ABSTRACT

HALL, SIMON C. Beef Consumption in Curitiba, Brazil: Willingness to Pay for Sustainable Production. (Under the direction of Erin Sills).

Expansion of the beef industry in Brazil has propelled the nation to the forefront of both global production and international trade. Brazil now has the largest commercial cattle herd in the world. The growth of this industry has attracted significant controversy and concern. Expansion of cattle operations is associated with land use transformation in Brazil, including the intensification of existing ranches and controversial forest clearing for new pasture in Amazonia. Both of these processes are associated with potentially negative environmental impacts, including the degradation of local and regional soil and water quality and contributions to global climate change.

There have been efforts to harness market pressure to discourage deforestation and encourage more sustainable production. First, partnerships between domestic beef producers and export oriented organizations have sought to create international market opportunities for environmentally responsible domestic producers. However, the overwhelming majority of Brazilian beef production, approximately 83.5%, is consumed domestically. Second, beef can be certified organic, but currently only 1.67% of domestic beef producers have such certification. Although organic producers represent a relatively small proportion of total Brazilian agricultural producers, 40% of all organic production is consumed domestically, suggesting interest among Brazilian consumers.

In this thesis, I assess the viability of promoting more sustainable beef production via the domestic market for beef in Brazil. Specifically, I estimate willingness to pay for environmentally differentiated beef in a case study in the city of Curitiba. We conducted a

face-to-face intercept survey of a random sample (n=413) of residents of Curitiba who actively participate (consume and/or purchase) in the market for beef products. We assessed willingness to pay for environmentally differentiated beef (certified under a hypothetical program described in the survey) using a double bounded dichotomous choice question with follow up method. On average, survey respondents were willing to pay an additional R$ 2.39 per kilogram (12.8%), equivalent to approximately $1.30 USD per kilogram, more for beef that has a certification of sustainability. Coupled with recent growth in domestic organic markets in Brazil, this study provides evidence that environmentally differentiating beef products has potential as a market approach to promoting sustainable ranching in Brazil.

Beef Consumption in Curitiba, Brazil: Willingness to Pay for Sustainable Production

by
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DEDICATION

To my parents, Charles and Christine, for always supporting my ambitions and encouraging me to succeed. Thank you!

BIOGRAPHY

Simon Charles Hall was born on July 4, 1986 in Rochester, New York to parents Charles and Christine. The oldest of three, he has two younger brothers, Jake and Logan. Simon grew up playing soccer, surfing, and enjoying the outdoors. His passion for sports and the outdoors developed into a respect and concern for the natural world. As an undergraduate, Simon became interested in environmental issues and their relationship with economic-based decision making. The realization that these two fields are inexorably intertwined prompted Simon to make these disciplines the focus of his academic career, receiving Bachelor's degrees in Economics and Environmental Studies from Salisbury University. Simon continued his pursuit of knowledge through graduate studies and NCSU. Studying abroad in Brazil for 6 months, Simon had an opportunity to immerse himself in a new culture. While abroad, Simon gained international experience, taking classes taught in Portuguese while also collecting data and conducting research for his M.S. thesis. Upon completion of his Masters degree in Natural Resources, Simon hopes to earn a job applying his knowledge of environmental issues and economics to help promote and expand the application of sustainability in private enterprise.

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There have been efforts to harness international market pressure to discourage deforestation and encourage more sustainable production. Partnerships between domestic beef producers and export oriented organizations such as the Association of Brazilian Beef Exporters (ABIEC), the Brazilian Trade and Investment Promotion Agency (ApexBrasil), and the Brazilian Association of Organic Beef Cattle (ABPO), help provide international market opportunities for environmentally responsible domestic producers. Although such efforts exist, the overwhelming majority of Brazilian beef production, approximately 83.5%, is consumed domestically (ABIEC 2011). To assess the viability of a market approach to promoting more sustainable beef production, I analyze the domestic market for beef in Brazil, estimating willingness to pay for environmentally differentiated beef in a case study in the city of Curitiba.

The primary goal of this study is to assess the potential market for environmentally differentiated beef products in Brazil. Specifically, I assess consumer preferences regarding beef, consumer knowledge about the source and environmental impacts of beef production, and consumer willingness to pay for certified sustainable beef. My study area is Curitiba, the capital city of the southern state of Paraná, Brazil. Willingness to pay was elicited through contingent valuation questions in a personal face-to-face intercept survey, resulting in estimates of consumer willingness to pay for certified sustainable beef products. This thesis presents the results of this survey in the context of a literature review on the market for Brazilian beef, the use of contingent valuation methods (CVM), product differentiation and eco-labels as well as the state of the organic agricultural sector in Brazil.

1.1 Understanding the Market for Brazilian Beef

The global market for animal food products and the demand for meat based sources of protein have increased significantly throughout the world (Speedy 2003, Nicholson et al. 2001, Brown et al. 1996, York and Gossard 2004). Beef represents an important livestock commodity in the global market for animal based food products. Growth in the global market for beef products has promoted significant expansion of cattle operations throughout the world (USITC 2008). The expansion of meat producing cattle operations in Brazil has propelled the nation to the forefront of both global production and international trade (USITC 2008).

In 2010, the commercial cattle herd in Brazil was ranked the largest in the world (Ferraz and Eduardo de Felicio 2010). According to 2010 estimates by Food and Agriculture

Organization (FAO) and the Brazilian Institute for Geography and Statistics (IBGE), the total cattle herd consisted of over 209 million head (FAOSTAT 2010, IBGE 2010). From 2000 to 2010, the cattle herd in Brazil grew by more than 39.67 million head (FAOSTAT 2010). According to IBGE (2010), the Center-West region of Brazil, represented by the states of Mato Grosso, Mato Grosso do Sul, Goiás and the Federal District, has the largest cattle population of the five geographic regions in Brazil, with over 34.6% of the total domestic herd. The North region of Brazil represents approximately 20%, the South-East region approximately 18.3%, the North-East approximately 13.7% and the South approximately 13.3% of the total domestic herd (IBGE 2010).

The importance of beef products in terms of both domestic consumption and international trade has increased over time, resulting in significant expansion of cattle operations throughout Brazil. The expansion of the cattle herd in Brazil has been associated with significant increases in the production of beef products (FAOSTAT 2010, USITC 2008). From 1997 to 2007, the production of Brazilian beef increased by more than 3.38 million metric tons, from 10.3% to 14.4% of total global production (FAOSTAT 2007). In 2005, Brazil surpassed the European Union (EU-27) to become the second largest producer of beef in the world (FAOSTAT 2010).

In 2003, the export potential of Brazilian beef increased significantly when approximately 1.5 million square kilometers of southern and eastern Amazonia were declared free of foot and mouth disease (FMD) (Nepstad et al. 2008, Nepstad et al. 2006). Several incidents of bovine spongiform encephalopathy (BSE) traced to cattle from the United States also significantly increased the competitiveness of Brazilian beef producers (Nepstad et al.

2006). These synergistic factors lead to substantial increases in Brazilian production and export of beef, resulting in a growing share of the global market. From 2000 to 2007, Brazilian exports of bovine meat[1] increased by more than 400%, from 6.9% to 21.7% of total global exports (FAOSTAT 2007). During this time period, exports continued to expand and in 2004 Brazil became the leading world exporter of beef products (FAOSTAT 2010).

Bovine meat represents a valuable source of proteins, vitamins, minerals and micronutrients that are an important component of human development and growth (Bender 1992). The consumption of animal based food products, especially beef, has become an increasingly important dietary component of many societies throughout the world (Delgado 2003, York and Gossard 2004), including Brazil (IBGE 2009). According to the Association of Brazilian Beef Exporters (ABIEC), the majority (83.5%) of beef is consumed domestically, while only 16.5% is exported to foreign markets (ABIEC 2011). From 1987 to 2007, the per capita consumption of bovine meat products in Brazil increased from 24.9 kg/ year to 37.2 kg/ year, respectively (FAOSTAT 2007). The correlation between socioeconomic status and consumption of animal based food products suggests that increasing levels of per capita income in Brazil will drive increased domestic demand for beef products (Speedy 2003, Rask and Rask 2011).

Currently, the Legal Amazon accounts for nearly half of the entire Brazilian cattle herd. The Legal Amazon spans nine states (Acre, Amazonas, Amapá, Maranhão, Mato Grosso, Para, Rondônia, Roraima and Tocantins), covering a geographic area measuring 550

[1] FAO classifies "bovine meat" as a composition, including; meat of a bovine animal, boneless (beef and veal), dried, salted, smoked, meat extracts, sausage beef and veal, preparations of beef meat, canned, homogenous preparations and buffalo meat (for this study, buffalo meat was excluded from all bovine meat calculations).

million hectares (Browder 1988). The initial growth of cattle ranching in this region was spurred by government incentive programs and rural credit initiatives that followed colonization projects in the 1960s and 1970s (Walker et al. 2000). Fiscal incentives for establishing cattle operations in this region included a variety of tax holidays, direct subsidy payments and rural credit opportunities (Browder 1988, Mahar 1990, Binswanger 1991). From 1965 to 1983, the Superintendence of the Development of the Amazon (SUDAM) approved 808 projects (agricultural operations eligible for credit and other forms of subsidies) in the Legal Amazon, 58% of which were livestock operations (Browder 1988). During this same time period, SUDAM distributed over 1.4 billion USD in direct tax credits to projects in this region, 42% of which were allocated to livestock operations (Browder 1988). By 1985, SUDAM had approved approximately 631 livestock projects (the majority of these focused on cattle), covering a total area of 8.4 million hectares, an average of nearly 24,000 hectares per ranch (Mahar 1990).

In addition to direct tax credits, the Brazilian government also provided income tax exemptions and rural credit opportunities for SUDAM approved projects in the Legal Amazon. As specified by Law Nº 5.174 and amended by Law Nº 1.564, companies were permitted up to 100% tax exemptions for up to 15 years on income generated from projects approved by SUDAM (Browder 1988). By 1983, SUDAM approved corporate income tax holidays for approximately 328 cattle operations (Browder 1988). Rural credit disbursements also played an important role in stimulating ranching prospects in the Legal Amazon (Browder 1988). Altogether, from 1966 to 1983, total investment tax credits to the livestock

sector and subsidized rural credit disbursements for pasture creation have been conservatively estimated at over 730 million USD (Browder 1988).

Thus, the livestock sector was one of the primary beneficiaries of government sponsored policies promoting development of the Legal Amazon region through the early 1980s. These policies directly contributed to land use conversions, promoting forest clearing and pasture creation. In 1980, there were an estimated 8.93 million head of cattle occupying the Legal Amazon and pasture formation accounted for over 12.36 million hectares of altered land (Browder 1988). According to 1980 Landsat estimates, total pasture formation, including those funded by SUDAM, accounted for approximately 72% of the region's deforested area (Browder 1988).

Advantageous market conditions and land speculation has continued to promote the expansion of cattle operations throughout the Legal Amazon since the early 1980s (Bowman et al. 2012). According to IBGE (2010), the total cattle herd in this region, in 2010, totaled over 104 million head, representing approximately 49.6% of the total domestic herd. From 1980 to 2010, the total Brazilian cattle herd grew by more than 90 million head, averaging approximately 3 million head of cattle per year. From 1990 to 2007, the herd grew by more than 53 million head (Bowman et al. 2012). The majority of this growth, 83%, occurred in the Amazon (Bowman et al. 2012). Production of cattle, particularly in this region of Brazil, has long been controversial due to the environmental impacts associated with forest clearing and pasture creation (Fearnside 1999, Walker 2009, MacDonald and Simon 2011). According to recent estimates, pasture land occupies approximately 85% of total cleared areas in the Amazon (Bowman et al. 2012).

The expansion of cattle operations throughout Brazil has drawn considerable attention, both domestically and internationally from government agencies, researchers and environmental organizations (Bowman et al. 2012). Recently, attention has been directed towards management techniques, specifically the implications of intensifying ranching operations (Bowman et al. 2012). With regards to cattle operations, intensification can be used to describe a wide range of practices, from increased intensity of extensive pasture systems to a complete transition to feedlots (Cohn et al. 2011). Although intensification methods vary across Brazil, the primary objective is to increase the animal stocking ratio. Feedlot systems represent a method of intensification for Brazilian cattle ranchers. In Brazil, cattle operations are generally managed as open graze systems in which animals are raised and finished on natural pastures (Ferraz and Eduardo de Felicio 2010). Cattle raised in feedlot systems, currently, only account for approximately 5% of total Brazilian production (MacDonald and Simon 2011).

In contrast to open graze pasture systems which are characterized as one of the most extensive land uses for cattle production in Brazil, feedlots represent one of the most intensive animal based agricultural systems. Given that intensification efforts are increasing in Brazil, feedlots can be compared against pasture based systems to examine tradeoffs between the two production methods. Although open-graze management systems are often considered as a more "natural" production method relative to feedlot systems, they do not necessarily have lower environmental impacts. For example, tradeoffs exist between greenhouse gas emissions from the two systems. Using a life cycle assessment analysis, Peters et al. (2010) show that grain-finished beef (feedlot systems), when compared against

open graze production methods, are associated with 38% fewer enteric methane emissions. Harper et al. (1999) found that methane emissions associated with grain-fed cattle are nearly 70% less than those associated with pasture fed cattle, primarily due to improved animal digestion resulting from higher quality feed.

Although feedlot systems have been associated with lower overall methane emissions, there is evidence that they emit significantly more carbon dioxide, per animal (relative to pasture based systems). Phetteplace et al. (2001) found that the carbon dioxide emissions from feedlot cattle systems in the U.S. significantly exceeded other production methods, including cow-calf and stocker. Grain cultivation, processing and transportation were primarily responsible for the higher CO2 emissions levels in feedlot systems (Phetteplace 2001). In general, feedlot systems, compared with open graze pasture systems, are associated with higher quality feed, resulting in easier digestion and lower enteric methane emissions (Phetteplace 2001, Harper et al. 1999, Peters et al. 2010). However, the production, transportation and processing of feed for cattle is associated with significantly higher CO2 emissions (Phetteplace 2001, Harper et al. 1999, Peters et al. 2010).

The relationship between feed management and GHG emissions creates tradeoffs between feedlot and pasture based production methods. The greenhouse gas emissions associated with forest clearing and pasture creation as well as ranching operations have raised concerns as to the sustainability of these agricultural practices in Brazil. Given the undesirable implications associated with agricultural extensification of cattle operations coupled with international pressures to reduce greenhouse gas (GHG) emissions (especially those associated with land use conversion from forest clearing), the Brazilian government is

promoting the intensification of land use in an attempt to increase production per unit of land and thereby mitigate rates of deforestation (Gouvello 2010, Cohn et al. 2011). International climate negotiations and increased awareness of global environmental issues has led to the development of Brazil's Nationally Appropriate Mitigation Actions (NAMAs). This plan explicitly targets cattle operations by committing 10% of total GHG mitigation to come directly from changes in cattle ranch management (Cohn et al. 2011).

Although intensification efforts may help improve per unit production of beef and thereby reduce pressures for deforestation, there are also concerns about the ecological impacts associated with high intensity cattle production. Intensified production can significantly affect both local and regional soil and water quality (Neill et al. 2006, Neill et al. 2011), which has raised concerns about the viability of intensification from both an environmental and social welfare perspective. Given the relatively marginal agricultural soil qualities characteristic throughout much of Brazil (Resk 1998, Vosti et al. 2002) coupled with the higher initial capital and labor costs associated with intensive agriculture (Vosti et al. 2001), it is uncertain whether or not intensification alone will be able to provide solutions to the environmental issues associated with cattle production in Brazil.

As an alternative to intensification, some Brazilian producers are engaged in organic ranching to help reduce the environmental impact associated with cattle production. According to the most recent Agricultural Census, there are over 30,000 organic animal based agricultural operations in Brazil, representing approximately 1.67% of total animal based producers (IBGE 2006). Although there is evidence that the organic sector is growing

in Brazil, the majority of all organic agricultural products, 60%, are exported to foreign markets, primarily the U.S., Europe and Japan (IBGE 2006).

To help mitigate greenhouse gas emissions and the loss of ecological services associated with both the intensification and expansion of cattle operations in Brazil, management alternatives that promote more sustainable approaches to ranching could be encouraged. Although the organic agriculture sector of Brazil is primarily oriented towards foreign markets, there is evidence that this sector is expanding domestically. To increase conservation practices and promote more sustainable management strategies in Brazilian cattle operations, it is necessary to develop a better understanding of the mechanisms that drive the market for domestic beef products. Consumer preferences represent a significant factor in the market for beef products and have the potential to alter the decision making patterns of suppliers. There is evidence of this in the growing consumer demand for organic agricultural products, which are argued to be healthier for both the consumer and the environment. Therefore, it is important to understand consumer consumption patterns and individual preferences for beef products in order to identify possible management strategies that encourage environmental stewardship while continuing to meet consumer demands. This knowledge will help inform market based environmental strategies that seek to harness consumer preferences to provide an incentive and compensation to producers to adopt more sustainable production methods.

1.2 Understanding Organic Policy in Brazil

In 2003, the federal government of Brazil established a broad and inclusive conceptual definition for organic agricultural production (Lei Nº 10.831).

> *"An organic agriculture and livestock production system is considered to be any system that employs specific techniques by optimizing the use of available natural and socioeconomic resources and respecting the cultural integrity of rural communities with the purpose of attaining economic and ecological sustainability; maximizing social benefits; minimizing dependence upon non-renewable energies; employing cultural, biological and mechanical methods wherever possible, as opposed to the use of synthetic materials; eliminating the use of genetically modified organisms and ionizing radiation at any phase of the production process, processing, storage, distribution and trading; and protecting the environment"* (Lei Nº 10.831).

Comprehensive regulatory procedures and guidelines were incorporated into Law Nº 10.831 in 2007 with the addition of Decree Nº 6.323. In 2011, Law Nº 10.831 was amended (Law Nº 10.831/ 03) to include specific provisions that oblige all products marketed as organic (domestic or imported) to be inspected and certified by an accredited entity. According to the requirements set forth by Law Nº 10.831/03 and Decree Nº 6.323, there are three distinct classifications for the organic agricultural sector in Brazil; direct sale to consumer, Participatory Guarantee Systems (PGS) and audited certification. Direct sale of organic agricultural products from farm to consumer does not require certification. Producers engaged in direct sale are required to maintain 'operational organization' and formally register with the Ministry of Agriculture. Participatory Guarantee Systems (PGS) mainly rely on social control measures. Producers are required to be organized under a legal entity which must be registered with the Ministry of Agriculture. This legal entity is directly responsible for issuing the necessary documentation required for quality assurance and validation in the market. Audited certification requires accredited assessments of compliance by third party organizations that are registered, certified and accredited by the Ministry of Agriculture.

