IDENTIFYING STAKEHOLDER AND OWNER MOTIVATIONS DRIVING THE MANAGEMENT OF URBAN AND LARGE FAMILY FORESTS FOR CLIMATE CHANGE MITIGATION, CONSERVATION, AND PRODUCTIVE PURPOSES

by

YENIE LE TRAN

(Under the Direction of Jacek Siry)

ABSTRACT

The aim of this dissertation was to identify variables that were important to different stakeholders in forest management, including urban residents, municipal governments, and the private family forest owners with large landholdings. The research introduced a basis for thinking about policies that affect changes in forest land use. Three studies were conducted addressing policy factors at the household level, the municipal level, and the forest landowner level. The first study examined the opinions and attitudes of urban residents and how much they supported the increase of urban forests as part of a climate change strategy. Results showed that respondents were willing to support and pay for increasing and maintaining additional urban forests for climate change mitigation. The second study examined how U.S. mayors prioritized the issues of climate change and urban forest management in their respective cities. Climate change adaptation was the top ranked method to address climate change and the increase of urban forests ranked highest from a list of environmental priorities. The third study focused on private family forest landowners with large landholdings in the U.S. South and their land management objectives. Results showed that noneconomic benefits, extent of family ownership, and size of landholdings affect decisions made by landowners in this segment.

INDEX WORDS: Forest Land Use, Willingness to Pay, Urban Forest Policy, Climate Change Policy, Family Forest Landowners, Family Firms

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DEDICATION

To God who makes all things possible

To my parents and brothers who provided love and encouragement every step of the way

To Stephen for your unwavering support, prayers, love, patience, and kindness

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CHAPTER 1

INTRODUCTION

Humans have dramatically altered the amount, pattern, and composition of global vegetation over time, but increased population pressures have raised concerns that land use resulting in the loss of forests and endangering the sustainability of goods and services provided by forest land (Riitters et al., 2000). Concerns about the effects of the development of forest land in the United States have risen since the 1990s (Stein et al., 2010), especially given that the U.S. population is projected to grow 40 percent by 2050 (Alig, 2010). The process of urbanization is thought to be one of the greatest influences on U.S. forests during the 21st century due to land use pressure (Nowak et al., 2005), leading to deforestation and forest fragmentation concentrated in distinct regions, including the U.S. South (Alig, 2010). Although the concepts of parcelization and fragmentation are closely related, Mehmood and Zhang (2001) clarified the term forest parcelization as a shift from few landowners with large landholdings to many landowners with smaller landholdings and forest fragmentation as a concept that described forest habitats becoming isolated islands across the landscape. Implications of urbanization, forest parcelization and fragmentation, and overall forest cover loss included impacts to timber production, greenhouse gas emissions, biodiversity, and water quality (Riitters et al., 2000).

Land use changes are recognized as important to understanding consequences of environmental, economic, and social interactions on the land (Drummond and Loveland, 2010). Much is already known about land use trends in the United States. The U.S. Census provides a reliable source of information on the distribution of human population in the United States over time. It also provides information on housing unit data, which can be used to derive measures of urbanization. Agricultural and forest land use have been documented over time by the U.S. Department of Agriculture Economic Research Service. This information has been further reinforced by technological advances in remote sensing. U.S. historical land use trends have been dominated by a decline in agriculture and subsequent reforestation of farmland (Drummond and Loveland, 2010). As agriculture and settlement relocated westward, eastern forest cover rebounded. This recovery of forests has important implications for society and the environment, including a stable timber supply and carbon storage capacity. However, low-density developments can lead to urban sprawl, which is a process that can lead to land use changes and forest fragmentation (Brown et al., 2005). Urban sprawl is characterized in terms of the amount of land consumed to accommodate new urbanization by a Brookings Institution study (Fulton et al., 2001). If land is being consumed at a faster rate than population growth, then the area can be characterized as "sprawling." If the population is growing at a faster rate than land is being consumed, then the area can be characterized as "densifying." Fulton et al. (2001) found that most metropolitan areas in the United States were adding urbanized land at a much faster rate than they were adding population between the years of 1982 and 1997.

A related concern to changes in land use and a loss in forest cover is the impact they might have on climate change. Land use changes, including deforestation, are estimated to account for 15-20 percent of carbon dioxide emissions (Waage and Hamilton, 2011). In the long term, a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fiber or energy from the forest, will generate the largest sustained mitigation benefit (Metz et al., 2007). Improving the productivity of land use systems may also increase incomes and food security (Smith and Scherr, 2002).

Studying local populations and how they value urban forests and the effects climate change would increase understanding on how forest management may be improved to meet societal needs. Quantifying the effects of the policy alternatives are also important to further understanding the public's values for forests as a resource. Do urban residents care about the loss of forest cover or forest fragmentation and their effects on climate change? To what degree are they willing to address or pay for these effects? To address these questions, Chapter 2 examined household survey results from Atlanta, Georgia. Atlanta is a city that has become synonymous with sprawl and had the largest absolute increase in urbanized land in the nation during the period 1982-1997 (Fulton et al., 2001). The study examined what forest amenities households in Atlanta value and how much they are willing to pay for increasing and maintaining urban forests as part of a climate change plan. In the survey, urban forests were introduced as one method to address climate change mitigation in a referendum type format. Focusing on this may reveal the nature and origins for climate change mitigation policies, including the willingness to pay for more tangible goods than carbon offsets. Also explored were the beliefs and attitudes on climate change and urban forests, media preferences, race, income, and other variables that may predict attitudes and preferences of climate change mitigation.

Understanding policy variables and how local policymakers are prioritizing environmental investments, particularly in urban forests and climate change, are also critical for evaluating policy implications for future forest land use. U.S. public support for climate change action has waned since the economic downturn beginning in 2008 (Scruggs and Benegal, 2012). This downturn has not been limited to the United States, and an indicator of international support will be gauged by actions that will be taken to establish a legally-binding global deal to reduce greenhouse gas emissions, which would take effect in 2020 after the Doha Amendment to the

Kyoto Protocol expires. At the same time, population growth in urban areas will continue to encroach on productive forest land. Some of these forests will become urban forests, parks, and open spaces, which provide multiple benefits, such as shade, recreation, and aesthetic beauty. Policy initiatives such as the monetization of carbon sequestration and other nonmarket goods could provide cities an opportunity to earn income to manage these forests. Chapter 3 addresses local government initiatives in climate change and urban forests, as well as how they are prioritizing these investments. To carry out this study, the members of the U.S. Conference of Mayors Climate Protection Agreement were surveyed. These mayors represented more than 1,000 cities and 93.6 million people in the United States.

As it relates to both publicly and privately managed timber land, forest fragmentation and parcelization have the potential to increase harvesting costs as tracts become smaller and more challenging to access and decrease biodiversity as smaller parcels of noncontiguous forests change the landscape and the way it is managed. Increased urbanization has the potential to not only increase ordinances and regulations on forest land due to negative public attitudes toward harvesting and other forest management practices, but also to create increased taxes from rising property values and liability concerns due to trespassing. There has been much focus on smaller landowners, but little is known about the larger, private family forest landowners who control a large amount of the privately-owned, contiguous timberland tracts in the U.S. South. If the concern is parcelization and fragmentation, then it is important to examine how larger landowners view the ownership and management of their forest land. Chapter 4 examined the role of large family forest landowners in forest management across the U.S. South. Understanding their characteristics, the reasons why they hold the land, and their challenges will help explain what variables contribute to land use change and forest fragmentation. Because little is known about the noneconomic benefits that this group of landowners may value, a qualitative approach was taken to examine this population. Land managers were interviewed and asked questions pertaining to how they structured their landholdings, what their motivations were to keeping the land under family ownership, what their forest management practices were, and what challenges or opportunities they faced in owning the land.

The overarching aim of these studies were to identify variables that were important to different stakeholders in forest management, including urban residents, municipal governments, and the private forest owners, regardless of whether the primary objective of the forest land is for timber production, wildlife management, or for climate change mitigation. The results of these studies could be used in policy targeting the efforts of cities in maintaining and enhancing their urban forests, and to curb conversion of the many valuable forest lands by helping working forests to remain productive, both economically and environmentally.

