of each of Colombia's protected areas was at least half the lowest estimate in this analysis, the unpaid recreational benefits accruing to Colombians from the existence of the nation's protected area system would be about 57 billion COP, more than twice the amount currently invested to protect the country's natural heritage in the form of parks and reserves. There is, therefore, evidence to suggest that Colombia's protected area system is under-funded and that Colombians would benefit by increases in public expenditures on parks and reserves toward the improvement of infrastructure and services targeted at recreational visitors, as well as the creation of new protected.

Policy Prescription

The economic relevance of PAs in general and of LNNP in particular was highlighted through the use of well-accepted economic valuation methods, and it seems that environmental conservation in Colombia is a socially desirable outcome. The high ratio of recreational benefits to costs for LNNP suggest that budgetary increases for the UAESPNN toward improved

management are justified. Expansion of the park and improvements in park quality may also be desirable social investments.

In regards to restoration of the areas affected by the 2006 wildfires, the existence of a positive and significant WTP of users indicates that a decentralization of UAESPNN finances may help park managers raise their own money for restoration. Increases in the entrance fee or some other self-funding mechanism would allow the establishment of an ongoing restoration or improved management program that should also heavily involve local communities.

Caveats and Limitations of the Analysis

The analysis conducted in this study is entirely reliant on the integrity of the sample as representative of the population. While great efforts were made to maintain such integrity, budgetary and time constraints prohibited a truly randomized sampling of visitors to LNNP and the implementation of a thorough pre-testing protocol. The seasonality inherent in tourism activities also implies that the visiting population may be completely different at periods other than July and August, which was when the fieldwork for this study was conducted. Most notable was the exclusion of international tourists, which are the traditional focus of non-market valuation estimation of protected areas in developing countries.

The secondary visitation data used to construct the visitation rates that were integral to the TCM analysis were also limited in that they excluded several peak periods of visitation, namely during the summer months. And, of course, the exclusion of the opportunity cost of time results in consumer surplus estimates that are biased downward.

Uncertainties regarding model specification and estimation may also be a limiting factor in the interpretation of this study's analysis. As is shown by the dramatically different estimates of consumer surplus under different functional specifications, our estimates should be considered "ball-park" estimates and be used as such. While it can be argued that there is an important and

significant economic value of recreation in LNNP with some certainty, the magnitudes of consumer surplus would be very likely to change if data collected in different periods were used.

Future Directions

Non-Market Valuation in Los Nevados National Park

This study may serve as a stepping stone towards a more comprehensive valuation study in LNNP. The datasets used contain the names and addresses of over 27,000 visitors, which could be used to conduct a comprehensive mail survey. Given that both the UAESPNN and the Eco-tourism Concession continually collect data on visitors, collaboration with them could prove to be extremely productive in procuring visitation information across a continuous 12-month period to enable the derivation of annual totals directly.

A more comprehensive duplicate of this study where data are collected at several times throughout the year and a larger sample is used may also provide a better overview of recreational demand at LNNP. But short of a new and improved study, the further investigation of average income by stratum and by state could prove fruitful in including the opportunity cost of time into the travel cost estimates.

While not directly related to non-market valuation, LNNP is a potential research site for a wide variety of projects. Since it is located close to several major urban areas, field research can be conducted easily. A combination of high tourism, unique biodiversity, valuable hydrologic and other ecological functions, and classic common pool resource problems provide for an excellent site for applied research in economics and other disciplines.

Non-Market Valuation in Developing Country Protected Areas

Economic valuation of PAs in general and of parks and reserves in the developing world in particular is an area where little research exists but much more is needed. As is the case with LNNP, most parks in the developed and developing world alike are highly valuable but are

extremely undervalued under the existing institutional framework, opening the way for other land uses. Research on the total economic value of these parks and reserves can fill an important gap and allow decision-makers and the general public to make more informed choices regarding these important social assets. It is also important to note that several hypotheses regarding the effect on willingness to pay estimates related to questionnaire design were supported or disputed (e.g., the anchoring effect and information bias, respectively), which raises several interesting theoretical questions regarding the behavior of residents in developing countries.