Ecocert – Brasil, IBD certifications, IMO - Control do Brasil, INT (Instituto Nacional de Technologia) and TECPAR - Instituto de Tecnologia do Paraná represent a few of the large nationally recognized accredited certification entities.

Ecocert – Brasil was established in 2001 and is based on the model of certification developed by the French company, Ecocert. Currently, Ecocert - Brasil and the associated international Ecocert branches, such as Ecocert SA have international accreditation in Europe, the United States and Japan. Ecocert – Brasil is headquartered in Florianópolis, Santa Catarina and has operations throughout the country in nearly every state with the majority of certified organic projects concentrated in the state of São Paulo (Ecocert-Brasil).

IBD certifications were established in Brazil in the late 1980s and early 1990s and were based on the Institute for Biodynamic and Rural Development's self proposed standards (IBD). Currently, IBD certifications are internationally recognized with accreditation from IFOAM (International Federation of Organic Agricultural Movements), DAR (Deutsche Akkreditierungsrat) of Germany, USDA (United States Department of Agriculture), Demeter International and JAS (Japan Agriculture Standard). IBD is headquartered in São Paulo and has operations throughout Brazil as well as Paraguay, Mexico, China and Thailand. Certifications cover a range of organic agricultural products, including a wide variety of fruits, soybean, honey, coffee, cotton, tea, beer, wine as well as beef, poultry, milk, eggs and shrimp (IBD).

The Brazilian Association of Organic Ranching (ABPO) was created in 2001 and represents a major producer organization for certified organic beef in Brazil (ABPO). ABPO is composed of cattle ranchers with operations in the Pantanal wetlands region of Mato

Grosso do Sul. Members of this association are certified under compliance with IBD certification standards and, in addition, ABPO offers optional IFOAM accreditation. Currently, the association is made up of 20 ranches, covering 110,000 hectares and approximately 35,000 head of cattle ABPO (ABPO).

IMO - Control do Brasil was established in Brazil in 2001 under the Swiss based certification company IMO (Institute for Market Ecology). Currently, IMO is present in over 50 countries throughout the world with over 20,000 certified projects, coving an area of approximately 200,000 hectares (IMO). IMO – Control do Brasil is internationally recognized with accreditation by IFOAM and ISO 65 certifications, providing access to markets in Europe, USA and Japan (IMO). IMO – Control do Brasil is headquartered in São Paulo and has certified operations throughout the country (IMO).

INT (Instituto Nacional de Technologia) is a governmental unit of the Ministry of Science, Technology and Innovation (MCTI) responsible for promoting the sustainable development of Brazil through technological research, development, innovation and knowledge transfer (INT). INT was established in Brazil in 1921 and in 2001 became the first public federal organization to be accredited for product certification in Brazil (INT). In 2012, INT was accredited as a third party certification entity for organic agricultural products in Brazil (INT). INT is headquartered in Rio de Janeiro and provides accredited certification services for the entire country (INT).

TECPAR - Instituto de Tecnologia do Paraná is a public company based in Curitiba, Paraná. In 1999, TECPAR received accreditation as a third party certification entity for organic agricultural products from the Ministry of Agriculture (TECPAR). TECPAR certifies

a wide variety of organic agricultural products, including both vegetable and animal based commodities. Although the majority of certified agriculture operations are concentrated within the state of Paraná, TECPAR services the entire country with operations throughout Brazil. TECPAR certification authorizes use of the Organic Seal of Brazil, a nationally recognized product symbol (TECPAR).

In addition to third party certification entities, there also exists several organizations classified under the Participatory Guarantee System (PGS) in Brazil, including; Associação de Agricultores (ABIO), Associação de Agricultura Natural de Campinas (ANC) and Associação Ecovida – Organismo Participativo de Avaliação de Conformidade (OPAC). Associação de Agricultores (ABIO) represents the Biological Farmers Association of the state of Rio de Janeiro and was established in 1985 as a result of the first fair for organic products in Brazil. Through the Participatory Guarantee System (PGS), ABIO controls the quality of organic production for 131 members throughout the state. Associação de Agricultura Natural de Campinas (ANC) represents a similar organization, specific to the Campinas region in the state of São Paulo. Since 1991, ANC has been promoting sustainable activities and increasing public awareness of environmental benefits associated organic agriculture. Associação Ecovida (OPAC) represents a similar organization, specific to the southern region of Brazil, including the states of Paraná, Santa Catalina and Rio Grande de Sul.

There are several organizations that help monitor, regulate and enforce the organic sector in Brazil. In 2004, the Sectorial Chamber for the Organic Agriculture Production Chain (CSAO) was established as an advisory body for the Ministry of Agriculture (Egelyng

et al. 2010). CSAO consists of thirty three public and private representatives of the organic sector which review implementation of Law Nº 10.831 (Egelyng et al. 2010). The Ministry of Agriculture also established the Organic Agriculture Development Programme (PRO ORGANICO) to support production, manufacture and commercialization of certified organic agricultural products (Egelyng et al. 2010). PRO ORGANICO involves participation from all Ministry of Agriculture units, states, municipal authorities and civil society organizations, such as CSAO, the Organic Production Commissions in Federal Units (CPOrg) and the Organic Production National Commission (CNPOrg) (Egelyng et al. 2010). The Brazilian accreditation institution, INMETRO, is primarily responsible for reviewing and awarding accreditations of organic agriculture certifications for both third party auditors as well PGS. The Agrarian Development Ministry (MDA) also supports the organic sector in Brazil by providing financial support for land conversion from conventional to organic agricultural.

1.3 Understanding Organic Markets in Brazil

Domestic markets for organic agricultural products in Brazil are predominately concentrated in major metropolitan centers. According to Egelyng et al. (2010) and Guivant (2003), awareness of organic product labels and benefits associated with these types of production methods tend to be, in general, starting from a relatively low consumer and shop manager knowledge base. In an attempt to increase consumer awareness and market demand for organic agricultural products in Brazil, several federal, state and municipal "buy organic" campaigns have been initiated.

Since 2005, the Ministry of Agriculture (MAPA) along with the Association of Brazilian Supermarkets and several other governmental and non-governmental organizations have sponsored and promoted "Organic Food Week" throughout cities across Brazil (MAPA). The objective of Organic Food Week is to improve consumer awareness of organic agricultural products and help provide networking opportunities for producers. The week long campaign is promoted through newspaper, radio and television advertisements and offers seminars, technical meetings, workshops, educational courses, research presentations and organic product tastings for participants (MAPA).

In addition to the "Organic Food Week" campaign, the federal government also promotes other informational based strategies such as educational initiatives in public schools to help increase awareness of organic agriculture. In 2010, the Ministry of Agriculture (MAPA), the Ministry of Science and Technology (MCT) and the Ministry of Education (MEC) invested more than R$1 million (reais) for implementation of a one-year project focused on expanding school and community access to knowledge, technologies and materials associated with agro-ecology and organic production (MAPA). This project was initiated in every region of Brazil, across 30 selected schools and is forecasted to be permanently institutionalized in the coming years (MAPA).

Consistent with federal initiates towards education and the dissemination of knowledge, the Ministry of Agriculture also provides a variety of informational brochures for consumers. Brochures, such as "O Olho do Consumidor", 2009 (The Eye of the Consumer) and "Mechanismos de Controle para a Garantia da Qualidade Organica", 2008 (Mechanisms of Control to Guarantee the Organic Quality) provide both consumers and producers with

simplified, color, informational guides about organic agriculture (MAPA). These informational brochures are publically accessible through the centralized website for organic agriculture, developed by the Ministry of Agriculture (http://www.prefiraorganicos.com.br/).

Although multiple federal, state and municipal level initiatives exist to promote domestic markets, the organic agricultural sector in Brazil is predominately supported by external demand. According to the 2006 Agricultural Census, approximately 60% of total organic agricultural products are exported, primarily to the United States, the European Union and Japan. Among exported organic agricultural products; soybean, sugar, rice, coffee, cocoa, meat, dairy, honey and palm extracts represent the most important commodities. In terms of domestic production, livestock and animal based operations represent one of the largest categories of organic agricultural production. According to the 2006 Agricultural Census, approximately 42% of all organic agricultural operations were classified under the economic activities of cattle ranching and/or raising animals.

There are several governmental and non-governmental organizations dedicated to assisting Brazilian producers reach foreign markets. One of the largest export oriented initiatives is Project Organics Brasil. In 2005, APEX-Brasil, (the Brazilian trade and investment promotion agency), Development Institute of Paraná (now called Development Promotion Institute) IPD, and the Industrial Federation of the State of Paraná (FIEP) established the private joint initiative, Project Organics Brasil. The project began with 12 companies in the food sector of Paraná and has since expanded to include over 64 companies from 12 states in Brazil. In 2008, Project Organics Brasil was responsible for export of a total of 58 million USD worth of certified organic products to over 70 countries (organicsBrasil).

Project Organics Brasil continues to support Brazilian producers by facilitating participation in major international industry expos and fairs throughout the world, including "Expo West", "BioFach", and "All Things Organic".

Although a large portion of the organic agricultural sector in Brazil is driven by external demand, there is evidence that domestic markets are expanding throughout the country (Egelyng et al. 2010). According to Instituto Biodinâmico de Desenvolvimento (IBD) and Projeto Organics Brasil, the market for organic products in Brazil increased by 40% between 2009 and 2010 (IBD 2011). Currently, there are approximately 15,000 certified organic producers in Brazil, representing about one percent of the nation's farmers (Egelyng et al. 2010). Brazilian producers supply more than 700 domestically available organic product lines which are sold in more than 600 sales outlets, predominately in metropolitan cities throughout the country (Egelyng et al. 2010). Given continued multi-institutional collaboration, support from both the public and private sector along with increasing consumer knowledge and awareness of organic products as well as strong international support for sustainable development, the organic agricultural sector of Brazil may continue to expand, representing a larger more significant share of the domestic food and drink market.

1.4 Understanding the Use of CVM to Assess Consumer WTP

The values of most goods and services are well defined by economic markets through revealed prices and consumer decision making behavior. In contrast, non – market goods and services do not have observable monetary values, because they are not traded in a market with revealed prices. Most environmental goods and services, such as clean air, fresh water,

healthy biodiversity levels and biogeochemical processes, fall into this category. Non-market valuation methods have been developed to assess policy initiatives and assess damages from accidents that affect non-market goods and services.

The contingent valuation method (CVM) is a well-established tool for quantifying the values of non-market goods and services, in use since the 1960s (Carson et al. 2001). This method is based on a survey that directly asks respondents about their willingness to pay (WTP) for a specific environmental good or service (King and Mazzotta 2000). The CVM is referred to as "contingent" because it elicits WTP in a hypothetical market and the resulting value is therefore contingent on that market scenario (Carson et al. 2003, King and Mazzotta 2000). CVM is a type of stated preference method, as distinct from revealed preference methods that instead infer values from actual choices (King and Mazzotta 2000). The fact that contingent valuation is based on what individuals say they would do in particular hypothetical situations, as opposed to what they are actually observed doing, is the source of its greatest strengths and its greatest weaknesses (King and Mazzotta 2000).

The most significant advantages of contingent valuation are the ability to value non – use goods and services and the opportunity to introduce new or modified goods and services beyond the range of previous consumer experience (Carson and Hanemann 2005, King and Mazzotta 2000, Whitehead and Blomquist 2006, Venkatachalam 2004). This enables researchers to estimate the values that consumers place on goods and services that do not yet exist, which is valuable for product development and marketing schemes. Non –use (or passive use) goods and services are not associated with actual physical use or even the opportunity/ option to use a specific good or service (King and Mazzotta 2000).

Although estimation of passive use or non-use values is a significant advantage of CVM, it has also led to criticisms (Whitehead and Blomquist 2006). There is controversy over the validity and reliability of willingness to pay values elicited through contingent valuation methods, especially for non-use or passive-use goods and services (Venkatachalam 2004**,** Carson et al. 2003). Critics of CVM argue that the values elicited are inconsistent with the tenets of rationale choice and that respondents fail to approach the questions in a serious manner because the results of the survey are non-binding (Arrow et al. 1993). These criticisms are difficult to evaluate because most CVM studies cannot be externally validated, since there are no other methods available to elicit non-use values (Arrow et al. 1993, Venkatachalam 2004).

In addition to these fundamental criticisms of stated preference methods and the concept of non-use values, CVM is also subject to a host of other potential problems that can affect the reliability of value estimates. The accuracy of value estimates is highly dependent on the survey structure, the delivery method used to collect responses, the type of payment vehicle used to elicit willingness to pay values and other technical issues associated with recording responses and data collection (Whitehead 2006, Venkatachalam 2004). To address these issues, best practice methods have been developed for CV studies. The most widely accepted set of guidelines were produced in 1993 by a Blue Ribbon Panel on Contingent Valuation appointed by the National Oceanic and Atmospheric Administration (NOAA). Since the NOAA guidelines, many other references have been published on optimizing survey performance and increasing the reliability of CV studies (Arrow et al. 1993, Venkatachalam 2004, Alberini and Kahn 2006).

This literature generally suggests that reliable value estimates can be obtained with CVM through careful planning, appropriate structural organization and comprehensive preliminary testing (Arrow et al. 1993, Venkatachalam 2004). These steps are designed to minimize the effects of the following potential response biases in CVM surveys: hypothetical bias, strategic response bias, information bias, embedding effects, sequencing effects, protest bids, non - response bias and the 'warm glow' effect.

Hypothetical bias exists when respondents overestimate their real WTP (Whitehead and Blomquist 2006). Given the non-binding characteristics of the survey format, respondents may tend to state that they will pay for a good even if they would not actually purchase, given a real opportunity (Whitehead and Blomquist 2006). Loomis et al. (1996) and Cummings and Taylor (1999) find that hypothetical bias can be mitigated by including additional instructions and certainty verifiers during the elicitation questions.

Strategic response bias occurs when respondents provide answers to intentionally influence a particular outcome (Venkatachalam 2004, Haddad and Howarth 2006). To help reduce the impact of strategic response bias, dichotomous choice payment formats have been used (Venkatachalam 2004). In addition, Mitchell and Carson (1989) suggest that CV studies be designed so that the questionnaire does not provide any "hints" which may encourage strategic responses.

Information bias may occur when respondents are forced to value attributes of an unfamiliar scenario (Arrow et al. 1993). To address this issue, the NOAA Panel recommends providing respondents with a detailed and accurate description of the scenario to be valued. Ajzen et al. (1996) find that information bias is particularly likely when respondents lack

prior knowledge of the good and therefore, recommend that valuation questions be formatted around goods with which respondents are well acquainted.

Embedding effects exist when respondents either internalize or externalize attributes of a valuation scenario that are beyond the intended research parameters. This often leads to inconsistency in valuation estimates (Venkatachalam 2004, Haddad and Howarth 2006). As a check on embedding, the NOAA Panel recommends building an internal consistency test into the survey (Venkatachalam 2004). In addition, Corso et al. (2001) found that the use of effective communication devices, such as visual aids, improved the accuracy of respondents' interpretation of the survey instrument and reduced issues associated with embedding.

Sequencing effects exist when responses are influenced by the specific organizational structure of the survey questions and or response values (Venkatachalam 2004, Arrow et al. 1993). Boyle et al. (1993) found that respondents not familiar with the good were more likely to be affected by the sequencing of questions or answer categories, and suggest that improved knowledge about the valuation scenario and good in question may potentially reduce these effects. Mitchell and Carson (1989) suggest that respondents be informed of what is to come before the WTP question and be provided with an opportunity to revise their responses to the questions.

Protest bids occur when respondents refuse to answer the CVM question or drop out of a survey entirely (Haddad and Howarth 2006). Extremely low or zero bids and extremely high or infinite bids have also been considered "protest bids" (Haddad and Howarth 2006). To minimize this problem, Hanemann (1994) recommends dichotomous choice rather than open ended elicitation format. General survey methodology suggests that protest bids could

also be minimized through a user-friendly, easy to follow questionnaire that does not elicit personal identifiable information from respondents.

Non – response bias occurs when individuals who do not respond to the survey or the CVM question are systematically different from individuals who do respond (Arrow et al. 1993). To minimize non-response, the NOAA Panel recommends comprehensive pre-testing of the survey questionnaire and careful experimental design and planning.

The 'warm glow' effect exists when respondents have additional positive feelings, beyond those directly in question, distorting valuation estimates (Haddad and Howarth 2006). This effect is often observed in charitable donations. Although the 'warm glow' effect has been identified as a potential issue in CVM, there are no clearly defined guidelines or strategies developed to minimize its effects.

Although all of these response biases have been identified in CVM survey data, several decades of research and analysis provide best practice recommendations on how to identify them and minimize their effects. They need to be considered carefully, especially when aggregating value estimates to inform public policy decisions. However, the literature suggests that CVM can at least provide preliminary evidence of market tendencies and initial estimates of WTP.

1.5 Understanding Product Differentiation

The theory of product differentiation can be traced back to the work of Chamberlin and Robinson in 1933 (Sharp and Dawes 2001). Since then, product differentiation has been analyzed from a variety of perspectives. From a competitive marketing approach, product

differentiation represents a strategy whereby firms attempt to increase the desirability and consumer value of their products over those of their rivals (Niederhauser 2008). Strategic marketing emphasizes a specific set of product characteristics in an attempt to increase the perceived value of the good (Niederhauser 2008). The characteristics associated with a commodity provide an important combination of values that can potentially influence consumer utility and thus decision making patterns (Ireland 1987). The process of identifying consumer values associated with specific product characteristics is an integral component of competitive marketing strategy and can provide significant advantages for sellers.

Products can be differentiated through a wide range of characteristics (Beath and Katsoulacos 1991), and competitive marketing strategies for differentiated products often advertise a multi-dimensional spectrum of consumer benefits. The most prevalent non-price competitive marketing strategies differentiate products by quality distinctions (Ireland 1987). The perception of higher quality characteristics in differentiated products (over non-differentiated products) is a significant determinant of consumer willingness to pay and purchasing behavior.

Environmentally differentiated products include both perceived direct benefits of consumption and potential indirect environmental benefits (Bougherara and Combris 2009). The perceived health benefits of consuming products, such as organic goods, which have not been genetically modified or subject to ionizing radiation, represents a direct benefit gained by the consumer. Environmentally differentiated products also provide indirect benefits for the natural world, including improvements in ecosystem services and the promotion of sustainable land use practices associated with more eco-friendly production methods. The

indirect consumption benefits associated with these types of products provide external values, beyond those associated with direct consumption, both before and after final use by the consumer. The direct and indirect consumption benefits of environmentally differentiated products provide multi-dimensional attributes that may help improve the marketability of this class of commodity (McCluskey and Loureiro 2003).