CHAPTER 2

ATLANTA HOUSEHOLDS' WILLINGNESS TO INCREASE URBAN FORESTS TO MITIGATE CLIMATE CHANGE

Introduction

Public concerns about the effects of climate change on forests are generally related to the ecosystem services that contribute to human health and well-being. Urban areas in the United States have quadrupled in size between 1945 and 2007, increasing at about twice the rate of population growth in the same period (Nickerson et al., 2011) with an average tree cover of 35.1 percent (Nowak et al., 2010). Because urban forests absorb and store atmospheric carbon dioxide (CO_2) from urban areas and affect the emission of CO_2 from urban areas, they play a critical role in climate change (Nowak and Crane, 2002). Urban tree cover can also mitigate the urban heat island effect and reduce heating and cooling needs, thereby reducing polluting fossil fuels and energy costs (Rahman et al., 2011; Nowak, 2000). Urban trees have the potential to absorb CO_2, nitrous oxide (N_2O), sulfur dioxide (SO_2), and other pollutants, which would improve air quality (Escobedo et al., 2008; Tallis et al., 2011). Shaded parking lots also reduce stationary car emissions and the resulting ozone concentrations (Scott et al., 1999). For all these reasons, urban forests could be an important component to a climate change strategy for providing public goods and increasing climate change resiliency in urban areas. The recognition of the benefits of urban forests has already resulted in the expansion of a network of urban forestry organizations across the U.S. in every state. The groups include diverse governmental, commercial, and nonprofit organizations (Sustainable Urban Forest Coalition, 2014). However, for policymakers, the costs of a policy and their impacts on gross domestic product (GDP) and consumption are important.

There are also the questions of whether an increase in the public good of urban forests increases the social welfare of urban residents, what the optimum amount of urban forests is, and if residents are willing to pay for the forests.

A great deal of economic literature has been devoted to the issue of climate change and how society should address it (Cline, 1992; Nordhaus, 1993; Weyant, 1993; Fankhauser and Hepburn, 2010; Stern, 2006; Pindyck, 2013). Cline (1992) and Nordhaus (1993) calculated efficient approaches to slowing global warming, with Nordhaus (1993) specifically supporting the carbon tax approach. Projecting the costs of reducing carbon emissions is difficult because of the global nature of climate change (Weyant, 1993). Fankhauser and Hepburn (2010) supported a carbon market mechanism, but using auctions rather than cap-and-trade. Stern (2006) advocated early action on climate change and that one percent of world economic activity should be invested to reduce its impacts. Pindyck (2013) thought all models projecting carbon emissions were flawed, but still thought climate abatement policy should still be pursued as a form of insurance for society. Climate change has generally been considered a public bad, where certain individuals and firms emit greenhouse gas (GHG) emissions that impose costs on everyone on the planet through gradual change of climate. Current generations enjoy the wealth and lifestyle that require high emission of GHGs, while future generations may have to bear the consequences of any resultant climate change. Similarly, the benefit of emissions reduction, or climate change mitigation, is considered as a global public good, since one country's efforts to curb global climate change will benefit societies other than its own. However, the non-excludable nature of curbing global climate change makes it easier for governments to refuse to commit to reducing emissions because it would allow others to "free ride," or take benefit without assuming the cost.

While the debate over the causes of climate change continues, scientists believe that the increase of anthropogenic emissions such as CO_2, methane (CH_4), and N_2O are mainly responsible for global warming and climate change (Pachauri and Reisinger, 2007). Precise measurements for CO_2 have been available for many years, but measurement of CH_4 and N_2O have been limited due to lack of appropriate technology (Savage et al., 2013). Different methods to reduce carbon emissions have been proposed, focused mainly on transportation and electricity sectors, as they account for about 87 percent of the U.S. carbon emissions (Energy Information Administration, 2012).

Urban areas have the highest concentration of population, industries, and infrastructure. They are also likely to face the most severe impacts of climate change (United Nations Habitat, 2011). For instance, the population concentration of urban areas can generate risk when residential and industrial areas lack space for evacuation and emergency vehicle access or when high income populations reside in low-lying coastal zones and low income groups settle on at-risk sites for floods and landslides. Because of increased urbanization and land fragmentation, U.S. policymakers have increasingly looked at ways to improve the sustainability and livability of cities. According to the U.S. Census, 80 percent of the U.S. population resides in urban areas, which are defined as areas with at least 50,000 people residing in Census-designated urban areas with core population density thresholds of 1,000 persons per square mile (tracts with a population density of at least 500 persons per square mile are also included if contiguous to core tracts) (U.S. Census, 2011).

There remains considerable uncertainty about the consequences of climate change, and the distributional consequences of the changes are also unclear (International Panel on Climate Change, 2014; Tol et al., 2004). Individual groups within the American public may not respond to the issue of climate change in the same way. Engaging each group to participate in climate change solutions will require different approaches. Therefore, it is important to understand how the public perceives climate change, their values and preferences, and barriers that might constrain their engagement in policy solutions. Some essential questions that must be addressed first are: 1) what mitigation methods will be used; 2) will people support the proposed policy; and 3) are they willing to pay to mitigate the problem. To address these questions, a mail survey was implemented. This study was distinguished from other climate change studies in that the focus was on households' willingness to support and pay for urban forests as a climate change mitigation method. Atlanta, Georgia, USA was selected for this study given its environmental issues such as heat island effect and land cover changes, including conversion of forestland, that come with rapid population growth and urban sprawl (Stone et al., 2013). This study focused on increasing urban forests as one policy option in an overall climate change strategy for Atlanta.

Relevant Literature

Public Attitudes toward Climate Change and Quantifying Effects of Climate Change Policy

Attempts to describe the characteristics and behaviors of individuals toward climate change are substantial (Brulle et al., 2012; Lachapelle et al., 2012; Scruggs and Benegal, 2012). Brulle et al. (2012) constructed a time series measure of public opinion on climate change, which included the Gallup poll on environmental concerns, and modeled it with a media index. They found that media coverage exerted an important influence over public opinion of climate change over time. The promulgation of scientific information had minimal effect and extreme weather events such as high temperature, precipitation, and drought did not change individuals' opinions regarding the threat posed by climate change (Brulle et al., 2012). Public opinion studies also suggested that the public's concern over climate change has declined dramatically since 2008 and it is likely driven by economic security (Scruggs and Benegal, 2012). Scruggs and Benegal (2012) examined Gallup poll trends from 1990 until 2010 and found that the level of public worry peaked at the top of the economic cycles in 2001 and 2008. Newport (2014) also found the same results after examining Gallup poll trends. Americans reached the highest levels of worry in April 2000 at 40 percent and March 2007 at 41 percent and the lowest level of worry in October 1997 at 24 percent, March 2004 at 26 percent, March 2011 at 25 percent (Newport, 2014). The current level of worry at 34 percent is the same as it was in 1989. Few studies have explored the nature and origins of support for different types of mitigation policies. One study exploring this found that Norwegians favored policy options that are good for the environment, but present low personal hardship, such as tree-planting and higher fuel efficiency standards, rather than measures that require difficult tradeoffs such as limiting population growth and a carbon tax (Rosentrater et al., 2013).

Quantifying the effects of environmental policy alternatives is also important to further understand the public's values for a particular resource. Since environmental goods are not typically bought and sold in marketplace, the value estimates can be "revealed" by using stated information pertaining to the preference of the good (Carson, 2011). The basic consumer choice problem is to obtain the highest utility level of the bundles of goods subject to the individual's given level of income (Flores, 2003). Individuals are also constrained by the level of nonmarket goods available, such as mitigating climate change with urban forests in this study, because they are tend to be fixed. A policy or project that provides urban forests involves costs. Assigning a value to these projects is important to justifying costs (Flores, 2003). This is often done by undertaking a benefit-cost analysis, which is first carried out by measuring the aggregate willingness to pay (WTP) of those who gain from the policy and then measuring the aggregate willingness to accept of those who lose from the policy (Freeman, 2003). The major impediment to this approach is that the good of interest is not routinely bought and sold in markets and hence, the economic indicators of the goods are generally not available. To overcome this, the contingent valuation method (CVM) is often used to elicit people's preferences in WTP amounts to determine the missing market for the public good (Mitchell and Carson, 1989).