APPENDIX

Interview Script

Valuation of Los Nevados National Park

Version 1 – Card A / Services After

Informed Consent

My name is Sergio Alvarez and I am a graduate student at the University of Florida. The purpose of this study is to evaluate the benefits created by recreation in the park. The answers you provide will help us better understand the economic benefits created by the park, and will be shared with the managers of the park so that they can better serve you in the future. The study is being carried out by the Tropical Conservation and Development Program, the Department of Food and Resource Economics of the University of Florida in the United States, and the Colombian National Parks Special Management Unit. You will be asked about your current and past visits to the park. The duration of the interview is about 10 minutes. The survey is anonymous in that you will not be asked to provide your name or any other type of identification. There are no risks for participating in this study. Your participation in this study is completely voluntary. There is no penalty for not participating. You have the right to withdraw from the study at anytime without consequence. For questions about your rights as a research participant, contact the IRB office at 352-392-0433 or irb2@ufl.edu. For questions regarding this study, you can contact me at 352-870-7604 or sergioal@ufl.edu, or my supervisor (Dr. Larkin) at 352-392-1845 ext. 431 or slarkin@ufl.edu.
Will you participate in the study? Yes No

Introduction

Thank you for participating in the Valuation of Los Nevados National Park survey.

Date:_____, Time: _____

Visitante de: Salida Entrada

Part 1. Visitation to Los Nevados National Park

1) Is this your first visit to Los Nevados National Park? Yes No

2) If No, how many times did you visit the Park in the past 12 months? _____ trips

3) And, about how many days total did you spend in the park during those trips? ____ days

4) When will you be leaving this Park? _____ (date)

5) Is this Park the primary purpose of your trip? Yes No

Part 2 Travel Expenses to Visit the Park

The following questions pertain to this specific visit to Los Nevados National Park:

6) How many other people, if any, are you currently traveling with? _____ people

7) If you are traveling with others, how many including you are employed full time? _____

8) How many are under 18 years of age? _____ children

9) Where are you traveling from? _____

10) During this trip, how many nights will you spend away from home? _____ nights

11) What transportation method(s) have you used to come to the park? Explain thoroughly.

_____
_____
_____

The next four questions ask about expenses for your group on this trip for transportation, lodging, equipment rental and guide fees. Approximately, how much was spent on….

12) Transportation? _____ Columbian pesos per: person group

13) Lodging? _____ Columbian pesos per: person group

14) Equipment rental? _____ Columbian pesos per: person group

15) Guide fees? _____ Columbian pesos per: person group

Part 3 Value of Park Restoration

16) How familiar are you, if at all, of there being recent wildfires at Los Nevados National Park?
not at all familiar, somewhat familiar, or very familiar

In July 2006 several wildfires swept through this Park and burned about 7,000 hectares of forest and paramo and affected the ecosystems. Park authorities are considering increasing the entrance fee to finance a full restoration of the area affected, which would completely restore the integrity of the ecosystems.

I am going to show you a card with the proposed fee increase. Please consider how much you spend on recreation each year and for this trip. Would you have been willing to pay this extra amount per person during this visit?

17) Card A: 2,000 pesos yes no don't know refuse

18) If your answer is NO, what is the highest amount you would be willing to pay as an increase of the existing park fee on this visit? _____pesos

19) If your answer is YES, what is the highest amount you would be willing to pay as an increase of the existing park fee on this visit? _____pesos

Part 4 Environmental Services

The next three questions ask about your awareness of the environmental services provided by the park.

20) Are you aware that this Park is the source of several rivers in the states of Caldas, Risaralda, Quindio, and Tolima, and supplies drinking water for more than 2 million people? Yes No

21) Are you aware that this Park offers refuge for several rare and endangered species of plants and animals, including Andean bears, wax palms, and condors, among many others? Yes No

22) Are you aware that the trees in this Park help to offset the greenhouse effect and thereby improve the environment by absorbing carbon dioxide? Yes No

Part 5 Demographics

23) In a scale from 0 to 10 where 0 is 'not at all, 5 is 'somewhat' and 10 is 'very', how concerned are you about environmental issues in Colombia?

0 1 2 3 4 5 6 7 8 9 10

24) Are you a member of, or do you donate money to, any environmental or nature-related organizations? Yes No

25) Do you visit National Parks or other natural areas regularly? Yes No

26) What year were you born in? _____

27) What is your marital status? single married divorced/separated widowed

28) What is the highest level of education you have completed?

_____ Less than elementary school
_____ Elementary School
_____ Secondary School
_____ College Degree
_____ Graduate or Professional Degree

29) From the card that I'm showing you, please select your annual household income?

A B C D E F

That is all. Thank you for your time. Have a good stay.

30) Gender of respondent: male female

Time completed: _____

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BIOGRAPHICAL SKETCH

Sergio Alvarez was born and raised in Manizales, Colombia. In 2001 he moved to South Florida to pursue studies in Environmental Science at Broward Community College. Sergio arrived at Gainesville in 2004 to enroll in the Environmental Science program at the School of Natural Resources and Environment at the University of Florida. In 2006 he joined the Food and Resource Economics Department at UF as a Master's Student. Sergio will continue his academic career in Food and Resource Economics at the University of Florida, where he will pursue a doctoral degree.