Environmentally differentiated products include a wide range of characteristics, benefits and commodity types. According to Rubik and Frankl (2005), the majority of products differentiated based on environmental attributes can be characterized as credence goods. This is because some of their attributes cannot be easily identified through consumption (Rubik and Frankl 2005). As a result, marketing strategies need to provide consumers with detailed information about the environmental attributes not evident from consumption (or observation) of the good (Rubik and Frankl 2005). More specifically, the environmental attributes of these goods could be characterized as credence attributes because the consumer transaction costs associated with investigating the ecological benefits are beyond the expected range of feasibility and may even, in some instances, be prohibitive (Rubik and Frankl 2005). In many cases, detailed information regarding production processes and associated attributes is held privately by the producer firm and not publicly available (Rubik and Frankl 2005).

To help address this information asymmetry with credence goods, external purchasing support and knowledge delivery systems are needed (Rubik and Frankl 2005). These have been labeled as “environmental product information schemes” (EPIS) (Rubik and Frankl 2005). Eco-labels represent a specific type of EPIS which, in particular, aims to

establish and verify a reliable and trustworthy information system for product features (Rubik and Frankl 2005). The application of eco-labels as a strategy for environmental product differentiation can be traced back to the 1970s and 1980s with early initiatives such as the International Federation of Organic Agriculture Movements and the German Blue Angel (Boström and Klintman 2008). Since these earlier initiatives, the application of eco-labeling and environmental product differentiation strategies have expanded throughout much of the industrialized world, especially in Europe, Canada and the United States (Boström and Klintman 2008, Rubik and Frankl 2005).

The application of eco-labeling as a product differentiation strategy has become an important component of the consumer food market (Belz and Peattie 2009, Boström and Klintman 2008, Bougherara and Combris 2009). Evidence indicates that consumers are increasingly willing to incorporate environmental considerations into their decisions about food purchases (Bougherara and Combris 2009, Belz and Peattie 2009). The growing consumer trend towards environmentally differentiated food products is most evident in the expansion of organic markets throughout the world. From 1999 to 2007, the global food and drink market for organic products tripled in size, increasing from 15 billion USD to over 46 billion USD, respectively (Sahota 2009). The expansion of the organic industry continued through 2009, reaching a global market value of 54.9 billion USD (Willer 2011).

Consumer demand for organic products is highly concentrated in Europe and the United States, which together account for 97% of total global consumption (Sahota 2009). However, there is evidence of growing consumer demand for organic products throughout the world. According to the Instituto Biodinâmico de Desenvolvimento and Projeto Organics

Brasil, sales of organic products in Brazil increased by 40% between 2009 and 2010 (IBD 2011). With approximately one third of the world's organically managed land (11 million hectares) located in developing nations, there is significant potential for development of consumer markets for organic products in these countries (Willer 2009). Among developing nations, Brazil has the third largest area of organic agricultural land with over 1.77 million hectares (Willer 2009). These organic producers are well positioned to take advantage of the increasing consumer demand for organic food products in Brazil.

1.6 Conceptual Framework

The global market for beef has experienced significant changes in recent decades. Increased market participation (both consumption and production) in developing countries represents one of the most substantial changes. In response to the emergence of expanding market opportunities, Brazilian beef production has increased significantly (Nepstad et al. 2005). Brazil is now at the forefront of the beef industry, leading the world in export of beef products and ranking second (to the U.S.) in total global production (FAO 2010).

From an environmental perspective, the production and consumption of beef products has come under considerable criticism. The production and management systems of cattle operations in the tropics, especially the Brazilian Amazon region, have been frequently accused of directly contributing to deforestation, environmental degradation and the loss of ecosystem services (Nepstad et al. 2008, Fearnside 2005, Nepstad et al. 2005, and Walker et al. 2000). According to the Terra Class report by the Brazilian National Institute for Space Research (Instituto Nacional de Pesquisas Espaciais - INPE), by 2008, approximately 71.9

million hectares had been cleared in Amazonia (INPE 2011). Of the total forest area cleared by 2008, it is estimated that 44.7 million hectares, over 62%, is in pasture (INPE 2011).

One of the key environmental concerns with expanded cattle production is greenhouse gas emissions that contribute to climate change. In addition to the carbon emissions associated with converting tropical forest to pasture, the cattle production process itself is a significant source of emissions (Garnett 2009). Cattle, like other ruminant livestock, produce methane, a greenhouse gas, through the process of enteric fermentation which occurs during feed digestion (Verge´ et al. 2007). Emissions from ruminant livestock represent the largest source of agricultural methane in the world (Verge´ et al. 2007). The production of methane through the process of enteric fermentation represents approximately 75% of total life cycle greenhouse gas emissions (excluding land use change) from cattle in Brazil (Cederberg et al. 2011). Life cycle greenhouse gas emissions of Brazilian cattle, excluding land use change, have been estimated at a national average of 28kg CO2 equivalent per kg carcass weight (Cederberg et al. 2011). Including land use change can increase life cycle greenhouse gas emissions from Brazilian cattle to an estimated 44 to 726 kg CO2 equivalent per kg carcass weight, depending on the type of land use converted to pasture (Cederberg et al. 2011).

Although opposition to beef consumption exists and considerable literature has been published identifying the negative environmental impacts of beef production, global demand for beef products continues to increase (Speedy 2003). The correlation between socio-economic status and animal based protein consumption along with the increasing affluence of developing nations, supports the forecasted expansion of global demand for beef products

(Speedy 2003). As a result of the importance of beef in both world and Brazilian domestic markets coupled with the undeniable ecological impacts of cattle production, it is important to develop alternative management strategies that emphasize environmental stewardship and help transition the industry to a more sustainable path of development.

The certification and labeling of beef products that are produced in a more environmentally sustainable way is one possible option to help reduce the negative impacts of current management practices. In this context, product differentiation and strategic marketing may provide some of the tools necessary to help transition domestic production in Brazil to a more sustainably managed system. The viability of certification schemes and marketing strategies based on environmentally differentiated "sustainable beef" depends on whether Brazilian consumers perceive values in those differentiated beef products and whether those values are sufficient to cover any additional production costs. Evidence of Brazilian consumer willingness to pay for improved environmental quality through retail purchases of differentiated beef products would help evaluate the viability of a market approach to promoting improved production practices in the Brazilian cattle sector. Such a market approach could involve certification and the application of an environmental information labeling scheme.

There is substantial literature describing consumer demand for environmentally differentiated products in the affluent markets of the developed and industrialized world (Bostrom and Klintman 2008, Rubik and Frankl 2005, McCluskey and Loureiro 2003). However, there is considerably less known about the consumer preferences of the growing middle class in developing countries. Because of the significant proportion of beef

production absorbed by the domestic market in Brazil, this represents critical information needed for assessing whether market demand can be harnessed to promote more sustainable production.

Environmentally differentiated agricultural goods can be produced using a wide range of management methods. Products marketed as 'organic', 'natural', or 'sustainable', represent forms of environmental differentiation. Although these types of products tend to be marketed using relatively similar strategies, the production methods associated with these goods can vary significantly, especially with regards to cattle production in Brazil. The majority of beef production in Brazil is managed as an open-graze system in which animals are raised and finished on pasture grasses. Although this type of system can be characterized as a 'natural' production method (i.e. cattle are fed a diet consisting primarily of natural grasses), it does not necessarily represent a sustainable operation and may potentially contribute to soil degradation and nutrient leaching, as well as encourage deforestation and a variety of other types of environmental degradation. 'Natural' product systems in Brazil provide no guarantee of environmental stewardship or sustainable management. Therefore, this study elicits willingness to pay values for beef products that have a certification of environmental sustainability. In contrast to 'natural' certification, a 'sustainable' certification ensures environmental stewardship and guarantees that production is not ecologically damaging.

The primary goal of this study is to assess the potential market for environmentally differentiated beef products in Brazil. Specifically, I assess consumer preferences regarding beef, consumer knowledge about the source and environmental impacts of beef production,

consumer awareness of and demand for environmentally certified products and consumer willingness to pay for certified sustainable beef. My study area is Curitiba, the capital city of the southern state of Paraná, Brazil. Willingness to pay was elicited through contingent valuation questions in a personal face-to-face intercept survey, resulting in estimates of consumer willingness to pay for certified sustainable beef products. The willingness to pay question was based on payment for beef that had a certification of environmental sustainability or green seal.

2. The Study Region

2.1 The City of Curitiba: Background Information

The state of Paraná is located in the southern region of Brazil, bordered to the east by Atlantic coastline and sharing political bounds with the states of São Paulo to the north, Santa Catarina to the south and Mato Grosso do Sul to the West (Macedo 2004; Figure 1). In addition to domestic boundaries, Paraná also shares international borders with both Argentina and Paraguay. Geographically, the state of Paraná can be characterized by three distinct plateaus that extend westward from the Atlantic coastline, across the state along the Paraná River, and back down to the meeting of the rivers that form the Iguaçu Falls (Macedo 2004). The capital city of Curitiba is located within the first plateau at an altitude of 945 meters, separated from the Atlantic coastline by the Serra do Mar mountain range (Macedo 2004).

The territorial bounds of Curitiba span an area measuring 435,274 square kilometers (IBGE Cities@). According to the 2010 census, the population of Curitiba was estimated at 1,751,907 with a population density of approximately 4,024 inhabitants per square kilometer

(IBGE Cities@). The gender distribution of the city is estimated at approximately 47.7% male and 52.3% female (IBGE Cities@). The 2010 census enumerated 575,899 permanent private housing units with an average household occupancy of approximately 3.03 (IBGE Cities@).

Economically, the city of Curitiba can be characterized predominately by the service sector. In 2009, the gross value added from the service sector considerably outperformed both the industrial and agricultural sectors of the economy. Gross value added from the agricultural sector accounted for only R$16.19 million, while the industrial sector accounted for over R$7.36 billion and the service sector accounted for over R$30.5 billion (IBGE Cities@). In 2009, total Gross Domestic Product (GDP) in Curitiba was estimated at approximately R$45.7 billion, ranking fourth overall among large cities (over 1 million inhabitants) in Brazil (IBGE Cities@).

From a socio-demographic perspective, Curitiba represents one of the more affluent cities in Brazil. In 2009, GDP per capita, measured at current prices, was estimated at approximately R$24,720, significantly higher than the national average of R$15,989 (IBGE Cities@). According to the 2010 census, the resident population of Curitiba, at least 10 years of age, considered literate was estimated at 1.5 million, representing a literacy rate of 97.9%, significantly higher than the national average of 90.9% (IBGE Cities@). The rate of poverty incidence in Curitiba also ranks better than the national average, 31.71% compared to an average of 33.35% among all other state capitals (IBGE Cities@). In terms of inequality, measured by the Gini Coefficient, Curitiba also ranks very well among other Brazilian state

capitals with the second best index rating of 0.41, compared to an average of 0.47 among state capitals and an overall national average of 53.9 (IBGE Cities@).

In addition to the socio-economic affluence associated with Curitiba, the city has also been characterized as a model of sustainable development and smart growth (Rabinovitch 1992, Basiago, 1999). One of the most prominent features of sustainability in the city is the integrated network of public transportation and land use planning (Rabinovitch 1992, Basiago 1999). The public transportation system is based exclusively on the use of buses and a network of integrated routes (Macedo 2004, Basiago 1999). This system functions in coordination with zoning regulations which facilitates concentrated development, enabling the necessary densities that make public transit feasible (Macedo 2004, Basiago 1999). The bus system maintains segregated express bus lanes that permit rapid transit and avoid potential congestion from other sources of traffic, increasing the efficiency of the transportation system. (Macedo 2004). The bus system in Curitiba is also known for its 'tube' style street bus stop which allows users to wait in semi-enclosed stations elevated off the ground, enabling pre-boarding payment and efficient entrance and exit of the buses (Macedo 2004, Basiago 1999). In 2010, Curitiba was internationally recognized by Globe Forum of Stockholm when the city received the Globe Sustainable City award for excellent sustainable urban development (Globe Award 2010).

In addition to the integrated public transportation network, the city is also recognized for its innovative approach to trash collection. Instead of relying solely on publicly funded municipal trash collection services, the city adopted a multi-dimensional approach to street cleaning which incorporates a program for exchanging garbage for food (Basiago 1999).

Through this program, residents can collect street trash using publically supplied hand carts and exchange six bags of garbage for one bag of groceries, consisting of dietary staples such as rice, beans, eggs, fruits and vegetables (Basiago 1999). This program helps maintain cleaner public areas and also provides sustenance for economically disadvantaged individuals and families.

In terms of sustainability and environmental awareness, the city of Curitiba is also widely recognized for its recycling programs. In 1989, the city launched its public policy campaign of separating recyclable materials with the slogan "*Lixo que nao è Lixo*" (Garbage that is not Garbage) (Lubow 2007, Rabinovitch 1992). Public media campaigns coupled with educational programs throughout the public school system helped ensure the success of city recycling initiatives (Rabinovitch 1992, Basiago 1999). Approximately, 70% of all residents participate in recycling and trash separation initiatives, helping significantly reduce waste deposited in landfill sites (Rabinovitch 1992). It is estimated that the city of Curitiba recycles approximately 70% of all recyclable paper and 60% of all recyclable plastic, metal and glass (Basiago 1999). The paper recycling alone is estimated to save approximately 1200 trees per day (Rabinovitch 1992).

2.2 The Selection of Curitiba as a Study Site

As noted, Curitiba represents one of the most affluent cities in Brazil (Macedo 2004). The city has been widely recognized for its innovative approaches to public transportation and sustainable urban development as well as pioneering several recycling initiatives and promoting social programs that encourage solid waste removal (Rabinovitch 1992, Basiago

1999). The socio-economic and environmentally sustainable characteristics associated with Curitiba provide an advantageous framework for analyzing the market potential for environmentally differentiated products. In this sense, the city of Curitiba can be examined as one potential threshold market for certified sustainable agro-food products in Brazil. Thus, if Brazilian consumers would be willing to pay the price premiums associated with certified sustainable agro-food products, specifically beef, we would expect to find evidence of this in Curitiba.

In terms of household food acquisition, inhabitants of Curitiba consume an average quantity of meat compared with other large metropolitan centers throughout Brazil. According to the 2008 - 2009 Consumer Household Expenditures Survey, inhabitants of Curitiba consumed an annual estimated 24.97 kg of meat per capita (IBGE 2009). Beef consumption during this time period in Curitiba was estimated at 18.04 kg per capita annually, representing approximately 72.24% of total meat consumption (IBGE 2009). The average annual per capita meat consumption in large metropolitan cities throughout Brazil is estimated at 24.84 kg and average annual per capita beef consumption is estimated at 18.76 kg (IBGE 2009). Consumption levels of meat and specifically beef in Curitiba closely match those associated with national averages of other large metropolitan centers throughout the country, providing an excellent reference for willingness to pay estimates.

3. Methods

3.1 Survey Development

To gather information regarding purchasing preferences of beef products and to investigate the consumer value of certified sustainable beef products, a personal face-to-face intercept survey was developed and administered in the city of Curitiba. The survey was designed as a street intercept survey whereby respondents were interviewed in public locations throughout the city of Curitiba. Similar to consumer intercept surveys, street intercept surveys represent a type of marketing research which typically relies on obtaining a sample of product consumers at or near retail purchase locations (Green 1988).

Following consumer intercept methodology, the survey was intended to be conducted at locations where beef products are purchased, such as grocery stores, markets and butcher shops. Logistical limitations, however, prevented us from successfully securing permission to conduct surveys in a sufficiently diverse and large enough sample of private retail locations to conduct this type of research. Instead, we adopted a street intercept survey methodology. Street intercept surveys are methodologically similar to consumer intercept surveys, however, they have the advantage of not being bound to the exact location of retail purchase. Formatting the survey as a street intercept questionnaire provided a more extensive set of potential survey locations, relative to the limited scope of the consumer intercept methodology.

To ensure the survey captured the desired sample, participants in the market for beef products (inhabitants of Curitiba who actively purchased and/or consumed beef), the initial survey questions were designed as qualifiers, verifying the respondents' participation in the beef market and therefore enabling the survey to proceed.

The primary objective of the survey was to gather data on consumer willingness to pay values for improved environmental quality on cattle ranches in Brazil through retail purchases of certified sustainable beef. The questionnaire also collected data on respondents' purchasing preferences for beef, knowledge about the environmental impacts of beef production as well as a series of socio-economic demographic questions. To avoid confusion and entangled responses, all questions in the survey, regarding consumption and expenditure on beef products, were based on raw, uncooked meat.

The survey instrument included approximately 30 questions (depending on responses) spanning three pages. The survey was structurally organized into three distinct sections. The first section of the survey focused on respondents' preferences for beef, including consumption quantities and monetary expenditures. This section also included several questions regarding consumer knowledge and perceptions about environmentally differentiated products and knowledge about the impacts of beef production. The second section of the survey presented the contingent valuation scenario and recorded respondents' willingness to pay values for certified sustainable beef. The third section of the survey recorded individual and household demographic data as well as socio-economic information associated with the respondents.

The structural development of the survey was based on the conceptual framework of a marketing intercept survey. The survey was developed to be a quick 'intercept' type questionnaire, enabling data collection from respondents who were located in public areas throughout the city. To accommodate logistical limitations associated with stopping individuals to conduct interviews, the survey was designed to be completed between 10 and

12 minutes, using straightforward easy to understand questions. To ensure effective delivery and comprehension of the survey questions as well as to maintain an appropriate interview time length, the majority of questions were formatted with categorical responses. This formatting approach provided respondents with several categories, allowing selection of the most applicable range of values, thus enabling a fluent and efficient interview process.

The survey questions were collaboratively developed using a combination of published statistical data from Instituto Brasileiro de Geografia e Estatística (IBGE) and pre-test interviews with residents of Curitiba. Initial development of the survey was based on statistical data from IBGE. Selected data for Curitiba from the 2008-2009 Consumer Household Expenditure Survey and preliminary results from the 2010 Census were used to format the initial range of values for the majority of survey questions and response categories. Once the initial survey questions and response categories were developed an extensive pre-test interview process was conducted. We received all necessary approval from the North Carolina State University International Review Board prior to initiating the pre-testing phase of the survey.

Pre-test interview respondents represented a convenience sample of 10 residents of Curitiba who actively purchased and consumed beef products and were willing to collaborate with the research team. This group of pre-test respondents provided feedback throughout the entire survey development process. Throughout the pre-testing process, feedback from respondents was incorporated into the survey questions and response categories to more accurately reflect consumer perceptions and purchasing behavior as well as the most current information available on pricing.