Prior to the Exxon Valdez oil spill in 1989, the CVM was not widely used (Carson et al., 2003), and the method is still not without criticism today. One limitation is that an individual may not reveal true preference values due to social norms, strategic behavior, or because there is no real money involved (Arrow et al., 1993). For instance, respondents could strategically bid below their true WTP if they believe that others will carry the cost of providing the good (Haddad and Howorth, 2006). Also, the survey may be answered only by individuals most interested in the nonmarket good, which would present response bias. These limitations led critics to question the accuracy of the contingent valuation approach (Diamond and Hausman, 1994). Despite criticism of the CVM, it has been widely used to assess the benefits of nonmarket goods, including how much the public is willing to pay for climate change mitigation and urban forests. Even if an individual does not reveal true preference values, CVM can still reveal how individuals make choices which in turn reveals some information about an individual's value for natural resources, such as urban forests (Smith, 2006).

According to one study that examined climate change attitudes in a western Canadian city, one predictor of willingness to mitigate climate change is the belief that climate change is caused by humans (Heath and Gifford, 2006). Another study examined Canadian and U.S. households' willingness to pay for climate change mitigation (Lee and Cameron, 2008). In particular, Lee and Cameron (2008) examined how different subpopulations would react to climate change policy and found that women were willing to pay more than men; Canadians were less willing to pay than Americans; and that the more liberal an individual's political preference was, the more willing that person was to pay.

Potential Role of Urban Forest on Offsetting GHG and Other Co-Benefits

In urban areas, afforestation projects are increasingly common (Oldfield et al., 2014). These projects are intended to capture carbon as well as improve air quality, lower air temperatures during hot weather months, increase stormwater infiltration, and create wildlife habitat (Oldfield et al., 2014). Studies of how urban forests benefit urban populations conclude that tree cover improves the urban environment (Lee and Maheswaran, 2011; Nowak et al., 2002; Stone et al., 2013). Cities have increasingly invested in urban forests, and research studies generally assert that any increase in urban forests is desirable and will mitigate pollution problems (Manning, 2008; McPherson et al., 2013; Roy et al., 2012; Siena and Buffoni, 2007). However, there are studies that call into question whether the net effect of urban forests on environmental quality is always positive (Escobedo et al., 2011). Disservices from urban forests can include financial costs (pruning, removal, vegetation damage), social nuisances (allergenic pollen, obscured views, fear of crime, safety hazards), and environmental (soil nutrient inputs, pesticide runoff, displacement of native species) (Escobedo et al., 2011).

Public Attitudes and WTP for Urban Forestry Programs

Several studies have examined public attitudes toward urban forests. Zhu and Zhang (2008) found that the demand for urban forests in U.S. cities is elastic with respect to prices and changes in income with urban forest area increasing as total population grows, but at a lower rate than population growth. They also found a higher demand for urban forests among people of higher income level. Another predictor of the attitudes and preferences of urban forests is race.

A study by Elmendorf et al. (2005) documented that there are racial differences between individuals in the preferences of urban forests, even when gender, age, education, and income were controlled. A study using Philadelphia and Atlanta as settings documented racial differences between individuals who identify with being black/African American and individuals who identify with being white/Caucasian in the preferences for urban forests (Elmendorf et al., 2005). Black/African American populations were less likely than white/Caucasians to perceive urban parks and forests as providing natural amenity benefits, such as streams, lakes, and birds; but they were more likely to value recreation facilities and evidence of ethnic representation. This led Elmendorf et al. (2005) to believe that racial preferences for urban forestry could be based, in part, on feelings of marginality, ethnicity or subcultural variation, and discrimination. Persons with higher incomes were more likely than those with lower incomes to view parks as beneficial. Education, age, and gender were not found to be significantly related to perceiving parks as beneficial. Moreover, black/African Americans were more willing to volunteer than their white/Caucasian counterparts in park development and maintenance activities. This study is important for urban foresters and arborists to understand and respond to differences in participation and the expectation of diverse users.

Some studies have estimated the monetary value of nonmarket benefits derived from urban forests. Majumdar et al. (2011) examined the aesthetic value of urban forests for tourists in Savannah, Georgia. Lorenzo et al. (2000) estimated residents' WTP for community urban forests in Mandeville, Louisiana. Treiman and Gartner (2006) studied residents in Missouri communities and estimated their willingness to pay for establishing a tree fund for community forests. These studies examined how much residents were willing to pay for urban forests as a whole and not for specific benefits that the urban forests may provide.

How This Study is Different from Other Studies

Instead of focusing on general beliefs and attitudes of climate change, this study introduced a tool to address climate change mitigation in a referendum type format to households in Atlanta, Georgia, USA. This evaluated how much urban residents value the potential climate change mitigation benefit of urban forests. Focusing on this may reveal the nature and origins of climate change mitigation policies, including the willingness to pay for a more tangible good than for carbon offset strategies. Explored are the beliefs on climate change and urban forests, media preferences, race, income, and other variables that may predict attitudes and preferences of climate change mitigation and the role of urban forests.

This study integrated the role of trees in mitigating carbon pollution and maintaining quality of life by assessing the characteristics and behaviors toward climate change and carbon pollution and urban residents' willingness to mitigate carbon pollution by planting additional trees. Awareness of the issue of climate change is high among the general public due to the visibility given to the topic by news media. However, this awareness may not translate into a deep understanding of climate change and a willingness to pay to mitigate its effects. Urban forests provide many benefits, including improved air quality (Nowak et al., 2006), shade from leaf foliage during the growing season months (Akbari, 2002), increased real estate values (Payton et al., 2008), stormwater regulation (Inkilainen et al., 2013), health benefits (Lee and Maheswaran, 2011), and the mitigation of heat island effect (Lynn et al., 2009). Stone (2012a) and Trenberth et al. (2007) found that the heat island effect can cause climate change effects in localized areas or regions, including changes in precipitation, clouds, and daily temperature ranges.

Study Area

Atlanta, the state capital of Georgia, is ranked 40th in most populous of U.S. cities with a population of 420,003, according to the 2010 U.S. Census; and it also has the fourth largest black and African American population, making up 54 percent of the general population. The Census projects a 2.96 percent annual increase in population, which will result in a population of 562,260 by the 2020 Census, making it one of the fastest growing U.S. urban cities. Because of the population growth, Georgia recently gained an additional congressional seat in the U.S. House of Representatives, boosting the total number of congressional seats to 14. The Atlanta metropolitan area contained more than 5.3 million people, according to the 2010 U.S. Census, stretching across 29 counties. As a result of the tremendous population growth, the metropolitan Atlanta area has become a city known for its urban sprawl (Miller, 2012). Urban sprawl is a term given to describe low-density development around urban areas, which often necessitates significant automobile transportation for residents. Urban sprawl often is attributed to lack of centralized city planning and the increased demand of residents for living in settings that seem closer to nature (Austin and Kaplan, 2003).

Atlanta encompassed 133.2 square miles (85,248 acres) of land area. The Georgia Model Urban Forest Book suggests that 40 percent average tree canopy cover is a reasonable community standard, and sometimes can be even higher depending on the circumstances (Georgia Forestry Commission, 2001). American Forests (2001) performed a study on Atlanta's urban forest resource and found that average tree cover declined from 45 percent to 29 percent over a 22-year time period, between 1974 and 1996. American Forests (2001) estimated that Atlanta had an urban tree canopy of 27 percent. However, another study found that tree cover in

Atlanta ranged between 50-53 percent in both 1951 and in 2010, but the location of the tree cover changed (Merry et al., 2014).