3.2 Contingent Valuation Scenario and Willingness to Pay Questions

The contingent valuation (CV) section of this survey was developed based on the NOAA Blue Ribbon Panel (1993) guidelines for the use of CV to estimate passive use values. Although NOAA guidelines specifically consider applications for Natural Resource Damage Assessment (Ahearn et al. 2006), which are not applicable for this study, the survey instrument meets many of the specific design features identified by the NOAA Panel (see Table 1).

Although this study incorporated many of the NOAA Panel guidelines into the development of the survey instrument, several logistical limitations prevented the adoption of some recommendations. The NOAA Panel recommends formatting the willingness to pay valuation question as a vote on a referendum (Arrow et al. 1993, Ahearn et al. 2006). Given the strong negative sentiment towards elected officials and issues associated with governmental corruption expressed throughout the pre-testing stages, the willingness to pay questions were reformatted to reflect a less volatile and controversial payment vehicle. Instead of a referendum vote, the willingness to pay questions were formatted based on consumer market behavior and retail decision making. Although a referendum voting format was not used, the willingness to pay questions still maintain the dichotomous choice structure emphasized by the NOAA Panel.

The elimination of the referendum format of the valuation question may help reduce several concerns identified by the NOAA Panel as well as some critiques of the contingent valuation method. One of the most significant issues associated with survey interviews that

deal with tax increases or higher fees is strategic response bias (Barro et al. 1996, Fix et al. 2005, Loomis et al. 1996). Strategic bias is a problem because respondents often overestimate or underestimate their willingness to pay values in order to intentionally influence policy in a favored direction (Barro et al. 1996, Fix et al. 2005, Loomis et al. 1996). Restructuring the willingness to pay question away from the referendum format may help reduce respondent motivation towards strategic responses, helping improve the accuracy and reliability of value estimates.

The contingent valuation section of the survey was designed using a double-bounded discrete dichotomous choice structure, followed by an open-ended rationale question. The valuation scenario was carefully read by interviewers, providing respondents with an accurate description of the environmental issues associated with beef production in Brazil and the potentially beneficial impacts of sustainable production methods. Respondents were then presented with a hypothetical scenario in which they were provided a baseline per kilogram value for alcatra[2] and asked if they would be willing to pay more (on a per kilogram basis) for alcatra that had a certification of sustainability (or green seal). The stated prices ranged from R$ 18.10 to R$ 26.00, with discrete interval values of: 18.10, 18.25, 18.50, 19.00, 19.50, 20.00, 21.50, 23.00, 24.50, and 26.00. See Table 2 for details on the distribution of the bids. The discrete interval values were developed based on pre-tests, including debriefing interviews with the initial respondents. The baseline market value of uncertified alcatra, used in every survey, was R$ 18.00 per kilogram. The value was set

[2] Alcatra (al-kaht-ra) is a specific cut of Brazilian beef, comparable to the U.S. top sirloin cut. Alcatra is a popular cut of beef in Brazil and is prominently consumed during churrascos (Brazilian barbeques). It is characterized as an average priced cut of beef and is widely available at most grocery stores, markets and butchers throughout Curitiba.

based on a combination of first hand observations, pre-tests and published meat prices (Bem Paraná 2011).

Based on the introduced scenario and the given baseline price of alcatra, respondents were presented with a discrete dichotomous choice (Yes or No) for purchasing certified sustainable alcatra at R$18.00 + X (WTP values were randomly assigned to respondents). This initial willingness to pay question was followed by a second dichotomous choice question. The follow up question was designed to elicit either a higher or lower willingness to pay value based on the initial response. For example, if the response to the initial willingness to pay question was 'Yes', the respondent would be presented with a second dichotomous choice (Yes or No), based on the same scenario, but using an even higher per kilogram price of alcatra. In situations where the initial response was 'No', respondents were represented with a lower price, one which was between the baseline of R$ 18.00 and the initial price of the first willingness to pay question. Upon completion of both willingness to pay questions, respondents were asked to provide the rationale for their decisions. Following NOAA Panel recommendations, this was recorded using an open-ended response format.

The double-bounded discrete dichotomous choice elicitation format obtains more information about respondents' WTP amounts than the simple binary choice approach (Carson et al. 1994). However, it still imposes significantly less burden on respondents than other question formats, because individuals are not required to determine exact maximum willingness to pay values, only whether they would be willing to pay at least the amounts in question (Carson et al. 1994). The dichotomous choice method also tends to represent a more

familiar and realistic decision scenario, replicating how consumers generally make decisions about the purchase of private goods (Carson et al. 1994).

3.3 Interviewer Selection and Training

The survey instrument was designed to be implemented as an intercept survey, whereby respondents are stopped in public locations throughout the city of Curitiba and trained interviewers administer the questionnaire. A team of eight Brazilian students from the Universidade Federal do Paraná in Curitiba were hired to conduct interviews. They were selected based on their knowledge of environmental issues and ecosystem services and their personal communication and interviewing skills. The team included three women and five men, from the departments for Forest Engineering and Natural Resources.

The interview team went through a two stage training process. The first stage familiarized them with both the survey instrument and the types of questions to be administered. This stage of the training emphasized interviewing techniques and proper methodology. Interviewers were given specific instructions on how to select respondents from a group, specifically how to identify the individual in the group who was the primary decision maker with regards to household food purchases. Practice sessions within the group as well as with pre-test respondents helped significantly improve interviewer confidence and efficiency.

The second stage of training involved on-site practice interviews in public locations throughout the city. This provided the interview team with an active environment to experience real time data collection. Upon completion of practice interviews, I conducted de-

briefing sessions, allowing interviewers to clarify any questions that came up during the interview procedure. These practice interviews exposed the team to a dynamic data collection environment. Based on observational estimates and interviewer feedback, I found that training improved interviewing techniques, confidence in the field and the efficiency of data collection through the sample selection and interviewing stages of the survey.

After training, interviews were conducted during a ten day period in June of 2011 at selected locations in Curitiba.

3.4 Interview Location Selection

Interviews were conducted in public locations within the city limits of Curitiba (see Figure 2). Locations were selected based on two primary criteria: each site was conducive to stopping individuals for interviews, and the sites were distributed throughout the city. The locations selected included city bus terminals, public parks, and markets.

Bus terminals were selected because of their accessibility, high volume of foot traffic and the opportunity to interview respondents who were waiting in a centralized location. Specific terminals were strategically selected based on the high distribution of connective routes and the large spatial extent to which these routes serviced most of the city. Interviews were conducted at Terminal Carbral, Terminal Capão da Imbuia, Terminal Hauer, Terminal Portão, and Terminal Campina do Siqueira (see Figure 3). These centralized bus terminals provided access to multiple routes throughout the city, servicing the majority of neighborhoods in Curitiba. Thus, respondents in these locations were likely to include people from a wide range of neighborhoods throughout the city.

Interviews were also conducted at several public parks throughout the city as well as two public markets. Parks were selected based on location within the city, spatial proximity to other survey sites and observational estimates of daily foot traffic. Interviews were conducted at Jardim Botanico, Praça Japão, Praça Santos Andrade, Passeio Público, and Praça Rui Barbosa. Markets were selected based on observational estimates of popularity and size as well as pre-test respondent recommendations. Interviews were conducted at Mercado Municipal and the Largo da Ordem street fair.

The twelve selected interview locations (see Figure 4) were designed to capture a diverse sample, including residents from different neighborhoods and different socioeconomic classes. Further, by selecting bus terminals, popular parks and busy markets, we ensured that there were always large numbers of people who could be approached to take the survey, increasing the interviewers' efficiency.

3.5 Data Management

The survey was implemented with paper and pencil interviews (PAPI). This method of data collection utilizes printed questionnaires which includes the entire series of questions and spaces for recording responses. The PAPI technique allows interviewers to record data directly on the survey instrument. Upon completion of an interview, the survey instrument itself becomes the primary data source. To maintain data security, all completed survey instruments were digitally scanned, saved and backed-up on several different media. To organize and consolidate interview data, all survey responses were manually entered into a spreadsheet and checked twice by trained researchers. This process of scanning the

completed questionnaires and entering the data into a spreadsheet ensured that no data were lost.

3.6 Data Analysis

Contingent valuation (CV) studies often estimate WTP with both parametric and non-parametric analysis methods, enabling comparison and verification between results. Parametric estimation is often based on the maximum-likelihood method (Watanabe, 2010). Non-parametric analysis methods for double-bounded dichotomous choice contingent valuation are often based on Turnbull's (1976) self-consistency algorithm (Watanabe 2010). Consistent with the literature, this study also employs multi-dimensional analysis using both parametric and non-parametric methods.

Following Brouwer et al. (2008), WTP can be expressed as a function of respondent characteristics:

$$WTP_i^* = x_i'\beta + \varepsilon_i$$

where,

WTP* is the unobserved willingness to pay
x_i is a vector of individual respondent characteristics
β is the corresponding vector of coefficients
ε_i is a normally distributed error term with zero mean and variance σ^2

This study uses a double-bounded dichotomous choice elicitation format, which provides information on WTP intervals. Respondents answer two rounds of willingness to pay questions. If the response to the initial WTP question is 'Yes', then the follow up question presents a higher bid value. Alternatively, if the response to the initial WTP question is 'No', then the follow up question presents a lower bid value. As a result, there are

four distinct classifications of responses categories: (Yes/Yes), (Yes/No), (No/Yes) and (No/No), all of which correspond to specific intervals of WTP (Kanninen and Khawaja, 1995). Following Hanemann et al. (1991), Alberini (1995) and Brouwer et al. (2008), the bounds on WTP can be represented as follows:

$WTP < b_1$ for 'No'/'No' responses
$b_1 > WTP > b_{2L}$ for 'No'/'Yes' responses
$b_1 \leq WTP < b_{2H}$ for 'Yes'/'No' responses
$WTP \geq b_{2H}$ for 'Yes'/ 'Yes' responses

where,

b_1 represents the initial bid (randomly distributed across respondents)
b_{2L} represents the follow-up bid for respondents who answer "no" to first question
b_{2H} represents the follow-up bid for respondents who answer "yes" to first question
WTP represents the respondent's true willingness to pay

A survival analysis using the LIFEREG procedure in the statistical software SAS 9.2 is used to fit the parametric model to these interval data. The LIFEREG procedure estimates the parameters by maximizing the log-likelihood function. The LIFEREG model assumed for the response *y* can be can be expressed by the following equation:

$$y = X\beta + \sigma\varepsilon$$

where,

y represents a vector of response variable
X represents a matrix of independent variables
B represents a vector of regression parameters
σ represents a scale parameter
ε represents a vector of error terms assumed from the distribution

Following similar studies, the distribution of the random disturbance is assumed to be Weibull (Alberini 1995, Shiroiwa et al. 2010). A comparative analysis of different distributional assumptions (i.e. Weibull, Exponential, Gamma, Logistic, Log Logistic,

Normal and Log Norma) using several fit statistics (-2 Log Likelihood, AIC, AICc and BIC) supported use of the Weibull distribution.

I also conduct a non-parametric analysis, based on Turnbull's self consistency algorithm. Bid values are ordered based on percent response "No" to each individual bid value. Responses are then pooled based on the economic assumption of downward sloping demand (i.e. a negative relationship between quantity demanded and price). Response categories that violated the assumptions are 'pooled back' to the next lowest bid value, providing a conservative analysis of mean willingness to pay.

4 Data

4.1 Comparative Analysis between Curitiba and Survey Sample

To assess whether the sample is representative of Curitiba, I examine data from the 2010 Demographic Census as well as the 2002-2003 and 2008-2009 Consumer Expenditure Surveys. A comparative analysis between these data sets and survey results suggests that the survey sample is generally representative of Curitiba, but with some significant differences.

Comparisons between survey responses and the 2010 Demographic Census reveals similar results for gender distributions. According to the 2010 Census, the gender distribution in the city was approximately 47.7% male and 52.3% female (IBGE 2010). This closely matches the gender distribution of the survey sample of 48.2% male and 51.8% female. This similarity indicates that the survey accurately reflects the gender distribution within the city of Curitiba.

The average age of the survey respondents is also very close to the average age of residents of Curitiba, as reported in the 2010 Demographic Census. According to the survey results, the average age of respondents was 41 years, while the average age of residents of Curitiba is 41.5 years. However, these similar averages mask some differences in the distribution across age groups. According to the 2010 Demographic Census, of the population of Curitiba that is 18 years of age or older, approximately 29% is between age 18 and 29. This age group (18 to 29 years) is under-represented in the survey with only 14.77% of respondents. Again in comparison to the 2010 Demographic census, the survey sample over-represents the age groups of 30 to 39 and the 40 to 49 years. The 30 to 39 age group is the largest fraction of the sample with approximately 33% of respondents, as compared to the census estimate of 22.21%. Approximately 29% of the sample is 40 to 49 years old, over 10% more than reported by the 2010 Demographic Census. Over-representation of the 30-39 and 40-49 age groups in the survey sample may reflect the procedure for selecting respondents, which involved identifying individuals most responsible for household grocery purchases. In situations where groups of individuals were approached, interviewers were trained to select respondents who identified themselves as the primary decision maker with regards to household grocery purchases. The questionnaire was intended to capture data from these individuals, which may explain some of the over-representation in these age groups.

The survey sample is also representative in terms of household size (number of household members). The distribution of different size households is very similar in the survey sample and the 2010 Census, with the majority of categories separated by less than a 2% difference. The largest difference between the survey sample and the Census data is in

the category of 3 household members with a divergence of 3.47%. The average number of household members reported by survey respondents is 2.94, which closely reflects the Census average of 3.03. Thus, the survey sample accurately reflects the distribution of household members as well as the overall average household size in Curitiba.

The response format of the monthly household income question was 7 categories, from less than R$ 830 to more than R$ 10,376. The largest portion of survey respondents, approximately 28%, indicated that their total monthly household income was in the range of R$ 4,151 to R$ 6,225. This equates to approximately $2,441 to $3,661 USD, or eight to twelve times the monthly minimum wage. By using the midpoints of the income ranges, an overall average income can be calculated. The average total household income of survey respondents is approximately R$ 4,439. According to the 2010 Demographic Census, average household monthly income in the city of Curitiba was approximately R$ 4,786.

Although this suggests that the survey sample has a slightly lower average monthly household income, the sample actually has proportionally more individuals in the higher income brackets. According to the 2010 Demographic Census, approximatley 48% of households reported a total monthly household income greater than R$ 2,500, signficantly less than 70% reported in the survey sample (IBGE, Cities@). The difference in the proportion of households with total monthly household income over R$ 2,500 indicates that the survey sample may not be representative of the lowest income categories.

The Brazilian educational system is characterized by several distinct stages. The first mandatory public education stage is ensino fundamental I. This stage closely corresponds to the “elementary school” phase characteristic of the U.S. educational system, consisting of

five years of study. The second stage in the Brazilian system is ensino fundamental II. Although this stage resembles the "middle school" phase characteristic of the U.S. educational system, it consists of four years of study, extending into 9th grade, which is typically part of high school in the U.S. system. Following the completion of ensino fundamental I and II, the next stage in the Brazilian educational system is ensino médio. This stage corresponds to secondary school or the "high school" phase of the U.S. educational system, except that it consists of only three years. Upon competition of twelve years of study and graduation from ensino médio, a variety of technical schools and higher education opportunities are available to students.

The categorical response formatting of the education question in the survey measures the highest level of completed schooling. The largest portion of survey respondents, approximately 36%, indicated that the highest level of education they had completed was ensino médio or high school. In the Brazilian educational system, this implies completion of both ensino fundamental I and II as well as ensino médio, representing a total of twelve completed years of study. The average response for highest level of education completed spans the response categories of "ensino médio completo" or "high school graduate" and "ensino superior incompleto" or "incomplete college degree". Due to the fact that these categorical responses define the upper most bound of education, the survey average can be conservatively estimated as "Ensino Médio Completo" or "High School Graduate" because all the respondents in the "Ensino Superior Incompleto" or "Incomplete College Degree" category, by defiinition, have also completed high school.

According to the 2010 Demographic Census, of residents of Curitiba at least ten years of age or older, the educational distribution of the city, as measured by the highest level of schooling tends to be, on average, lower than the survey results A comparative analysis between survey results and census data reveals a close relationship with the categorical response, "incomplete high school" (fundamental completo – médio incomplete), with a difference of 1.05%. Results indicate that the survey sample over-estimates both the categorical responses "incomplete college" (médio completo – superior incomplete) and "college graduate" (superior completo) by approximately 18% and 13%, respectively. This suggests that the survey sample may be more highly educated than the average resident of Curitiba. See Table 3 for a detailed comparison of education levels between the survey and the 2010 Demographic Census.

To establish a comparative baseline for consumption and expenditure of beef between Curitiba and the sample, we examined data from the 2008-2009 Consumer Household Expenditure survey (Pesquisa de Orçamentos Familiares), available through IBGE. According to this consumer survey, residents of Curitiba consume an average of 18.043 kg per year per capita of beef. This can be extrapolated to an average of 54.67 kg per household per year, or approximately 1.05 kg per week. According to the survey, average household consumption of beef products is 1.76 kg per week. Thus, average household beef consumption reported in the survey exceeds the average household consumption level of Curitiba by more than 50%. This may be because the survey sample is biased towards higher socioeconomic classes, as indicated by high income levels and higher than average education.

In the southern region of Brazil, the average household allocates 8.1% of total household expenditures on food items specifically to beef products. According to the 2008-2009 Consumer Household Expenditure Survey for the southern region of Brazil, total household expenditures on beef products are positively correlated with income levels. Total monthly household expenditures on beef products range from R$ 19 a month in the lowest income bracket (less than R$ 830 per month) up to approximately R$ 76 per month in the highest income bracket (more than R$ 10,375), with an average expenditure of slightly over R$ 36 per month. In terms of total average weekly household expenditures on beef products in the southern region of Brazil, this corresponds to a range of approximately R$ 4.75 - R$ 19, depending on household income levels, with an overall weekly average of R$ 11.

The questionnaire elicited information on beef expenditures in two formats, depending on the number of individuals for which the respondent typically purchased. Respondents who typically purchased meat for at least two individuals were asked about 'household' expenditures, while respondents who typically purchase meat only for themselves were asked about 'individual' expenditures. The categorical response formatting of beef expenditure questions for both individual and household consumer groups provides a range of respective values. Just over half (50.43%) of survey respondents in the 'household' group indicated that their total weekly household expenditures on beef products were less than R$ 25, and 74% indicated that their total weekly household expenditures on beef products are less than R$ 40. Using the midpoints of the expenditure ranges, the average weekly household expenditure on beef products is approximately R$ 27.80. In the 'individual' expediture group, approximately 64% of respondents indicated that their weekly

expenditures on beef products ranged from R$ 7 to R$ 21. Average weekly expenditures for this respondent group spanned the range of R$ 12 - R$16 and R$ 17 - R$ 21. Again using the midpoints of the expenditure ranges, average total individual expenditure on beef products is approximately R$ 16.17. Thus, comparison of average weekly expenditures on beef products between survey results and regional statistics suggests that the survey sample represents a higher expenditure demographic relative to the regional average.

In sum, on average, survey respondents report consuming more beef relative to the city average, and they report spending more on beef than regional averages. This could be due to slightly different questions used to elicit information on quantities and expenditures in the survey vs. the census. However, given that income and education levels are also higher on average in the survey sample, it seems likely that the sample is not fully representative of the lower income classes in Curitiba, especially in the greater metropolitan area.

4.2 Descriptive Statistics

The survey was conducted in June of 2011 in the southern Brazilian city of Curitiba. The interviewers first asked if potential respondents were willing to answer a few questions, obtaining informed consent. On average, there were approximately 3.2 unsuccessful attempts to initiate an interview for every interview completed. After obtaining informed consent, the interviewers confirmed that the respondents make beef purchasing decisions, via two screening questions. 413 people were willing to answer the questionnaire and reported that they purchase beef; 412 of these respondents also indicated that they eat beef. The rest of the questionnaire was organized into three sections. The first section covered consumer

purchasing behavior as well as perspectives and knowledge regarding environmental issues, production of beef and environmental certifications. The second section presented the contingent valuation scenario and willingness to pay questions. The third section elicited socio-demographic information about the respondent. For a comprehensive listing of descriptive statistics for each survey question, please see the Appendix.

The initial section of the questionnaire covered purchasing behavior, consumption levels and associated expenditures. Over 77% of survey respondents indicated that, in an average week, 1 to 6 meals prepared at home include beef products. Before asking about expenditures on beef, interviewers determined whether respondents usually purchased for their household or just for themselves. 85% of respondents purchase beef products under the household classification (2 or more people), and 15% purchase beef as individual consumers. Respondents indicated that they make retail purchases of beef products primarily in three types of retail outlets. The majority of respondents, approximately 44%, normally purchase beef products at large supermarket chains; approximately 30% normally purchase beef from a butcher shop; and approximately 22% normally purchase beef from local markets.

In addition to purchasing behavior and consumption levels, the interviewers also asked about knowledge of environmental issues, beef production and environmental product certifications. On a scale from 1 to 5, where 1 represented the lowest value and 5 represented the highest value, respondents indicated an average concern level of 4.3 for environmental quality, an average knowledge level of 2.7 about beef production in Brazil and an average knowledge level of 2.4 about environmental issues related to beef production. Approximately 80% of survey respondents had heard of environmental certifications of sustainability or

green seals. Of this group, approximately 60% agrees that environmental certification programs are good ways to promote sustainability, while less than 2% indicated that it was not a good idea, and 38% indicated uncertainty with an "I don't know" response. Only 31% of respondents (who had heard of environmental certification) could name a specific product with such a certification. Of the respondents who are aware of specific products with environmental certifications, 67% identified some type of food product.

The second section of the survey instrument presented the contingent valuation scenario and willingness to pay questions as well as associated follow-up questions to check understanding and identify any protest responses. Applying a non-parametric Turnbull analysis, a lower bound WTP value of R$ 20.30 per kg was calculated based on initial bid responses. This lower bound value represents a conservative estimate of overall mean WTP. Since all initial bid values were based on the same baseline price of R$18.00 per kg, we can interpret mean willingness to pay for certified sustainable alcatra to be R$ 2.30, or approximately 12.8% more than the uncertified product. Therefore, we can interpret the consumer value of environmental quality improvements associated with sustainable cattle operations to be estimated at approximately R$ 2.30 per kg.

To determine respondent rationale for WTP values, an open-ended follow up question was incorporated into the survey. The follow-up questions indicate that the majority of respondents, approximately 74%, were willing to pay a higher price for the certified product because of reasons associated with environmental protection. Most respondents related positive WTP to the need for preservation or conservation of natural resources, general concern about nature, and the importance of preventing continued degradation of the

environment. Approximately 21% were willing to pay more because of perceived consumer consumption benefits such as improved well-being from healthier products. Of respondents who indicated that they would not be willing to pay more for certified alcatra, 82% attributed their response to the increased cost of the product, 7.56% explicitly opposed increased taxation, 5.88% opposed the higher price because of issues associated with corruption and 4.20% expressed concerns regarding the credibility of certification programs. While these last three categories could be considered "protest" responses, they are retained in the analysis to ensure a conservative estimate of WTP. For a detailed description of the WTP rationale responses, see Appendix C.

The third section of the survey gathered socio-demographic information on the respondent. The average respondent is approximately 41 years of age. The majority (71.7%) of respondents are originally from the state of Paraná, while 12.6% are from São Paulo, 6.6% from Rio de Janeiro, 4.6% from Santa Catarina and the remaining 4.5% from a variety of other Brazilian States. Excluding the 2.6% of respondents who were visitors, the average survey respondent has lived in Curitiba for approximately 30 years. In terms of the gender distribution, 48.2% of respondents were male and 51.8% of respondents were female. The average number of household members was estimated at approximately 2.94. The greatest number of respondents, nearly 36%, indicated that graduating high school was the highest level of education completed. Less than 1% of survey respondents are members of environmental organizations. Average total monthly household income is approximately R$ 4,439.

5. Results

To estimate overall mean willingness to pay, I combined responses to the initial and follow-up bids to identify the "bin" for each respondent's WTP. Using these interval censored data, I estimated a survival model with the LIFEREG procedure in the statistical software SAS 9.2. Similar to the non-parametric Turnbull analysis, the parametric LIFEREG procedure also provides a mean WTP estimate. Mean WTP is estimated using the 'bin' of values calculated for respondents' WTP. For example, if a respondent indicated that they would pay R$ 19 but that they would not pay R$ 20 (YES/ NO response code), then the bin of values ranges from R$ 19 to R$ 20. The LIFEREG procedure estimates WTP using this range of values as the dependent variable and a set of explanatory variables for each individual response, averaging WTP values across the entire sample.

Based on related literature (O'Donovan and McCarthy 2002), I hypothesize that WTP is related to knowledge of product features, concern and knowledge about environmental issues, and socio-economic characteristics of the respondent including their income and the quantity of beef that they typically purchase. Thus, we specify WTP as a function of the following explanatory variables:

- Per capita quantity of beef purchased
- Purchase location
- Concern for environmental quality
- Knowledge of beef production in Brazil
- Knowledge of the environmental impact of beef production
- Knowledge of environmental product certification
- Age
- Gender
- Education

- Income

Two variables (quantity of beef and age) are continuous, two variables are binary (knowledge of environmental product certification and gender), and the remainder are categorical. For a description of the explanatory variables used in the full model, see Table 4.

We ran a survival regression analysis in SAS with all ten predictors and analyzed the significance of each variable. Table 5 presents descriptive statistics for the explanatory variables used in this analysis. To check for multicollinearity, Table 6 presents Pearson's Correlation Estimates for continuous variables in the full model. These variables, consumption and age, are not highly correlated. Based on analysis of the full model, there is evidence at a 95% confidence level that knowledge of environmental product certification, education and income are all significant determinants of willingness to pay. There is also evidence at a 90% confidence level that knowledge of beef production in Brazil is a significant determinant of WTP. Results indicate a positive correlation between WTP for certified sustainable beef and both knowledge of environmental product certification and knowledge of beef production in Brazil. Therefore, as knowledge of environmental product certification and knowledge of domestic beef production increase, WTP also increases. For a description of the variables that are statistically significant determinants of WTP, see Table 7. Table 8 presents parameter estimates for each response category in the full model, indicating the direction of impact for continuous and binary variables. SAS drops the last response category of all questions formatted with categorical responses (all except Question 3 and Question 12).

Based on the parametric model, mean willingness to pay is R$ 20.25 per kg. with a standard error of 1.1938 (see Table 9). This is very close to the mean WTP estimated with the non-parametric Turnbull analysis: R$ 20.33 per kg. with a standard error of 1.0873. The Turnbull analysis is described in Figures 5 and 6. Based on these consistent estimates from the two methods, I conclude that respondents are, on average, willing to pay a 12.5% price premium for beef with a certification of environmental sustainability (or green seal).

Although Table 8 indicates that both income and education are statistically significant determinants of WTP, the direction of their impact is not straightforward using the full model. In addition, comparison of census data for Curitiba and the survey sample indicates that the average survey respondent represents a consumer demographic with higher education and income than the average resident of Curitiba. To facilitate better comparison to census statistics and to improve the interpretation of the direction of impact, given that income and education are significant determinants of WTP, I estimate an additional model using the LIFEREG procedure and the same explanatory variables but with income and education aggregated into three categories: low, medium and high. The medium category represents the census average for education and income. Based on this "aggregated parametric model," I estimate mean willingness to pay for certified sustainable beef at the census average education and income levels as R$ 19.28 per kg with a standard error of 1.11 (an additional R$ 1.28 per kg.) or a 7.1% price premium (see Table 9). As in the full model using all of the income and education categories in the survey, analysis of the aggregated model confirms that knowledge of environmental product certification, knowledge of beef production in Brazil, education and income are all significant determinants of willingness to pay. Parameter

estimates from these aggregated categories indicate that education and income are positively correlated with WTP. The multivariate regression results of the parametric analysis for the aggregated model are presented in Table 10 and Table 11. Table 10 presents the effects of the independent variables on mean WTP of the 'aggregated' model, indicating variables that are statistically significantly determinants of WTP. Table 11 presents parameter estimates for each response category of the 'aggregated' model. SAS drops the last response category of all questions formatted with categorical responses (all except Question 3 and Question 12).

Comparison of estimation results from the full and aggregated models helps provide a robustness check on the results of this study: the same variables are significant in both models, showing that estimation results are not sensitive to how answer categories are aggregated. Parameter estimates from both models suggest that income is positively correlated with WTP (i.e. respondents with low income are, all else equal, willing to pay less for certified sustainable beef than respondents with high income). This is true regardless of whether all original categories of income are included in the model, or whether it is compressed into three categories. The same trends are also evident for education, except for respondents with college and post-graduate degrees. As expected, when income and education are set at the census averages for Curitiba (the medium category in the aggregated model), the resulting mean WTP estimate is less than for the average survey respondent in the full model. This result is consistent with the parameter estimates which indicate a positive relationship between respondent income and education and WTP values.

6. Limitations and Recommendations

The questionnaire was intended to be developed as a consumer intercept survey, whereby respondents are interviewed at locations where beef products are purchased, such as grocery stores, markets and butcher shops. Logistical limitations, however, prevented us from conducting surveys in these locations. Although we successfully obtained permission to conduct surveys in several private retail establishments, we were unable to secure permission in a sufficiently diverse and large enough sample of private retail locations to conduct this type of research. Future studies may be interested in expanding the scope of research to include purchase locations in the survey site selection.

This study was also limited by the availability of literature describing life cycle emissions tradeoffs between feedlot and open graze cattle systems in Brazil. Due to these limitations we are unable to discern distinct advantages and disadvantages of each system relative to the other. Further studies may look to new literature describing the emissions trade-offs between these two agricultural production systems in Brazil.

This study was also limited by the availability of data from the 2010 Brazilian Census. When the survey was developed complete census data had not been published and data was only partially available for Curitiba. Due to these limitations, this study relied on the 2008-2009 Consumer Household Expenditures Survey to format some of the questions and response categories. Unfortunately, categorical classifications for income and education levels were not consistent between the 2008-2009 Consumer Household Expenditures Survey and the 2010 Census. This made comparative analyses between the population of Curitiba and the survey sample more challenging and limited some direct comparisons.

This study was also limited by the availability of literature describing the costs associated with transitioning from traditional cattle management systems to sustainable operations in Brazil. Due to limited knowledge regarding these costs it is difficult to make assumptions about the feasibility of implementing sustainable cattle ranching practices in Brazil. Further studies may be interested in investigating the feasibility of implementing sustainable ranching in Brazil by comparing costs with potential revenue from sales of these products.

7. Discussion

There is evidence that consumers are becoming increasingly aware of the social, environmental, and health benefits associated with more sustainable agricultural production systems (Grannis et al. 2000, O'Donovan and McCarthy 2002, Corsi and Novelli 2003). Several studies have found that consumers are willing to pay price premiums for products that do not contain chemical additives and are produced without the use of potentially harmful methods (Grannis et al. 2000). According to Grannis et al. (2000), in a study of 1400 US consumers, 67% of survey respondents indicated that they would pay a 12% premium for 'natural' beef products and 29% of respondents would pay a 23% price premium.

Price premiums for environmentally certified beef products can vary significantly throughout the world. In 2011, the average price of organic beef in the U.S. was $5.48 per pound, representing a premium of $1.70 per pound (or a 45% price premium) over non-organic products (AgMRC 2012). According to Hamm et al. (2002), price premiums for organic beef in Europe vary considerably between countries. On average, consumers in

Denmark, Netherlands and Sweden pay the lowest premiums for organic beef, 5%, 9% and 16%, respectively while consumers in Ireland, France and Austria pay the highest premiums for organic beef, 79%, 86% and 87%, respectively (Hamm et al. 2002).

Although variability exists in price premiums for environmentally differentiated beef products between nations, in general, the results of this study are consistent with previous studies. We also find evidence that consumers are willing to pay price premiums associated with environmentally differentiated beef products. Specifically, we find that consumers in Curitiba, actively engaged in the market for beef products, are willing to pay, on average, a 12.5% price premium for sustainably certified beef. In general, the results of this study are consistent with the lower range of consumer price premiums described by previous studies.

The determinants of willingness to pay, identified by this study are also consistent with previous studies. Results of the parametric regression analysis indicate a positive correlation between willingness to pay and the following characteristics: the level of knowledge of environmental certifications, the knowledge of beef production in Brazil, income and education. In a similar study of Irish consumer preferences for organic beef products, O'Donovan and McCarthy (2002) found that willingness to purchase organic meat was correlated with socio-economic characteristics of respondents, including both income and education levels. Contradictory to the findings of this study, O'Donovan and McCarthy found a weak yet significant relationship between gender and purchase behavior, with an emphasis towards female willingness to purchase over males. In a similar study conducted in the Piedmont region of Italy, Corsi and Novelli (2003) found that respondent knowledge of organic products was both significantly and positively correlated with willingness to pay for

organic meat. They also found that income was significant and positively related to willingness to pay for organic meat.

Reliable willingness to pay estimates are contingent upon respondent understanding of the valuation scenario and comprehension of the environmental goods and/or services being valued. Therefore, we formatted the valuation scenario using simple, concise, and informative descriptions of beef production methods and potential environmental benefits associated with sustainable production methods. Formatting the valuation scenario in a simplified and concise manner helped ensure that respondents understood what they were valuing. I assessed respondent comprehension of the valuation scenario by examining responses to the open ended follow-up question which elicited reasons why individuals were or were not willing to pay more for certified sustainable beef. The majority of survey respondents, 74% indicated that they were willing to pay more because of reasons associated with environmental protection, specifically citing conservation, concern for the environment and prevention of environmental degradation, all of which are specifically mentioned in the valuation scenario (see appendix for a detailed description of the follow-up rationale responses). The correlation between language used in the contingent valuation scenario and the open-ended rationale responses indicates that survey respondents accurately understood the environmental goods and services that they were valuing, increasing the reliability of WTP estimates.

A total of 413 surveys were completed during this study. Surveys were conducted at three specific types of location throughout the city of Curitiba: parks, markets and bus terminals. We conducted a total of 193 interviews at 5 parks, representing approximately

47% of the survey sample, 133 interviews at 5 bus terminals, representing approximately 32% of the survey sample and 87 interviews at 2 markets, representing approximately 21% of the survey sample. A comparative analysis of survey locations, based on the explanatory variables used in the parametric analysis, indicates minimal differences between survey sites (see Table 12). These results indicate that, on average, respondents did not vary significantly between survey sites.

The survey instrument was developed as an intercept survey, whereby respondents are interviewed in public locations. To ensure that we captured the desired sample, individuals actively engaged in the market for beef products (i.e. people who regularly consume and/or purchase beef), the first two questions of the survey were designed as 'qualifiers'. Question 1 (Do you eat beef products?) and Question 2 (In the past month, have you bought raw beef products?) were introduced as 'pre-survey' questions by the interviewers during the greeting and explanation of the survey. If a respondent answered 'No' to these first two questions the interview was terminated. 412 respondents (out of the 413 completed surveys) indicated that they consume and purchase beef products. There was only one occasion in which the responses varied for these two qualifying questions. One respondent indicated that they did not consume beef products but that they did make purchases of beef products for their household. Due to the fact that this individual was responsible for household purchases of beef, we considered them to be a participant in the market for beef and are therefore included in the sample.

Survey results indicate that some Brazilian consumers are willing to pay price premiums for certified sustainable beef products. On average, respondents were willing to

pay a 12.5% price premium (an additional R$ 2.30 per kg) for alcatra that has a certification of environmental sustainability. Sustainable production methods may represent one possible way to help mitigate GHG emissions associated with beef production in Brazil. The price premiums associated with certified sustainable beef may help entice producers to transition to more environmentally friendly production methods, thereby helping mitigate GHG intensive land use changes (in addition to the multitude of other beneficial ecosystem services that result from these transitions).

8. Conclusions

The study makes an important contribution towards understanding the potential market for environmentally differentiated beef products in Brazil and more generally the potential market for environmentally differentiated products in developing countries (in the upper-middle-income category). Specifically, the study characterizes consumer preferences regarding beef, consumer knowledge about the source and environmental impacts of beef production, and consumer willingness to pay for certified sustainable beef. Residents of Curitiba are willing to pay higher prices for beef that is certified environmentally sustainable. Specifically, the average consumer in my survey was willing to pay 12.5% more for alcatra that is certified environmentally sustainable. This finding is consistent with related research and the growing market for organic products in Brazil.

From a marketing perspective, this demonstrates that producers might be able to obtain a premium by pro-actively implementing more sustainable production methods and communicating those to the Brazilian consumer (and not just niche international markets).