Methodology

To gain a better understanding of whether Atlanta residents would support increasing urban forests as a climate change mitigation tool and if they are willing to pay for such a policy, the amount of forest cover in Atlanta was estimated, a mail survey was implemented, and the responses to the survey were analyzed. This study focused on Atlanta households only within the city boundaries (Figure 2.1). Figure 2.1 shows the boundary line of Atlanta, Georgia. The red plots represent responding residents who resided in Fulton County. The white plots represent responding residents who resided in the DeKalb County portion of Atlanta.

A mail-based survey was developed and administered using Dillman's Tailored Design Method (Dillman et al., 2009). The survey (Appendix A) was divided into three sections. The first section included general questions regarding respondents' attitudes towards climate change, and potential of urban forests to address climate change effect. The second section included questions designed to understand respondents' views of climate change policies and their willingness to pay for expanding urban forests as a method to address climate change mitigation. The last section included questions about the respondents' demographics.

Survey Sampling International provided randomly selected addresses within the municipal city boundaries of Atlanta. A pre-test was first implemented on 200 randomly selected addresses in Atlanta. This helped ensure the survey was clear, concise, and met the objectives of the study. This also provided an opportunity to determine if there were any questions or topics missing from the survey. Based on similar studies, we expected a response rate of at least 20 percent (Foster and Tobin, 2013; Lee and Cameron, 2008; Lorenzo et al., 2000). However, the pre-test yielded a response rate of 10 percent, which led to the decision to focus on increasing the number of responses so that a larger number of observations would be available for analysis.

In November 2013, a personally-signed, pre-notification postcard was sent to 5,500 Atlanta households alerting them of the purpose of the study and that a questionnaire in the mail would soon arrive (Appendix B). The survey itself was mailed out two weeks later via first class mail along with a personally-signed cover letter (Appendix C), a unique identifying number, and a postage paid envelope. The cover letter also guaranteed anonymity and confidentiality for the participants. The letters and survey received University of Georgia Institutional Review Board authorization prior to distribution (Appendix D). A personally-signed reminder postcard emphasizing the importance of participation was sent three weeks later (Appendix E). The percentage of tree canopy for each respondent's corresponding Census tract was estimated by using i-Tree Canopy[1] program. i-Tree Canopy is an open source tool that randomly lays points onto Google Earth imagery and the user can then classify the cover class for each point. i-Tree Canopy was first used to produce an overall Atlanta tree cover estimate for this study using 3,500 points, resulting in 36.6 percent tree cover with a standard error of ±0.8. The estimated 36.6 percent tree canopy cover is equivalent to about 48.5 square miles of land in Atlanta is comprised of urban forests. Given this figure, a five percent expansion of forests in Atlanta over five years should be a feasible proposed target. A five percent expansion of this would add 2.44 additional square miles or 1,551.6 acres of urban forest cover. Tree canopy percentages for respondents' respective Census tracts ranged from 2.5 percent to 67.6 percent with a standard error of ±3.0.

[1] i-Tree Canopy. I-Tree Software Suite v.5.x. (n.d.). Web.

The survey instrument was coded before the survey data was entered into Qualtrics[2], which is a web-based survey software. The software provided a simple interface to input survey data, which was then exported into comma-separated values. This file format was converted for further analysis in spreadsheet form and in Stata[3], a statistical software package. Using Stata, a series of parametric and non-parametric procedures were used to analyze the data.

Missing data was first analyzed, including analyses on nonresponse bias and data incompleteness. Missing data is an issue that is common in nearly all survey research, and there are several different ways to handle it, depending on the nature of the missing data. Missing data can be a result of item nonresponse, which occurs when questions are unanswered, or unit nonresponse, which occurs when surveys are not returned (Brox et al., 2003). Unit nonresponse and item nonresponse can cause bias analyses. The aim was to minimize nonresponse *ex ante* during the survey design state, but analyzing and dealing with nonresponse are typically done *ex post* (Korinek et al., 2007) and hence are discussed in the results section.

Analysis of Demographic and Attitudinal Data

Frequency and mean procedures were used to analyze and categorize demographic and attitudinal data. To measure the respondents' level of agreement that climate change is occurring, a 5-point Likert scale was used: strongly disagree = -2, disagree = -1, neutral = 0, agree = 1, strongly agree = 2. The same Likert scale was used when asking respondents questions related to their attitudes on urban forests. Respondents were also asked how much they would support increasing urban forests as part of Atlanta's climate change strategy using a Likert scale: not at all = 1, slightly = 2, moderately = 3, very much = 4, completely = 5.

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[2] Qualtrics. 2013. *Qualtrics Research Suite: Version 37,892.* Provo, UT: Qualtrics
[3] StataCorp. 2013. *Stata Statistical Software: Release 13*. College Station, TX: StataCorp LP

Determining Willingness to Pay

The contingent valuation method (CVM) typically involves a survey asking respondents how much they are willing to give up in current household income in exchange for an increase in the level of the public good. The theoretical basis of CVM is of consumer utility maximization and the measurement of welfare change (Freeman, 2003). The goal of contingent valuation studies is to measure a household's compensating surplus from a change in the good in question with the basic premise that individuals have preferences over market and nonmarket goods and that they can order the bundles of goods in terms of desirability (Flores, 2003). For market goods, assumed is that individuals can choose the amount of each good based on prices, P=$[p_1, p_2, \ldots, p_n]$ and available income. Individuals may not choose the amount of nonmarket goods, so they are in a sense rationed. The basic choice problem is how a household obtains the highest level of utility, U, while spending income, y, toward the purchase of market goods, $X=[x_1, x_2, \ldots, x_n]$ subject to the rationed level of nonmarket goods, $Q=[q_1, q_2, \ldots, q_k]$.

$$\max_{X} \; U(X, Q) \text{ s.t. } P \cdot X \leq y, Q = Q^0 \qquad (1)$$

From the utility function (1), two indirect utility functions may be obtained. The first is the compensating variation of the measure, which is the amount of income given up as a result of the policy that would return the individual's utility back to status quo level. The second is the equivalent variation measure, which is the amount of additional income an individual would need to maintain the same utility after the change. If the policy as a whole is bad, then the compensating welfare measure is an individual's willingness to accept (WTA) the policy and the equivalent measure is an individual's willingness to pay (WTP) to avoid the policy. If the policy as a whole is a good, then the compensating welfare measure is the WTP to obtain the policy and the equivalent welfare measure is the WTA forgoing the policy. The measure for this study is the compensating welfare measure and the WTP to obtain the policy. Conceptually, the economic valuation can be represented by indirect utility functions

$$V_0(Y_0, E_0, P_0) = V_0(Y_0 - WTP, E_1, P_0) \quad (2)$$

where V_0 represents the base level of utility, P_0 are existing prices, Y_0 is current income, and E_1 and E_0 are cases that include the urban forestry program and do not include the urban forestry program, respectively. Annual household *WTP* is the amount of income a household would give up to gain a higher level of urban forests for climate change mitigation, E_1, while maintaining constant utility.

The survey instrument provided a scenario and asked the respondent if s/he would vote in favor of an increase in urban forests in Atlanta if the measure were included on the next ballot. Respondents were asked how much they were willing to pay for more urban forests to mitigate climate change per household annually for five years, using an open-ended bidding process, where the respondent can write in any value s/he chooses with no values suggested, and therefore all values are possible (van Kooten, 2000). Follow up questions were included to determine the rationale of the respondents' answers. If the respondent did not enter an amount, but selected "contribute to a good cause," "duty to take action," or "pay my fair share," the responses were categorized as positive but unknown. Respondents were asked follow up questions if a zero WTP amount was entered. Choices included (a) cannot afford to pay at this time, (b) do not have enough information to make a comfortable decision, (c) not worth anything to me, (d) do not think this program will work, (e) opposed to new government program, or (f) unfair for me to pay for this program. Respondents who selected (a), (b), or (c) were classified as legitimate zero bidders and respondents who selected (d), (e), or (f) were classified as legitimate protest bidders (Yu and Abler, 2010; Cho et al., 2008; Bowker et al., 2003).

A person may want to select a negative value, but only a \$0 or higher in response was allowed, which means that the values are censored at zero; therefore, a Tobit model was used (Wooldridge, 2010). A Tobit (censored) model predict continuous WTP data, allowing for a large number of zero observations without causing sample selection bias (Wooldridge, 2010). Several CVM studies treated WTP bids as if they were censored at zero and estimated subsequent bid functions using Tobit estimators (Poudyal et al., in press; Cho et al, 2005; Bowker et al., 2003). The model is defined as

$$y_i^* = x_i\beta + u_i \qquad (3)$$

$$y_i = y_i^* \quad if \quad y_i^* > 0 \quad (4)$$

$$y_i = 0 \quad if \quad y_i^* \leq 0 \quad (5)$$

where y_i^* is the latent dependent variable (respondent's WTP amount), y_i is the observed dependent variable (respondent's WTP amount censored at zero), and x_i is the vector of independent variables. The variables included the respondent's climate change news sources (*cc_news1-9*), valued urban forest attributes (*uf_reas1-11*), support for a cost increase to reduce carbon emissions (*ce_bal*), whether the respondent identified with being black/African American (*black*), age (*age*), natural log of median income of the respondent's Census tract (*median_inc*), percent tree canopy cover in the respondent's Census tract (*tree*), highest level of education (*educ*), and environmental education (*educ_env*). β is the vector of coefficients, and u_i is the error term, assumed to be independent, normally distributed. Variation across individuals in willingness to pay studies can be explained by the differences in respondent characteristics and policy attributes, with the exception of unexplained error.

To obtain the expected WTP values, with censoring at zero (Greene, 2008),

$$E(WTP) = \Phi\left(\frac{X_i\beta}{\sigma}\right)[X_i\beta + \sigma\lambda(\alpha)] \quad (6)$$

where Φ represented the normal distribution function, ϕ represented the normal density function, σ represented the standard deviation, and $\lambda(\alpha)$ was the inverse Mills ratio, $\left[\frac{\phi\left(\frac{X_i\beta}{\sigma}\right)}{\Phi\left(\frac{X_i\beta}{\sigma}\right)}\right]$. The probability of being uncensored was multiplied by the expected value of y, given y as uncensored. Marginal effects of $X_i\beta$ with respect to the variable of interest was nonlinear and not equal to β_i like in linear models. Therefore, a decomposition of the marginal effect on the expected value for y (censored and uncensored) can be obtained by (McDonald and Moffit, 1980)

$$\frac{\partial E(WTP_i|X_i)}{\partial X_i} = \beta\,\Phi\left(\frac{X_i\beta}{\sigma}\right) \quad (7)$$

which shows how the change in X_i will affect the conditional mean of y^* in the positive part of the distribution.

Results

Out of the 5,500 surveys mailed, 1,021 were returned with bad addresses and 4 opted out of the survey by mailing back empty questionnaires (as detailed in survey instructions). After accounting for declines and returned or undeliverable surveys, the revised survey sample was 4,475. Out of the remaining surveys, 470 surveys were completed and deemed usable for the study, yielding a response rate of 10.5 percent.

Evaluation of Key Demographic Characteristics

Sociodemographic characteristics from survey respondents were compared with Census data (Table 2.1). Female respondents made up 47.9 percent of the observations, which is not far from the Census figure of 50.2 percent. Most of the respondents identified as being white/Caucasian (71.9 percent), 22.2 percent identified with being black/African American, 0.7 percent American Indian/Alaska Native, 2.3 percent Asian and 2.8 percent two or more races. In addition, 5.1 percent of the respondents identified as being Hispanic/ Latino, but because they may be of any race, they were included in the applicable race categories. The Census data showed Atlanta population was 38.4 percent white/Caucasian, 54.0 percent black/African American, 0.2 percent American Indian/Alaska Native, 3.1 percent Asian, 2.0 percent two or more races, and 5.2 percent Hispanic/Latino. Based on race categories, the survey respondents overrepresented the white/Caucasian category and underrepresented the black/African American category. Weighted averages were also shown for variables used in the Tobit analysis. The weighted proportions are closer to actual Census data. The weighting strategy is discussed in a later section.

Participant ages ranged from 20 to 92 years, with an average age of 48.2, and persons 65 years of age or older made up 16.4 percent of the respondents, not too far off from Census results. The median income of participants fell in the $75,000 to $99,999 category, with an average of $98,048[4]. About 76.4 percent answered they had completed a university or college education, compared to the Census figure of 46.1 percent. About 23.3 percent of the respondents had some form of environmental education either through classes or work. About 30.8 percent of the respondents owned a home, compared to the Census figure of 47 percent.

Missing Data Analysis

Using frame data is an approach often used to studying nonresponse bias in a dataset (Groves and Couper, 1998). Frame data is data on the actual population being measured. Sample frames such as population registers often contain information on sociodemographic

[4] Calculated by first taking interval midpoints for each category, multiplying the frequency of each category by the midpoints, and then finally applying the formula: Mean average = ∑(Frequency*Midpoint)/Total Frequency

characteristics of the intended respondents. Statistics from the U.S. Census Bureau are often used. Data on individual households were not available, but what can be used is low-level geographical information on neighborhoods and their population. Census data was used to compare survey respondents to the Atlanta population. From this information, the hypothesis that these factors that describe the addressees' communities will have no effect on response propensities can be tested.

Based on the comparison of survey results to Census information, there were significant differences between the percentages of white/Caucasian and black/African American population, percent of population with bachelor's degrees or higher, and median household income. There was also a significant difference in income by work categories (full time, part time, retired, self-employed, student and unemployed), which was expected. It can be thus inferred that the nonrespondents tended to be black/African American, lower in income, and lower in education. Lower education and lack of interest emerge consistently as characteristics of survey nonrespondents (Rogelberg and Luong, 1998). Weighting was used to correct for the bias. This method is most often used to address bias from unit nonresponse (Brox et al., 2003; Mitchell and Carson, 1989).

Data Weighting Strategy

To better reflect the actual characteristics of households in Atlanta, the sample was weighted by U.S. Census 2010 data (U.S. Census Bureau, 2010). Two weighting variables were used: (a) ethnicity (black/African American, white/Caucasian, and other, which included Asian, Hawaiian, Pacific Island, Native American, Alaskan Native, and those with two or more races) and (b) education (less than a bachelor's degree level of education versus bachelor's degree level of education and higher), and (3) gender. In the United States, education has been shown to be closely correlated to income (Gregorio and Lee, 2002). The combination of these two variables and their associated levels resulted in 12 cells (i.e., 3 levels of ethnicity * 2 levels of gender * 2 levels of education = 12). The population size and population percent for these 12 cells were based on Census 2010 data. The percent of the sample in these cells was based on the survey data. Weights were calculated using the formula: Weight = Population Percent / Sample Percent. This multivariate weighting strategy used to address nonresponse bias has been used in a previous study by Vaske and Donnelly (2007). This strategy has also been accepted by the U.S. Office of Management and Budget after a study was performed addressing nonresponse bias (Leeworthy et al., 2006). Details on the actual weights are described in Table 2.2.

Attitudinal and Behavioral Responses about Climate Change and Urban Forests

Most respondents believed that climate change is occurring (88.8 percent of respondents, weighted), and that its effects are overall negative (68.5 percent of respondents, weighted). Results appear in Table 2.3 and Table 2.4 with weighted and unweighted results. The respondents were asked to rate their level of agreement with a number of statements about climate change (Figure 2.2). Respondents agreed most strongly that they were concerned with the potential effects of climate change with 84 percent (weighted) selecting “agree” or “strongly agree.” Most respondents, 68.2 percent (weighted) selecting “agree” or “strong agree,” felt that climate change action should be taken. Respondents disagreed most strong that human activity had no effect on climate change with 66.6 percent of respondents selecting “disagree” or “strongly disagree.” There was moderate agreement that more research is needed on climate change with 53.3 percent (weighted) of respondents selecting “agree” or “strongly agree.” There was also moderate agreement that climate change would be lessened if fossil fuel use is reduced with 48.4 percent of respondents selecting “agree” or “strongly agree.”