From a policy perspective, this suggests that incentive-based policies or market incentives have potential for encouraging more sustainable production practices in the Brazilian ranching sector, which is globally important both for beef markets and for GHG emissions. From a research perspective, this study demonstrates the potential to use stated-preference non-market valuation methods in developing countries to help inform market-based environmental strategies that seek to harness consumer preferences to provide an incentive and compensation to producers who adopt more sustainable production methods.

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Tables

Table 1: Description of NOAA Panel Guidelines Incorporated into Survey

General Features	NOAA Panel Guidelines	Survey Design Features
Non-Response	Minimize	Short intercept survey, easy to respond to questions, no personal identifiable information collected
Data Collection	Face-to-face interviews are preferable	Face-to-face interviews conducted
Interviewer Effects	Pre- test / Trial runs	Interviewers underwent specific training
Pre-Testing	Careful pilot work	Extensive pre-testing conducted
Elicitation format	Willingness to pay preferred over willingness to accept	Willingness to pay used
Referendum format	Valuation question posed as a single bounded yes/no vote on a referendum	WTP question set up as a yes/no dichotomous choice
Accurate description of program or policy	Must be adequate and relevant	Respondents were provided with background information before presented with the WTP question
Yes / No follow ups	Follow up referendum question with open-ended questions about why the choice was made	WTP questions were followed up by an open ended rationale question

Adopted from: Alberini, Anna and Kahn, James R. (Editors) (2006). Handbook on Contingent Valuation. Ahearn, Mary Clare, Boyle, Kevin J. and Hellerstein, Daniel R. Designing a contingent valuation study to estimate the benefits of the conservation reserve program on

Table 2: Distribution of Starting WTP Bid Values

Starting Bid Value (R$)	Initial Bid Observations (number of times the bid value was proposed first)	Percent of Overall Sample
18.5	66	15.98%
19	69	16.71%
19.5	74	17.92%
20	75	18.16%
21.5	67	16.22%
23	62	15.01%
Total	**413**	100.00%

Table 3: Comparative Analysis of Education Levels between Curitiba and the Survey Sample

Highest Level of Education	Census (2010)	Survey
Incomplete Middle School (ensino fundamental I/II incompleto)	31.91%	N/A*
Incomplete High School (fundamental completo – médio incompleto)	17.83%	18.88%
Incomplete College (médio completo – superior incompleto)	30.07%	47.70%
College Graduate (superior completo)	20.19%	33.41%

* Survey instrument did not include this category of education.

Table 4: Explanatory Variable Definitions– Lifereg Analysis

Question Number	Variable Name	Survey Question Description
Q3	Consumption	Per capita household consumption of beef products (kg/person/week)
Q5	Purchase Location	Where do you normally purchase beef products? (1 = Commercial Supermarket, 2 = Local Non-Commercial Supermarket, 3 = Municipal Market, 4 = Butcher Shop and 5 = Other)
Q6	Concern Envir. Quality	On a scale of 1 to 5, where 1 represents no concern and 5 represents extremely concerned, how concerned are you about environmental quality?
Q7	Knowledge Beef Production	On a scale of 1 to 5, where 1 represents no knowledge and 5 represents extremely knowledgeable, how much do you know about beef production in Brazil?
Q8	Knowledge Envir. Issues Beef Production	On a scale of 1 to 5, where 1 represents no knowledge and 5 represents extremely knowledgeable, how much do you know about environmental issues related to beef production in Brazil?
Q9	Heard of Sustainable Certification	Have you ever heard of an environmental certification of sustainability or a green seal? (1 = Yes, 0 = No)
Q12	Age	How old are you? (Age in Years)
Q15	Gender	What is your gender? (Male = 1, Female = 0)
Q17	Education	What is the highest level of education you have completed? (1 = Middle School, 2 = Some High School, 3 = High School Graduate, 4 = Some College, 5 = College Graduate, and 6 = Post Graduate)
Q19	Income	What is your approximate monthly household income from all sources (1 = <R$830, 2 = R$831-R$1,245,3 = R$1,246-2,490, 4 = R$2,491-4,150, 5 = R$4,151-R$6,225, 6 = R$6,226-10375, and 7 = >R$10,375)

Table 5: Descriptive Statistics for Explanatory Variables – Lifereg Analysis

Variable Name	**Descriptive Statistics**				
Consumption	Mean	Standard Deviation			
	0.59	0.29			
Purchase Location	Large Supermarkets	Local Supermarkets	Municipal Market	Butcher	Other
	43.82%	22.52%	3.60%	30.00%	0%
Concern Envir. Quality	Mean	Standard Deviation			
	4.25	0.88			
Knowledge Beef Production	Mean	Standard Deviation			
	2.70	1.24			
Knowledge Envir. Issues Beef Production	Mean	Standard Deviation			
	2.40	1.19			
Heard of Sustainable Certification	Yes	No			
	79.90%	20.10%			
Age	Mean	Standard Deviation			
	41.18	10.71			
Gender	Male	Female			
	48.20%	51.80%			
Education	*Aggregated Response Category (% of sample)*				
	Low	Medium	High		
	Middle School - High School	High School Grad. - Some College	College Graduate - Post Graduate		
	19.87%	47.69%	33.41%		
Income	*Aggregated Response Category (% of sample)*				
	Low	Medium	High		
	R$0 - R$2490	R$2491 - R$6225	R$6266+		
	29.78%	47.94%	22.27%		

Table 6: Pearson's Correlation Estimation Matrix – Full Model (Continuous Variables)

	Consumption	Age
Consumption	1	-0.070791
Age	-0.070791	1

Table 7: Lifereg - Type III Analysis of Effects (Full Model - Complete Survey Sample)

Variable	**DF**	**Wald (Chi-Square)**	**Pr > ChiSq**
Consumption	1	1.3758	0.2408
Purchase Location	4	3.3957	0.4939
Concern Envir. Quality	4	3.3202	0.5057
Knowledge Beef Production	4	8.9788	0.0616
Knowledge Envir. Issues Beef Production	4	4.2964	0.3674
Heard of Sustainable Certification	1	5.1137	0.0237
Age	1	0.2154	0.6426
Gender	1	0.9969	0.3181
Education	5	11.0232	0.0509
Income	6	27.1352	0.0001

Table 8: Lifereg - Analysis of Maximum Likelihood Parameter Estimates (Full Model - Complete Survey Sample)

Variable	Response Category	Estimate	Std. Error	Chi-Square	Pr > ChiSq
Intercept		0.1021	0.0221	0.00	0.9986
Consumption	kg/person/week	-0.0127	0.0108	1.38	0.2408
Purchase Location	Large Supermarket	0.0131	0.0221	0.00	0.9997
	Local Supermarket	0.0192	0.0218	0.00	0.9997
	Municipal Market	0.0175	0.0224	0.00	0.9997
	Butcher	0.0195	0.0221	0.00	0.9997
Concern Envir. Quality	1	-0.0514	0.0853	0.00	0.9997
	2	-0.0140	0.0255	0.30	0.5824
	3	-0.0069	0.0122	0.32	0.5714
	4	-0.0176	0.0098	3.20	0.0738
Knowledge Beef Production	1	-0.0442	0.0277	2.55	0.1100
	2	-0.0238	0.0268	0.79	0.3740
	3	-0.0513	0.0243	4.46	0.0346
	4	-0.0418	0.0241	3.00	0.0832
Knowledge Envir. Issues Beef Production	1	-0.0180	0.0290	0.39	0.5341
	2	-0.0335	0.0273	1.51	0.2192
	3	-0.0174	0.0266	0.43	0.5125
	4	-0.0024	0.0269	0.01	0.9275
Heard of Sustainable Certification	Yes	-0.0224	0.0099	5.11	0.0237
Age	Years	0.0002	0.0004	0.22	0.6426
Gender	Male	0.0082	0.0082	1.00	0.3181
Education	Middle School	-0.0164	0.0289	0.32	0.5701
	Some High School	-0.0146	0.0275	0.28	0.5968
	High School Grad.	0.0138	0.0244	0.32	0.5702
	Some College	0.0008	0.0260	0.00	0.9749
	College Grad.	-0.0156	0.0223	0.49	0.4841
Income	less than R$830	-0.1287	0.0606	4.51	0.0337
	R$831-R$1,245	-0.1298	0.0596	4.74	0.0295
	R$1,246-R$2,490	-0.1091	0.0582	3.52	0.0606
	R$2,491-R$4,150	-0.0696	0.0578	1.45	0.2280
	R$4,151-R$6,225	-0.0552	0.0568	0.85	0.3578
	R$6,226-R$10,375	-0.0173	0.0579	0.09	0.7648

Table 9: Lifereg Analysis - Mean WTP Estimates (Full Model and Aggregated Model)

Model	Parameter	Estimate	Std. Error	95% Confidence Limits
Full Model - Complete Survey Sample	Weibull Shape	20.2555	1.1938	18.0458 - 22.7356
Aggregated Model - Census Average (Income and Education)	Weibull Shape	19.2822	1.1120	17.2214 - 21.5896

Table 10: Lifereg - Type III Analysis of Effects (Aggregated Model: Census Averages – Income and Education)

Variable	DF	Wald (Chi-Square)	Pr > ChiSq
Consumption	1	5.3091	0.1212
Purchase Location	3	5.9304	0.1150
Concern Envir. Quality	4	3.7352	0.4430
Knowledge Beef Production	4	16.5678	0.0023
Knowledge Envir. Issues Beef Production	4	5.3678	0.2570
Heard of Sustainable Certification	1	8.4726	0.0036
Age	1	1.3209	0.2504
Gender	1	0.4946	0.4819
Education	2	15.8477	0.0004
Income	2	15.6913	0.0004

Table 11: Lifereg - Analysis of Maximum Likelihood Parameter Estimates (Aggregated Model: Census Averages – Income and Education)

Variable	Response Category	Estimate	Std. Error	Chi-Square	Pr > ChiSq
Intercept		3.2188	0.0397	6579.64	<.0001
Consumption	kg/person/week	-0.0239	0.0104	5.31	0.0212
Purchase Location	Large Supermarket	-0.0197	0.0100	3.92	0.0477
	Local Supermarket	-0.0251	0.0115	4.80	0.0284
	Butcher	-0.0142	0.0273	0.27	0.6033
Concern Envir. Quality	1	-0.2616	0.0123	0.00	0.9981
	2	-0.0175	0.0261	0.45	0.5025
	3	-0.0060	0.0122	0.24	0.6244
	4	-0.0185	0.0099	3.46	0.0629
Knowledge Beef Production	1	-0.0391	0.0277	2.00	0.1575
	2	-0.0055	0.0266	0.04	0.8368
	3	-0.0483	0.0245	3.89	0.0485
	4	-0.0370	0.0242	2.33	0.1267
Knowledge Envir. Issues Beef Production	1	-0.0224	0.0287	0.61	0.4355
	2	-0.0396	0.0272	2.12	0.1452
	3	-0.0240	0.0265	0.82	0.3655
	4	-0.0041	0.0271	0.02	0.8798
Heard of Sustainable Certification	Yes	-0.0289	0.0099	8.47	0.0036
Age	Years	0.0005	0.0004	1.32	0.2504
Gender	Male	0.0058	0.0082	0.49	0.4819
Education	Middle School – Some High School	-0.0365	0.0146	6.22	0.0126
	High School Grad.– Some College	0.0049	0.0118	0.18	0.6743
Income	R$0 - R$2490	-0.0817	0.0230	12.64	0.0004
	R$2491 - R$6225	-0.0473	0.0241	3.85	0.0498

Table 12: Explanatory Variables (Lifereg Analysis) – Descriptive Statistics Stratified by Survey Location

Survey Locations	Descriptive Statistics	Survey Questions									
		Q3	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q12**	**Q15**	**Q17**	**Q19**
Parks											
(n = 193)	Mean	0.66	2.17	4.24	2.84	2.43	0.82	40.83	0.53	3.48	4.19
	Std. Dev.	0.28	1.29	0.85	1.22	1.14	0.38	9.74	0.50	1.38	1.44
Bus Terminals											
(n = 133)	Mean	0.55	2.39	4.26	2.59	2.33	0.79	41.22	0.38	3.74	4.32
	Std. Dev.	0.28	1.27	0.90	1.29	1.24	0.41	10.97	0.49	1.40	1.52
Markets											
(n = 87)	Mean	0.50	1.97	4.26	2.56	2.44	0.76	41.91	0.52	3.62	4.38
	Std. Dev.	0.27	1.26	0.91	1.22	1.22	0.43	12.34	0.50	1.43	1.53

Figures

Figure 1: Map of the Regions of Brazil
Source: IBGE

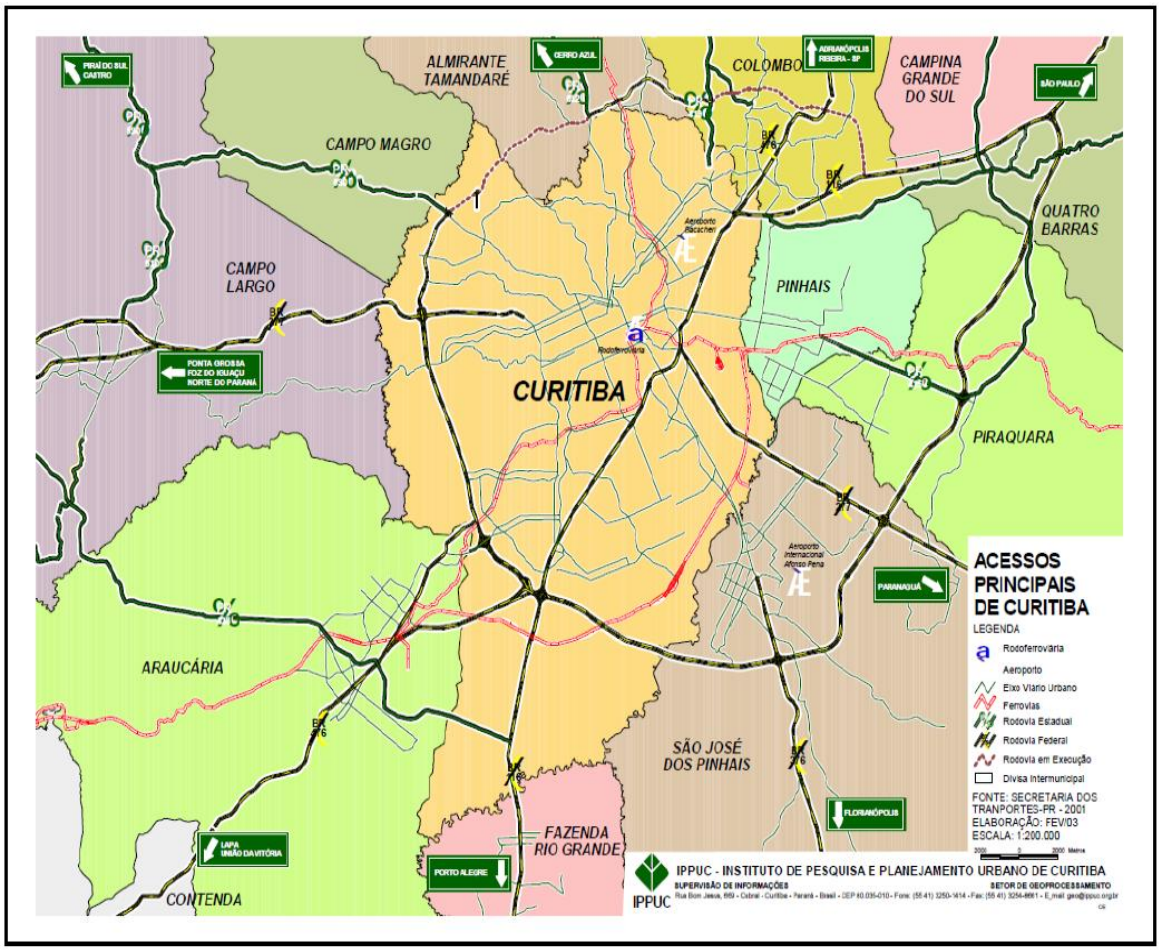

Figure 2: Boundary Map of Curitiba
Source: IPPUC: Instituto de Pesquisa e Planejamento Urbano de Curitiba.

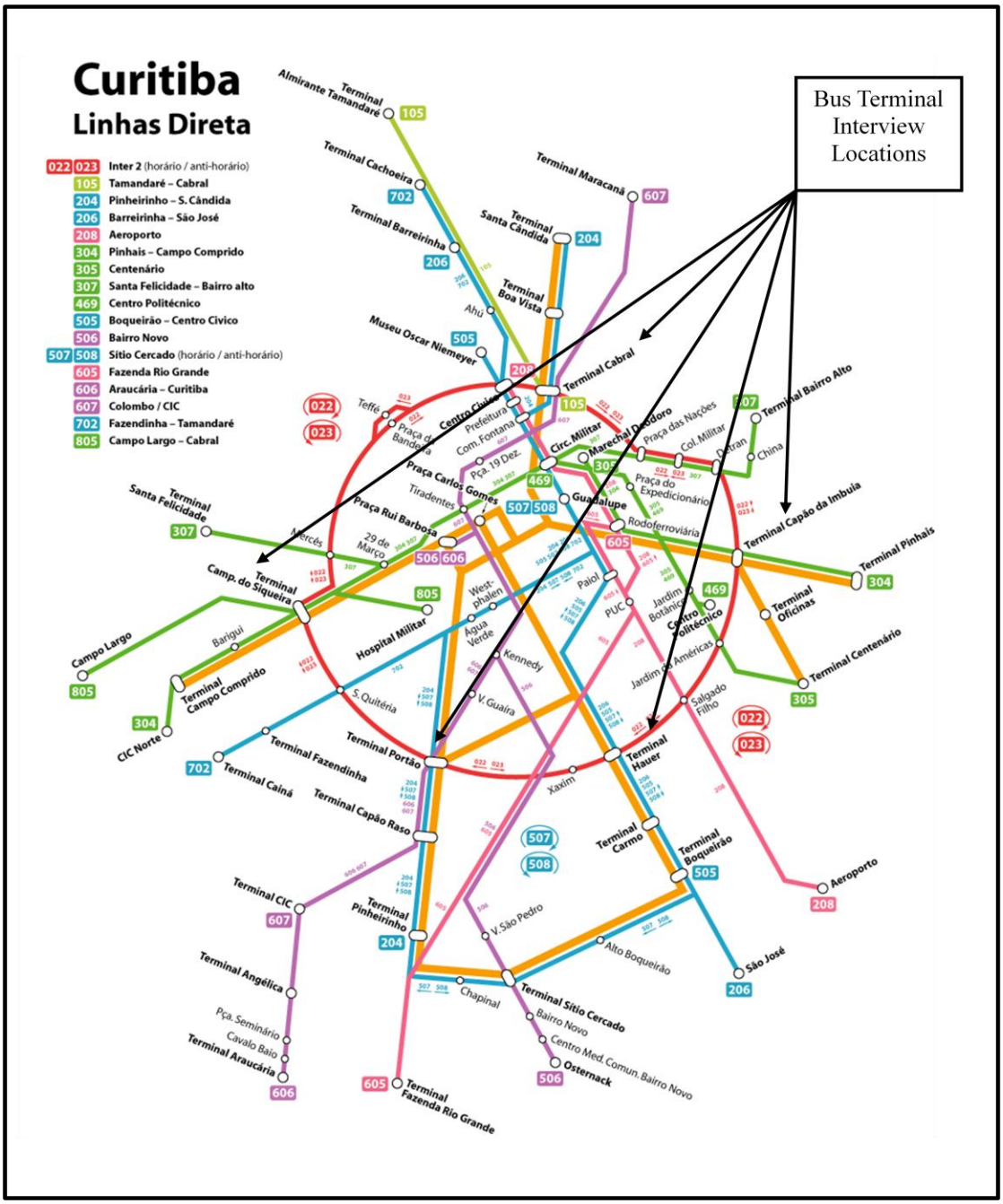

Figure 3: Map of the Direct Bus Lines in Curitiba
Source: Curitiba Info. Available at: http://www.curitiba.info/map-of-curitiba.html. Accessed: February 10, 2010.

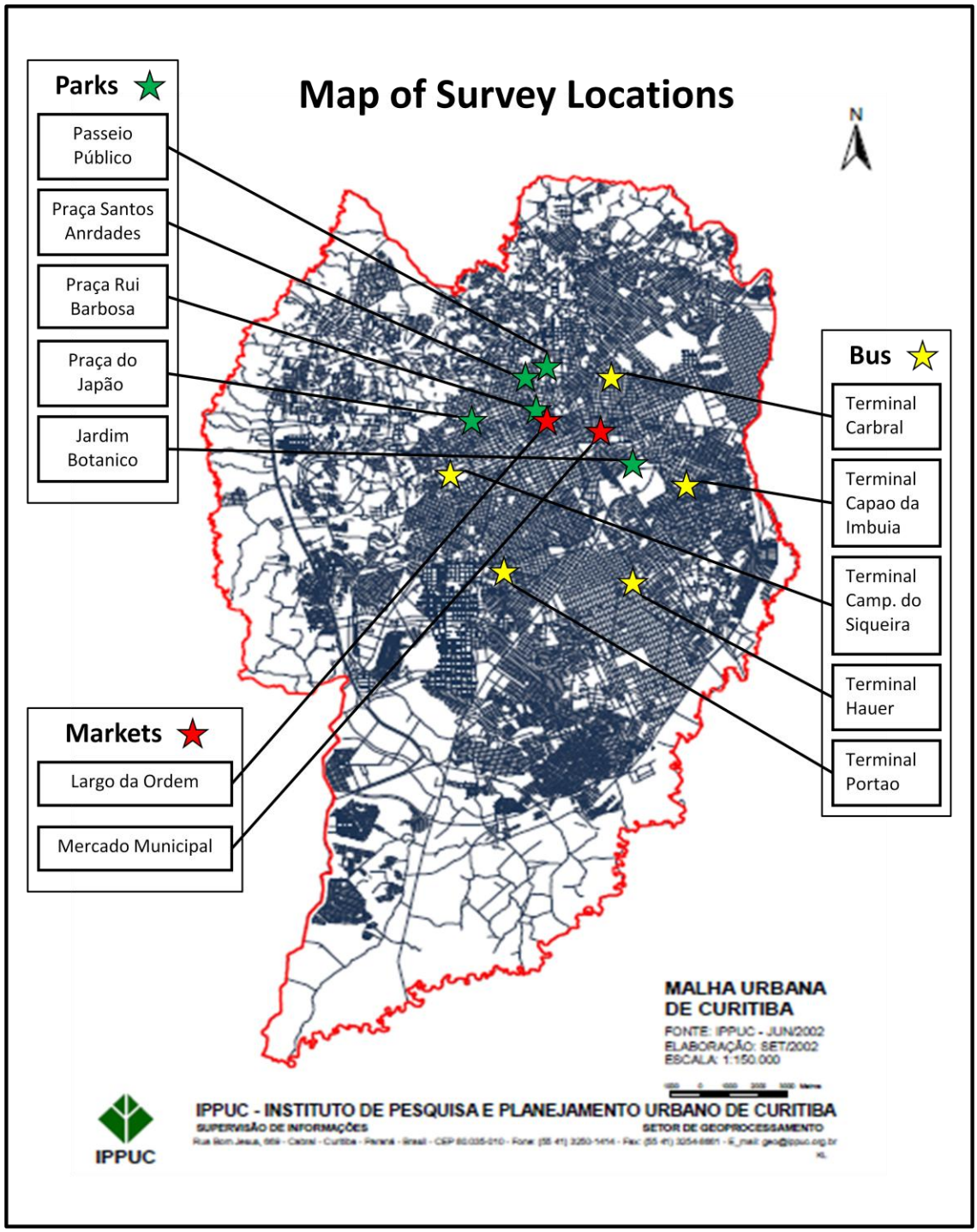

Figure 4: Map of Survey Location
Source: IPPUC – Instituto de Pesquisa e Planejamento Urbano de Curitiba.

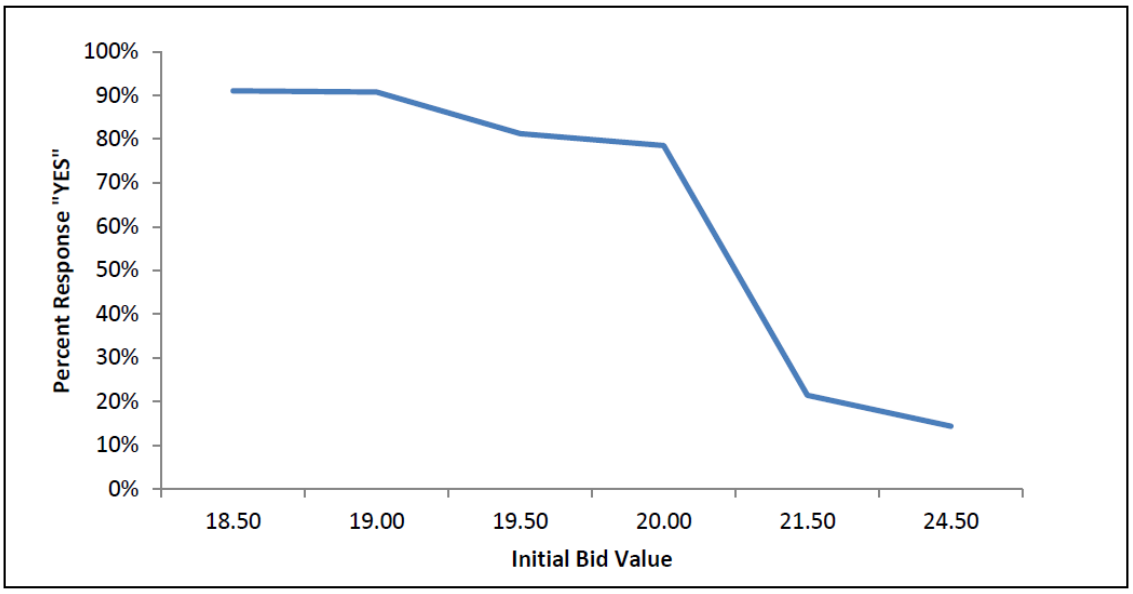

Figure 5: Pooled WTP Responses to Starting Bid*

*Bid Value "19.50" violated the analytical assumptions and was therefore pooled-back to the next lowest bid value.

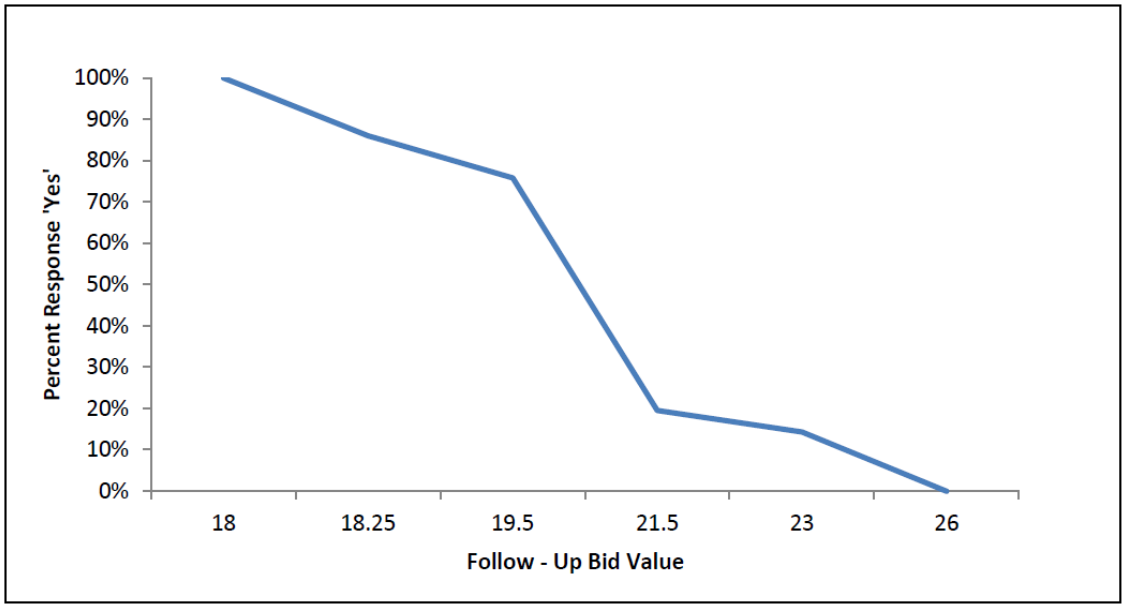

Figure 6: Pooled WTP Responses to Follow-Up Bid*

*Bid Values "18.50", "19.00" and "24.50" violated the analytical assumptions and were therefore pooled back to the next lowest bid value.

APPENDICES

Appendix A: Survey Instrument (English)

Interviewer: ______________________________ **Date:**________ **Location:**___________________________________

Attempts: [_]

I am a student from UFPR, helping a graduate student with his research about the consumption of beef. We are selecting people at random to respond to 20 questions regarding preferences of beef consumption. Could you help us by responding to the questions. It will take 10 minutes and the results will only be used as data in the student's thesis. All responses are annonymous and you will not be asked to give your name. We are only authorized to interview people over 18 years or older. You are not obligated to respond to all of the questions and you may terminate the survey at any time. If you have any questions or concerns about the survey, I have the name and phone number of the researcher for further information. **Are you willing to participate?**

Consent [__]

All of the questions in this survey are about raw beef (uncooked).

1) Do you eat beef products (steak, filet, ground beef, hamburger, etc.)? **Yes** **No**

1.1) If Yes, in an average week, how many of the meals that you eat at home include beef?

1 - 2 **3 - 4** **5 - 6** **7 - 8** **9 +**

2) In the past month, have you bought raw beef products (raw)? **Yes** **No**

3) When you purchase beef products, do you normally buy for a group of people like your family or do you normally purchase beef only for yourself? ***(Please circle one response)***

Household (2 or more people)

3.1a) Household
On average, how many people are you purchasing beef for?

____

3.1b) Household
On average, during the past month, how many **kilograms** of beef do you purchase **per week?**

____

3.1c) Household

On average, during the past month, how much have you been spending on beef products **per week?**

[__] < R$ 25
[__] R$ 26 - R$ 40
[__] R$ 41 - R$ 55
[__] R$ 56 - R$70
[__] R$ 71+

Individual (1 person)

3.2a) Individual
On average, during the past month, how many **kilograms** of beef do you purchase **per week?**

____

3.2b) Individual
On average, during the past month, how much have you been spending on beef products **per week?**

[__] < R$ 6
[__] R$ 7 - R$ 11
[__] R$ 12 - R$ 16
[__] R$ 17 - R$ 21
[__] R$ 22 +

3.2c) Individual

Do you live with other people who also purchase beef to cook at home?

Yes **No**

3.2d) If **Yes**, how many people?

____

4) Was last month about typical of how much beef you normally purchase? **Yes** **No**

5) Where do you normally purchase your beef products?

[__] Commercial Supermarket (Mercadorma, Wal-Mart, BIG, etc.)
[__] Local Non-Commercial Supermarket
[__] Municipal Market
[__] Butcher Shop
[__] Other (please specify) _____

6) On a scale of 1 to 5, where 1 represents no concern and 5 represents extremely concerned, how concerned are you about environmental quality?

1 **2** **3** **4** **5**

7) On a scale of 1 to 5, where 1 represents no knowledge and 5 represents extremely knowledgeable, how much do you know about beef production in Brazil?

1 **2** **3** **4** **5**

8) On a scale of 1 to 5, where 1 represents no knowledge and 5 represents extremely knowledgeable, how much do you know about environmental issues related to beef production?

1 **2** **3** **4** **5**

9) Have you ever heard of an environmental certification of sustainability or a green seal? **Yes** **No**

9.1) If Yes, are you aware of any products that have certifications of environmental sustainability? **Yes** **No**

9.1a) If Yes, what product? _____

9.2) If yes, do you think environmental certification programs or green seals are good ways to promote sustainability? **Yes** **No** **I do not know**

These questions are completely hypothetical. Your responses will be used for research purposes only.
We are **NOT** collecting any money!

Increasing demand for beef has resulted in significant land use transformation in Brazil. These transformation include the intensification of some existing ranches and controversial forest clearing for new pasture in Amazonia. Both intensification of cattle production and the expansion of pasture for cattle can negatively affect environmental quality, resulting in degraded landscapes and problems such as reduced water quality and loss of biodiversity.

One of the ways to prevent environmental degradation and maintain meat production is through use sustainable certification. Certification is a method that ensures meat is produced without harming the environment. Sustainable ranching operations provide a wide variety of ecological and social benefits, including; the conservation of natural resources, improved water quality, the protection of habitat and biodiversity as well as better working conditions for farm laborers. Although there are many benefits from sustainable ranching, increased management and restrictions, typically result in slightly higher prices for beef.

In order to gain more knowledge about consumer preferences for sustainably produced beef, we would like to ask you a hypothetical question regarding your purchasing preferences.

10) Imagine that the current price of standard un-certified Top Sirloin is R$ _____ per kilogram. Would you be willing to pay R$ _____ per kilogram if the Top Sirloin had a certification of environmental sustainability.

YES ⬇

10.1) Would you be willing to pay R$_____ per kilogram for Top Sirloin had a certification of environmental sustainability

Yes No

NO ⬇

10.2) Would you be willing to pay R$_____ per kilogram for Top Sirloin had a certification of environmental sustainability

Yes No

11. We are interested to know why you said "YES". What is the main reason you are willing to pay this amount or not willing to pay this amount?

_____

_____

Your responses are *completely anonymous and cannot be traced to you*.

12) How old are you? _____

13) What state are you originally from? _____

14) How long have you lived in Curitiba?

[__] Entire Life _____ Years (How many) _____ Months (How many)

15) What is your gender? **Male** **Female**

16) How many people reside in your household? _____

Please indicate below the ages of these household members:

	Age	Number of Household Members
16.1	0 - 10	
16.2	11 - 17	
16.3	18 - 60	
16.4	61 +	

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

[__] Middle School
[__] Some High School
[__] High School Graduate
[__] Some College
[__] College Graduate
[__] Post Graduate

18) Are you a member of an environmental organization? **Yes** **No**

19) What is your approximate **monthly household income** from all sources?

[__] Less than $830
[__] R$ 831 - R$ 1.245
[__] R$ 1.246 - R$ 2.490
[__] R$ 2.491 - R$ 4.150
[__] R$ 4.151 - R$ 6.225
[__] R$ 6.226 - R$ 10.375
[__] R$ 10.376 +

Thank you for your participation!

Appendix B: Survey Instrument (Portuguese)

Entrevistador: _____ **Data:**_____ **Localização:**_____

Tentativas: [_]

Sou aluno da UFPR e estou ajudando um estudante de pós -graduação em sua pesquisa sobre o consumo de carne bovina. Estamos selecionando pessoas de forma aleatória, para responder a 20 perguntas sobre preferências de compra de carne. Você poderia nos ajudar, respondendo as nossas perguntas. Levará menos de 10 minutos e os resultados serão utilizados como dados em sua tese de mestrado. As respostas são anônimas, portanto não é preciso dar seu nome. Nós estamos autorizados apenas a entrevistar pessoas maiores de 18 anos. Você não é obrigado a responder todas as perguntas e você pode terminar o questionário a qualquer momento. Em caso de dúvidas ou preocupações sobre a pesquisa, posso lhe fornecer o nome e o número de telefone do pesquisador para maiores esclarecimentos. **Você está disposto a participar?** **Consentimento [__]**

Todas as perguntas deste questionário são sobre a carne bovina crua (in natura)

1) Você come carne bovina (alcatra, picanha, carne moída, hambúrguer, etc)? **Sim** **Não**

1.1) Se sim, em uma semana normal, quantas das refeições que você faz em casa, incluem carne?

1 - 3 **4 - 6** **7 - 9** **10 - 12** **13 +**

2) No mês passado, você comprou carne crua (in natura)? **Sim** **Não**

3) Quando você compra carne crua (in natura), normalmente você compra só para você ou para mais pessoas, como sua família, por exemplo?

Família (2 ou mais pessoas) ⬇

3.1a) Família

Em média, para **quantas pessoas** você (sua família) compra carne?

_____

3.1b) Família

Em média, durante as últimas semanas **quantos kilogramas** você (sua família) comprou **semanalmente** de carne bovina?

_____

3.1c) Família

Em média, durante as últimas semanas quanto você (sua família) **gastou semanalmente** com carne bovina?

[__] < R$ 25
[__] R$ 26 - R$ 40
[__] R$ 41 - R$ 55
[__] R$ 56 - R$70
[__] R$ 71+

Indivíduo (1 pessoa) ⬇

3.2a) Indivíduo

Em média, durante as últimas semanas **quantos kilogramas** você comprou **semanalmente** de carne bovina?

_____

3.2b) Indivíduo

Em média, durante as últimas semanas quanto você **gastou semanalmente** com carne bovina?

[__] < R$ 6
[__] R$ 7 - R$ 11
[__] R$ 12 - R$ 16
[__] R$ 17 - R$ 21
[__] R$ 22 +

3.2c) Indivíduo

Você mora com outras pessoas que também compram carne para cozinhar em casa?