Respondents were asked to select the news sources from which they received their climate change information. Both unweighted and weighted percentages for news sources appear in Table 2.4. Sources included National Public Radio (NPR) at 41.2 percent weighted (50.1 percent unweighted), surfing the internet at 39.8 percent weighted (47.5 percent unweighted), ABC/CBS/NBC at 52.4 percent weighted (43.1 percent unweighted), other cable news such as MSN and CNN at 31.9 percent weighted (32.8 percent unweighted), The Weather Channel at 40.7 percent weighted (30.9 percent unweighted), family/friends at 20.3 percent weighted (21.7 percent unweighted), Fox News at 19.5 percent weighted (14.7 percent unweighted), and AM/FM radio at 19.9 percent weighted (13.2 percent unweighted).

The unweighted top five reasons for increasing urban trees and forests were for cleaner air and water at 82.1 percent, aesthetic beauty at 77.9 percent, value for future generations at 73.0 percent, heat reduction at 70.2 percent, and increased wildlife habitat at 62.8 percent (Table 2.6). The weighted top five reasons were different with cleaner air and water at 78.9 percent, wind control at 68.0 percent, heat reduction at 63.7 percent, aesthetic beauty at 62.8 percent, and wildlife habitat at 56.6 percent. Both unweighted and weighted averages for valued urban forest attributes appear in Table 2.5. When presented with statement about urban forests, respondents felt strongly that urban forests enhance the attractiveness of Atlanta with 92 percent (weighted) of respondents selecting “agree” or “strongly agree.” Respondents felt that adding more trees should generally be a priority with 75.6 percent (weighted) selecting “agree” or “strongly agree.” More than half of the respondents felt that urban forests did not create safety risks with 55.1 percent (weighted) of respondents selecting “disagree” or “strongly disagree.” Results appear in Figure 2.3. Figure 2.4 shows that most respondents supported increasing urban forests as part of

Atlanta's climate change strategy with 65.1 percent of respondents selecting "very much" or "completely" in agreement.

Respondents were also asked questions gauging their interest in receiving assistance on trees/forests on their private property. Results showed that 31.4 percent (weighted) were interested in assistance with identifying appropriate tree species to plant, 33.6 percent (weighted) were interested in tree seedlings to be provided, and 32.6 percent (weighted) were interested in services that provided a design plan for planting trees on their private property. A little more than half of these respondents (50.9 percent) were willing to pay a fee to offset these services.

Willingness to Pay

WTP data were first categorized into zeros and missing responses (Table 2.7). There were 172 zero bidders, which was 36.6 percent of the entire sample. Based on follow up questions, inferred were 92 valid zeros, 22 positive but unknown WTP, and 58 protest bidders. The positive, but unknown WTP, bidders were categorized with the valid zeros. These respondents were willing to pay something, but did not know at the time of the survey the quantity they were willing to pay. The protest bidders could have a negative WTP for the urban forestry program. Because the decision process for these protest bidders are unknown, the Tobit model was estimated including the protest zeros and excluding the protest zeros to see if factors influencing the WTP is the same or not. The sample size was reduced to 382 when excluding protest zeros.

Data collected showed a very high frequency of responses at $0 and spikes around $50 and $100 per household (Figure 2.5). The smallest positive WTP to increase urban forests in Atlanta is $1 and the largest is $1,200, with a mean of $76.70, which includes the $0 responses. The maximum bids of $1,000 (3 respondents) and $1,200 (1 respondent) were investigated in relation to strategic bidding (Mitchel and Carson, 1989; Brown and Gregory, 1999; Lienhoop and MacMillan, 2007). These respondents were found to have high household incomes and high levels of education; therefore, it was concluded that strategic bidding may not be in effect for the maximum bids.

The WTP amounts by respondents did not significantly differ according to their income, although economic theory predicts that income should have a significance influence on WTP. There was also no difference in WTP by education levels. Only 39 percent of WTP studies have shown a positive and significant correlation between income and WTP (Jacobsen and Hanley, 2009). Because household income figures are self-reported, they may be inaccurate for several reasons. Respondents may not all take the same view in calculating their income sources. Respondents may choose to report pre- or post-tax incomes. Income for some household members may be underreported or not reported at all. For these reasons, the median income of respondents' Census tracts was used instead of reported household incomes.

The sample mean household WTP to increase urban forests as a climate change mitigation method in Atlanta was $76.54, including protest bids, or $87.32, excluding protest bids. According to Census data, there were 179,089 Atlanta households in 2010. If the WTP were simply aggregated using this information, the annual household WTP estimate for the city was $13,707,472.06 for each of the five years in total when including protest bids, or $15,638,051.48 excluding protest bids. However, the amounts are different if race is factored in and post-stratification weights are used to correct for selection bias. Selection bias can occur if individuals who feel strongly about urban forests are more likely to respond to a survey, which would bias contingent valuation estimates either upward or downward, depending on if the respondent feels strongly positive or negative toward the amenity (Mitchell and Carson, 1989).

Related to selection bias is nonresponse bias, which arises when respondents differ from respondents in observable characteristics, which could also influence WTP amounts (Whitehead et al., 1992).

For the purpose of willingness to pay (WTP) analysis, only 423 respondents out of 470 responded to gender, age, and race questions. Using this information, the weight was focused on the households, because each household has the same probability of selection. The relative weight for the individual can be derived by dividing the number of adults in the household by the average number of adults per household. This weight reflected the probability of selection of an individual in the sample while preserving the sample size.

The sample size for the Tobit model was 436 respondents out of the 470 respondents because not all respondents responded to questions pertaining to age, education level, and race. The descriptive statistics for the variables used in the Tobit models appear in Table 2.8. The results of the weighted Tobit model including and excluding protest zero bids yielded many of the same significant variables with the same coefficient estimate signs, but the level of significance and the coefficient estimates themselves were very different for some of the variables (Tables 2.9 and 2.10). The significant coefficient estimates in the weighted model (including protest bids) returned were ABC/CBS/NBC (*cc_news1*), Fox News (*cc_news4*), National Public Radio (*cc_news5*), Other Cable News (*cc_news7*), The Weather Channel (*cc_news9*), climate change benefits from urban forests (*uf_reas7*), cost increase to reduce carbon emissions in Atlanta (*ce_bal*), age (*age*), and median income (*median_inc*). The results appear in Table 2.9. The results suggested that respondents who receive their climate change news from Fox News, National Public Radio, Other Cable News, and The Weather Channel were less willing to pay for an urban forestry project as part of a climate change strategy, but respondents who receive their news from ABC/CBS/NBC were more willing to pay. Respondents who supported a decrease in carbon emissions in Atlanta were also more willing to pay for the urban forest project, which is to be expected. The variable *age* yielded a negative coefficient, which implied that the older the respondent, the less willing s/he was willing to pay for the project. The variable median income (*median_inc)* yielded a positive and significant coefficient, which suggested that respondents living in Census tracts with an overall higher median income were more willing to pay for urban forests as a climate change mitigation method.

Median income was significant at the 1 percent level when protest bids were included, but it was significant only at the 10 percent level when the protest bids were excluded. Age was significant at the 1 percent level with protest zero bids and significant at the 5 percent level without protest bids. This suggested that income and age has more of an effect on protest zero bids. The percent of tree canopy cover (*tree)* was not significant with protest bids were included, but were significant at the 10 percent level when protest bids were excluded, suggesting that this factor influenced respondents' willingness to pay when they resided in tracts with higher tree canopy. The Tobit model was also estimated on unweighted variables to show the difference in results from adding weights (Tables 2.11 and 2.12). The variable of wildlife habitat (*uf_reas5*) was significant in these models, whereas it was not significant in the weighted models.