Sim **Não**

3.2d) Se sim, quantas pessoas?

_____

4) Com relação ao mês passado, sua compra de carne bovina esteve dentro da média? **Sim** **Não**

5) Onde você costuma comprar carne?

[__] Redes de Supermercados (Mercadorma, o Wal-Mart, BIG, etc)

[__] Mercados menores (Locais)

[__] Mercado Municipal

[__] Açougue

[__] Outro (especificar) _____

6) Em uma escala de 1 a 5, onde 1 representa nenhum interesse e 5 representa interesse extremo, como você classificaria sua preocupação com a conservação do meio ambiente?

1 2 3 4 5

7) Em uma escala de 1 a 5, onde 1 representa nenhum conhecimento e 5 representa muito conhecimento, o quanto você sabe sobre a produção de carne no Brasil?

1 2 3 4 5

8) Em uma escala de 1 a 5, onde 1 representa nenhum conhecimento e 5 representa muito conhecimento, quanto você sabe sobre questões ambientais relacionadas com a produção de carne bovina?

1 2 3 4 5

9) Voce ja ouviu falar de certificação de sustentabilidade ambiental ou selo verde? **Sim** **Não**

9.1) Se sim, você conhece algum produto que tenha certificação de sustentabilidade ambiental? **Sim** **Não**

9.1a) Se sim, que produto? _____

9.2) Se sim, você acha que os programas de certificação ambiental ou selo verde são umas boas maneiras de promover a sustentabilidade? **Sim** **Não** **Não Sei**

Essas perguntas são totalmente hipotéticas. Suas respostas serão utilizadas unicamente para fins de pesquisa.

Nós não estamos coletando dinheiro!

O aumento do consumo de carne bovina resultou em significativa transformação do uso da terra no Brasil. Essas transformações incluem a intensificação das atividades de algumas fazendas já existentes e desmatamento de florestas para novos pastos, especialmente na Região Amazônica. Tanto a intensificação da produção pecuária quanto a expansão de pastagens para o gado, podem prejudicar o meio ambiente, resultando em paisagens degradadas e problemas como a redução da qualidade da água e a perda de biodiversidade.

Uma das formas de não degradar o meio ambiente e manter a produção de carne, e através da certificação sustentável. A certificação é um método que garante através de normas pre-estabelecidas que a carne será produzida sem prejudicar o meio ambiente. A pecuária sustentável possui muitos benefícios ecológicos e sociais, incluindo, a conservação dos recursos naturais, melhorando a qualidade da água, a proteção da biodiversidade, bem como a melhora das condições de trabalho para os trabalhadores rurais. Embora haja muitos benefícios a partir da pecuária sustentável, as restrições impostas e o aumento do monitoramento, resultam em preços mais altos para a carne. A fim de obter mais conhecimento sobre as preferências dos consumidores pela carne produzida de forma sustentável, gostaríamos de lhe fazer uma pergunta hipotética sobre suas preferências de compra.

10) Imagine que o preço atual da Alcatra sem certificação é de **R$ 18, 00 por Kg**. Você estaria disposto a pagar **R$ _____ por Kg** de Alcatra que tenha certificação de sustentabilidade ambiental?

Sim ⬇

10.1) Você estaria disposto a pagar **R$ _____ por Kg** de Alcatra que tenha certificação de sustentabilidade ambiental?

Sim **Não**

Não ⬇

10.2) Você estaria disposto a pagar **R$ _____ por Kg** de Alcatra que tenha certificação de sustentabilidade ambiental?

Sim **Não**

11) Estamos interessados em saber por que você disse isso. Qual é a principal razão pela qual você está disposto a pagar esse valor **ou** não está disposto a pagar esse valor?

_____

_____

Suas respostas são totalmente anônimas e sigilosas

12) Quantos anos você tem?_____

13) De que estado você é?_____

14) Há quanto tempo você vive em Curitiba?

[__]Toda a Vida _____ Anos _____ Meses

15) Sexo: **Masculino** **Feminino**

16) Quantas pessoas moram em sua casa?_____

Por favor, indique abaixo a idade desses membros da família:

	Idade	Número de moradores
16.1)	0 - 10	
16.2)	11 - 17	
16.3)	18 - 60	
16.4)	61 +	

17) Qual é o seu nível de escolaridade?

[__] Ensino Fundamental
[__] Ensino Médio incompleto
[__] Ensino Médio completo
[__] Ensino Superior incompleto
[__] Ensino Superior completo
[__] Pós-graduação

18) Você é um membro, partidário ou um (a) afiliado (a) de alguma organização ambiental? **Sim** **Não**

19) Qual é a sua **renda familiar mensal** aproximada, incluindo todas as fontes?

[__] Menos de $830
[__] R$ 831 - R$ 1.245
[__] R$ 1.246 - R$ 2.490
[__] R$ 2.491 - R$ 4.150
[__] R$ 4.151 - R$ 6.225
[__] R$ 6.226 - R$ 10.375
[__] mais de R$ 10.376

Obrigado por sua participação!

Appendix C: Survey Instrument with Sample Results

Interviewer: ______________________________ **Date:**_________ **Location:**______________________________________
Attempts: [_]

Attempts made to initiate the survey	
Number of Observations (total completed surveys)	413
Average number of unsuccessful attempts	3.2
Standard deviation	1.71

I am a student from UFPR, helping a graduate student with his research about the consumption of beef. We are selecting people at random to respond to 20 questions regarding preferences of beef consumption. Could you help us by responding to the questions. It will take 10 minutes and the results will only be used as data in the student's thesis. All responses are annonymous and you will not be asked to give your name. We are only authorized to interview people over 18 years or older. You are not obligated to respond to all of the questions and you may terminate the survey at any time. If you have any questions or concerns about the survey, I have the name and phone number of the researcher for further information. **Are you willing to participate?**

Consent [___]

All of the questions in this survey are about raw beef (uncooked).

1) Do you eat beef products (steak, filet, ground beef, hamburger, etc.)? **Yes** **No**

Response	Number of Observations
Yes	412
No	1
Total Observations	413

Note: This survey was intended to gather information about individuals who actively participate in the market for beef, i.e. retail purchases and personal/ household consumption. Thus, Question 1 and Question 2 were introduced as pre-survey questions during the introduction and explanation of the survey. Interviewers were instructed to conduct surveys on individuals who consumed and purchased beef products.

1.1) If Yes, in an average week, how many of the meals that you eat at home include beef?

1 - 2 **3 - 4** **5 - 6** **7 - 8** **9 +**

Response	Percent of Responses
1) 1 - 2	29.05%
2) 3 - 4	23.00%
3) 5 - 6	25.18%
4) 7 - 8	9.20%
5) 9 +	13.56%
Mean (response category)	2.55
Standard deviation	1.35
Number of Observations	413

2) In the past month, have you bought raw beef products (raw)? **Yes** **No**

Response	Number of Observations
Yes	413
No	0
Total Observations	413

Note: This survey was intended to gather information about individuals who actively participate in the market for beef, i.e. retail purchases and personal/ household consumption. Thus, Question 1 and Question 2 were introduced as pre-survey questions during the introduction and explanation of the survey. Interviewers were instructed to conduct surveys on individuals who consumed and purchased beef products.

3) When you purchase beef products, do you normally buy for a group of people like your family or do you normally purchase beef only for yourself? ***(Please circle one response)***

Household (2 or more people) | **Individual (1 person)**

Response	Percent of Responses
Household	85%
Individual	15%
Mean	.849
Standard deviation	.357
Number of Observations	413

3.1a) <u>Household</u>
On average, how many people are you purchasing beef for?

_____

Response	Percent of Responses
2	31.34%
3	34.47%
4	21.65%
5	8.26%
6	3.42%
7	0.85%
Mean	3.21
Standard deviation	1.13
Number of Observations	351

3.2a) <u>Individual</u>
On average, during the past month, how many **<u>kilograms</u>** of beef do you purchase **<u>per week?</u>**

_____

Response (kg)	Percent of Responses
0.25	17.74%
0.50	58.06%
0.75	6.45%
1.00	17.74%
Mean	0.56
Standard deviation	0.24
Number of Observations	62

3.1b) Household

On average, during the past month, how many **kilograms** of beef do you purchase **per week?**

_____

Response (kg)	Percent of Responses
0 - 1.00	32.76%
1.01 - 2.00	39.89%
2.01 - 3.00	22.22%
3.00 - 4.00	4.55%
4.01 - 5.00	0.57%
Mean	1.83
Standard deviation	0.90
Number of Observations	351

3.2b) Individual

On average, during the past month, how much have you been spending on beef products **per week?**

[__] < R$ 6
[__] R$ 7 - R$ 11
[__] R$ 12 - R$ 16
[__] R$ 17 - R$ 21
[__] R$ 22 +

Response	Percent of Responses
< R$ 6	17.74%
R$ 7 - R$ 11	32.26%
R$ 12 - R$ 16	29.03%
R$ 17 - R$ 21	14.52%
R$ 22 +	6.45%
Mean (Response Category)	2.60
Standard deviation	1.14
Number of Observations	62

3.1c) Household

On average, during the past month, how much have you been spending on beef products **per week?**

[__] < R$ 25
[__] R$ 26 - R$ 40
[__] R$ 41 - R$ 55
[__] R$ 56 - R$70
[__] R$ 71+

Response	Percent of Responses
< R$ 25	50.43%
R$ 26 - R$ 40	23.93%
R$ 41 - R$ 55	17.66%
R$ 56 - R$70	6.55%
R$ 71+	1.42%
Mean	1.85
Standard deviation	1.02
Number of Observations	351

3.2c) Individual

Do you live with other people who also purchase beef to cook at home?

Yes **No**

Response	Percent of Responses
Yes	17.74%
No	82.26%
Mean	0.1833
Standard deviation	0.39
Number of Observations	62

3.2d) If **Yes**, how many people?

_____

Response	Percent of Responses
1	18.18%
2	45.45%
3	27.27%
4	0.00%
5	0.00%
6	9.10%
Mean	2.45
Standard deviation	1.37
Number of Observations	11

4) Was last month about typical of how much beef you normally purchase? **Yes** **No**

Response	Percent of Responses
Yes	98.06%
No	1.94%
Mean	0.9805
Standard deviation	0.1382
Number of Observations	413

5) Where do you normally purchase your beef products?

[__] Commercial Supermarket (Mercadorma, Wal-Mart, BIG, etc.)
[__] Local Non-Commercial Supermarket
[__] Municipal Market
[__] Butcher Shop
[__] Other (please specify) _____

Response	Percent of Responses
Large Supermarket Chains	43.82%
Local Markets	22.52%
Municipal Market	3.64%
Butcher	30.02%
Other	0.00%
Mean (Response category)	2.207
Standard deviation	1.29
Number of Observations	413

6) On a scale of 1 to 5, where 1 represents no concern and 5 represents extremely concerned, how concerned are you about environmental quality?

1 2 3 4 5

Response	Percent of Responses
1	0.70%
2	2.40%
3	17.19%
4	30.02%
5	49.63%
Mean (Response category)	4.25
Standard deviation	0.876
Number of Observations	413

7) On a scale of 1 to 5, where 1 represents no knowledge and 5 represents extremely knowledgeable, how much do you know about beef production in Brazil?

1 2 3 4 5

Response	Percent of Responses
1	21.55%
2	23.00%
3	28.33%
4	18.16%
5	8.96%
Mean (Response category)	2.699
Standard deviation	1.24
Number of Observations	413

8) On a scale of 1 to 5, where 1 represents no knowledge and 5 represents extremely knowledgeable, how much do you know about environmental issues related to beef production?

1 2 3 4 5

Response	Percent of Responses
1	28.09%
2	28.09%
3	25.67%
4	12.10%
5	6.05%
Mean (Response category)	2.39
Standard deviation	1.19
Number of Observations	413

9) Have you ever heard of an environmental certification of sustainability or a green seal? **Yes** **No**

Response	Percent of Responses
Yes	79.90%
No	20.10%
Mean	0.799
Standard deviation	0.401
Number of Observations	413

9.1) If Yes, are you aware of any products that have certifications of environmental sustainability? **Yes** **No**

Response	Percent of Responses
Yes	31.12%
No	68.88%
Mean	0.311
Standard deviation	0.463
Number of Observations	331

9.1a) If Yes, what product? _____

Response Category, n = 103	Percent of Responses
Food (General)	66.99%
Wood	14.56%
Packaging	8.74%
Cosmetics	5.82%
Other	3.89%

9.2) If yes, do you think environmental certification programs or green seals are good ways to promote sustainability? **Yes** **No** **I do not know**

Response	Percent of Responses
Yes	60.18%
No	1.82%
I don't know	37.99%
Mean	1.36
Standard deviation	0.518
Number of Observations	329

These questions are completely hypothetical. Your responses will be used for research purposes only.

We are **NOT** collecting any money!

Increasing demand for beef has resulted in significant land use transformations in Brazil. These transformations include the intensification of some existing ranches and controversial forest clearing for new pasture in Amazonia. Both intensification of cattle production and the expansion of pasture for cattle may negatively affect environmental quality, resulting in degraded landscapes and problems such as reduced water quality and loss of biodiversity.

One of the ways to prevent environmental degradation and maintain meat production is through use of sustainable certification. Certification is a method that ensures meat is produced without harming the environment. Sustainable ranching operations provide a wide variety of ecological and social benefits, including; the conservation of natural resources, improved water quality, the protection of habitat and biodiversity as well as better working conditions for farm laborers. Although there are many benefits from sustainable ranching, increased management and restrictions typically result in higher prices for beef.

In order to gain more knowledge about consumer preferences for sustainably produced beef, we would like to ask you a hypothetical question regarding your purchasing preferences.

10) Imagine that the current price of standard un-certified **Top Sirloin** is **R$ 18.00 per kilogram**.

Would you be willing to pay R$ _____ per kilogram if the Top Sirloin had a certification of environmental sustainability.

YES

10.1) Would you be willing to pay R$_____ per kilogram for Top Sirloin with a certification of environmental sustainability

Yes No

NO

10.2) Would you be willing to pay R$_____ per kilogram for Top Sirloin with a certification of environmental sustainability

Yes No

Initial Bid Values (R$):

18.50, 19.00, 19.50, 20.00, 21.50, and 23.00

Follow- Up Bid Values (R$):

18.10, 18.25, 18.50, 19.00, 19.50, 20.00, 21.50, 23.00, 24.50, and 26.00

11. We are interested to know why you said "YES". What is the main reason you are willing to pay this amount or not willing to pay this amount?

Motivation for "YES" response		n = 326
Response Category - WTP		**Percent Response**
Environmental Protection	**74.23%**	
General Concern (worried about nature)		15.65%
Preservation		15.33%
Conservation		10.73%
The Future		8.59%
Preventing Degradation		7.67%
Sustainability		6.75%
Deforestation		5.53%
Management		3.99%
Direct Consumer Benefit	**20.86%**	
Quality of Product		11.96%
Product Information (Origin)		3.68%
Health Benefits		3.07%
Consumer Confidence		1.23%
Small Price Difference		0.92%
Other	**4.91%**	
Responsible Production		2.14%
Good Cause		1.53%
Treatment of Animals		1.23%

Motivation for "NO" response	n = 119
Response Category - WTP	**Percent Response**
Increased cost of the product	82.35%
Opposed to more taxation	7.56%
Corruption Issues	5.88%
Credibility of Certification	4.20%

Your responses are *completely anonymous and cannot be traced to you*.

12) How old are you? _____

Age Group	Percent of Responses
18 - 29	14.77%
30 - 39	33.41%
40 - 49	29.30%
50 - 59	17.43%
60 - 79	4.12%
70 +	0.97%
Mean	41.18
Number of Observations	413
Minimum	19
Maximum	75

13) What state are you originally from? _____

Response	Percent of Responses
PR - Paraná	71.67%
SP - São Paulo	12.59%
RJ - Rio de Janeiro	6.54%
SC - Santa Catarina	4.60%
RS - Rio Grande do Sul	1.69%
BA - Bahia	0.97%
ES - Espírito Santo	0.73%
MT - MatoGrosso	0.48%
CE - Ceará	0.24%
DF - Distrito Federal	0.24%
RO - Rondônia	0.24%
Number of Observations	413

14) How long have you lived in Curitiba?

[__] Entire Life _____ Years (How many) _____ Months (How many)

Length of time	Percent of Responses
Less than 1	1.45%
1 - 5	5.57%
6 - 10	5.08%
11 - 20	19.61%
21 - 30	18.16%
31 - 50	35.84%
51 +	11.62%
Visitor	2.66%
Mean*	29.83126036
Standard Deviation*	16.28626554
Number of Observations*	402

*Excluding visitors

15) What is your gender? **Male** **Female**

Response	Percent of Responses
Male	48.20%
Female	51.80%
Mean	0.492
Standard deviation	0.529
Number of Observations	413

16) How many people reside in your household? _____

Response	Percent of Responses
Mean	2.94
Standard deviation	1.29
Number of observations	413

Please indicate below the ages of these household members:

	Age	Number of Household Members
16.1	0 - 10	
16.2	11 - 17	
16.3	18 - 60	
16.4	61 +	

Age group, n=413	Distribution of Household Members
0 - 10	5.32%
11 - 17	13.18%
18 - 60	74.21%
61 +	7.29%

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

[__] Middle School
[__] Some High School
[__] High School Graduate
[__] Some College
[__] College Graduate
[__] Post Graduate

Response	Percent of Responses
Middle School	8.47%
Some High School	10.41%
High School Graduate	35.84%
Some College	11.86%
College Graduate	25.42%
Post Graduate	7.99%
Mean (Category response)	3.593
Standard deviation	1.397
Number of Observations	413

18) Are you a member of an environmental organization? **Yes** **No**

Response	Percent of Responses
Yes	0.73%
No	99.27%
Mean	0.0073
Standard deviation	0.085
Number of Observations	413

19) What is your approximate **monthly household income** from all sources?

[__] Less than $830
[__] R$ 831 - R$ 1.245
[__] R$ 1.246 - R$ 2.490
[__] R$ 2.491 - R$ 4.150
[__] R$ 4.151 - R$ 6.225
[__] R$ 6.226 - R$ 10.375
[__] R$ 10.376 +

Response	Percent of Responses
Less than $830	4.12%
R$ 831 - R$ 1.245	10.65%
R$ 1.246 - R$ 2.490	15.01%
R$ 2.491 - R$ 4.150	19.85%
R$ 4.151 - R$ 6.225	28.09%
R$ 6.226 - R$ 10.375	19.13%
R$ 10.376 +	3.15%
Mean (Category response)	4.27
Standard deviation	1.486
Number of Observations	413

Thank you for your participation!