The reported WTP for each scenario was reported in Table 2.13. WTP amounts ranged from $1 million to $1.7 million per year or $5 to $8.5 million over a five-year period if aggregated over 10.5 percent of Atlanta households. WTP amounts ranged from $9.7 to $16.1 million or $48.5 to $80.5 million over a five-year period if aggregated over all Atlanta households. The variability depended on the model selected. Estimates were higher if protest bids were excluded.

Discussion and Conclusion

This study attempted to provide insight on the climate change values and attitudes of Atlanta residents by providing a tangible mechanism: planting additional urban forests, to mitigate climate change. Past research has found that tree cover in Atlanta has remained stable, but the distribution varied greatly over time (Merry et al., 2014). Due to the variance in tree cover distribution, temperatures at the city core have continued to increase at a higher pace than the surrounding areas, with the majority of the Atlanta land cover change having occurred outside of the city core (Stone et al., 2013).

The willingness to pay analysis showed that Atlanta households are willing to pay $1 million to $1.7 million per year or $5 to $8.5 million over a five-year period if conservative estimates are used. This study showed that residents who reside in higher tree canopy areas may be more willing to pay for additional urban forests because they more readily understand the benefits of the trees. The annual maintenance cost of maintenance for trees was estimated at $100 for small trees, $84 for medium trees and $93 for large trees from the cost/benefit worksheet on the Urban Forestry Network website[5]. Using the WTP totals and these estimates could amount to an additional 10,000 to 91,000 trees being maintained per year.

Contrary to previous studies, educational attainment did not have a significant relationship with willingness to pay, but median income was found to be significant, which is consistent with previous studies (Zhu and Zhang, 2008; Zhu and Zhang, 2006). Studies have found that higher income residents typically have higher demand for urban forests (Elmendorf et

[5] Urban Forestry Network, http://urbanforestrynetwork.org/costs/cost%20benefit.htm [accessed on April, 13, 2015]

al., 2005; Zhu and Zhang, 2008). Although actual reported household incomes were not used and median income of respondent Census tracts were used as a proxy, implications of this result may suggest that those residing in more affluent communities, regardless of whether they themselves were affluent or not, are more willing to pay to increase and maintain urban forests as part of a climate change mitigation strategy because they already recognize the benefits of urban forests. However, when residents were asked about their valued attributes of urban forests, the top attributes were cleaner air or water, aesthetic beauty, value for future generations, and heat reduction. Mitigation or adaptation to climate change came in 11^{th} place on a list of 14 attributes. Respondents who selected climate change mitigation as an important urban forest attribute were more willing to pay for the proposed program. This suggests that the public are either unaware of the role urban forests play in climate change or the other urban forest attributes are perceived as more valuable.

Media preferences for climate change information played a role in predicting the attitudes and preferences of climate change mitigation. Households that were willing to pay more money tended to receive their climate change news from ABC/CBS/NBC. Households who received their climate change news from Fox News, The Weather Channel, or other cable news channels were less likely to be willing to pay. These results suggest that media discourse may be a contributor to value judgments made by individuals when making decisions on issues related to climate change. Results emphasized how the support of climate change could be strongly influenced by information generated by the media, particularly since the level of education was not a factor in this study.

Implementation of such a project would require an assessment of public and private land available to be planted in additional trees. It would also require the city of Atlanta to offer residents technical assistance to plant trees on private land. The results showed that some residents were interested in receiving assistance in identifying appropriate tree species to plant, receiving tree seedlings, and a design plan for planting trees. A little more than half of these respondents were willing to pay a fee to offset these services. Seminars or workshops to inform residents may be a useful tool to increase knowledge and understanding of urban forests in Atlanta.

The results suggested that respondents overrepresented the more well-off, white/Caucasian, middle-aged, male, and opinionated residents (40 percent of the respondents handwrote additional opinions within the survey). They also disproportionately reside in higher median income Census tracts. Survey respondents may have elected to respond for altruistic reasons or because of strong agreement or disagreement over the topic of climate change or urban forests. Atlanta is the seventh most congested city in the United States for commuting workers with many of the workers driving from surrounding counties (Schrank et al., 2012). The majority of Atlanta lies in Fulton County and a small portion is within DeKalb County. The recent extensive growth of Atlanta has led to a disbursed settlement that requires the inclusion of the counties of Cobb, Cherokee, Clayton, Coweta, Douglas, Fayette, Forsyth, Gwinnett, Henry, Paulding, and Rockdale to represent the Atlanta Metro Area, as defined in the Atlanta Regional Commission and the jurisdiction of the Georgia Regional Transportation Authority. These counties experienced heavy deforestation and fragmentation from 1974 to 2005 (Miller, 2012). Future research studies should expand to the greater metropolitan Atlanta area to understand if suburban residents would be willing to pay for additional urban forests to reduce the amount of impervious suburban zones.

Future studies on this topic perhaps could include incentives beyond altruism, for instance small monetary incentives, to increase response rate. Further modeling of zero and missing responses may reveal additional information on individual decision making processes. Further study of nonrespondents would be valuable to understanding their reluctance in survey participation. This study made every effort to increase participation rate, including pre-notification and reminder mailings. Incentives were not provided for participants due to funding constraints, although past research suggest that providing incentives, particularly with ethnic or minority populations can increase response rates (Gregory, 2008; Martin et al., 2001). Even though the survey sample was drawn from the general population of Atlanta households, there was a 10.5 percent overall response rate to the lengthy and relatively complex questionnaire. However, the 470 observations acquired is large enough to make statistical estimates of the general population (Vaske, 2008; Dillman, 2009) and that a multivariate weighting technique is appropriate to address nonresponse issues (Leeworthy et al., 2006). Reasons for nonparticipation could include a lack of interest in urban forests or climate change issues. The large proportion of lower income and lower education black/African American residents not represented in this survey could point to a low level of topic salience for Atlanta residents and a low level of political mobilization by climate change advocacy groups in the Atlanta region. In the United States, climate change and environmental issues have consistently ranked at the bottom of public concerns as measured by polls (Brulle et al. 2012).

The 58 protest bids (12 percent of the sample), could also mean that climate change awareness does not translate into a deep understanding and/or a willingness to pay to address it for various reasons. When reviewing protest bids, respondents expressed concern on whether the city government would be able to carry out such a program, but there were generally positive comments for Trees Atlanta, a nonprofit organization which has worked with city government, local businesses, and citizens since 1985. This suggested that the City of Atlanta should pay attention to current urban tree ordinances and provide adequate staffing to tend to these needs. In addition, instead of increasing staff at the municipal level, perhaps this additional assistance can come from local nonprofit groups like Trees Atlanta. Involving the community in tree-planting projects can contribute to the sense of identity and increase leadership and expertise for residents (Austin and Kaplan, 2003). Further analysis of protest votes could serve to explicate how the city could improve trust among residents. The results of this study not only could help cities understand the subgroups of the population that might be more supportive of urban forestry and climate change projects, but serve as a starting point to identify and resolve issues with unsupportive subgroups.

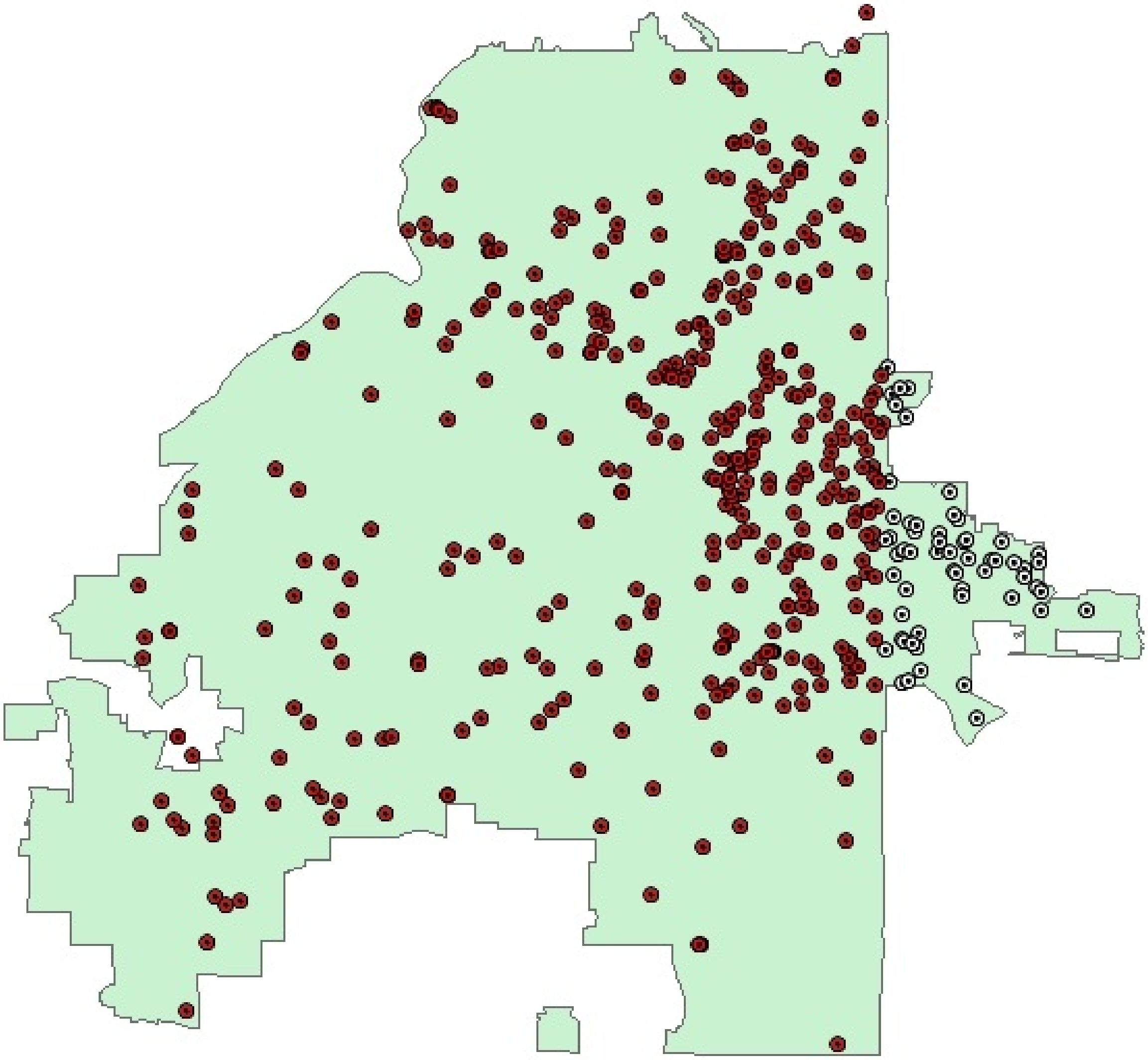

Figure 2.1. Study Area, Municipal Boundary Line, and Survey Respondents of Atlanta, Georgia (Dark plots indicate respondents in Fulton County and light plots indicate respondents in DeKalb County)

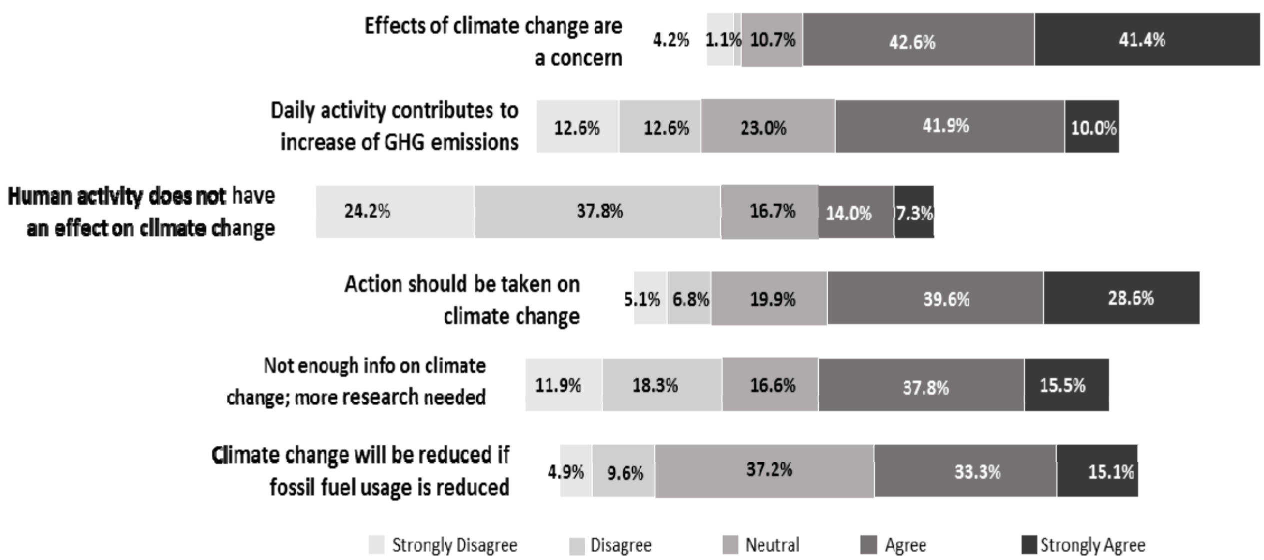

Figure 2.2. Respondents' Level of Agreement with Climate Change Statements, Weighted (n=470)

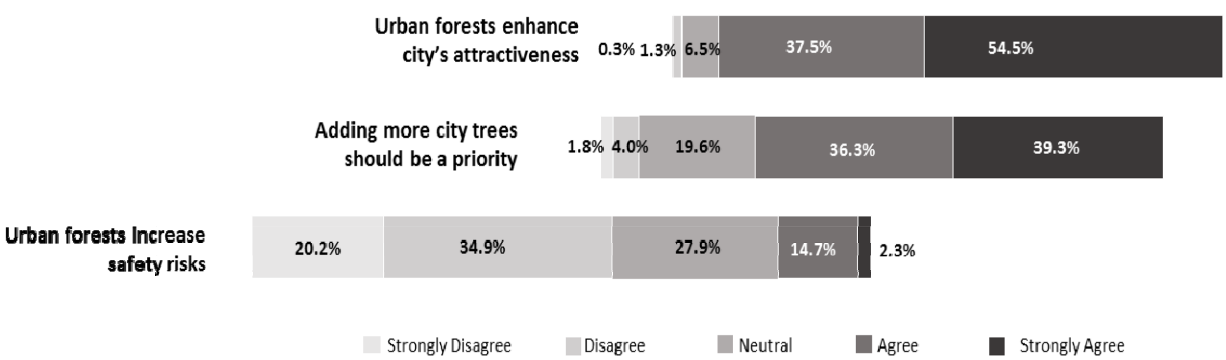

Figure 2.3. Respondents' Level of Agreement with Urban Forest Statements, Weighted (n=470)

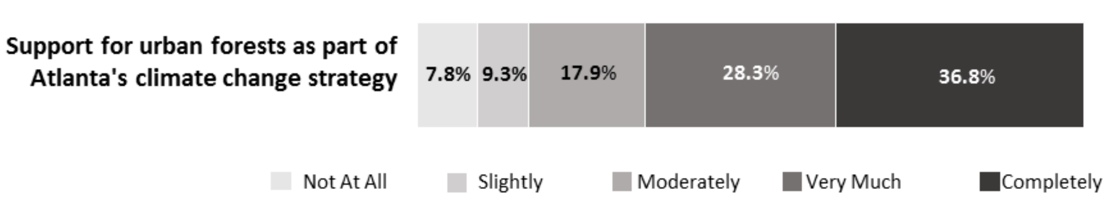

Figure 2.4. Respondents' Level of Support for Urban Forests as Part of Atlanta's Climate Change Strategy, Weighted (n=470)

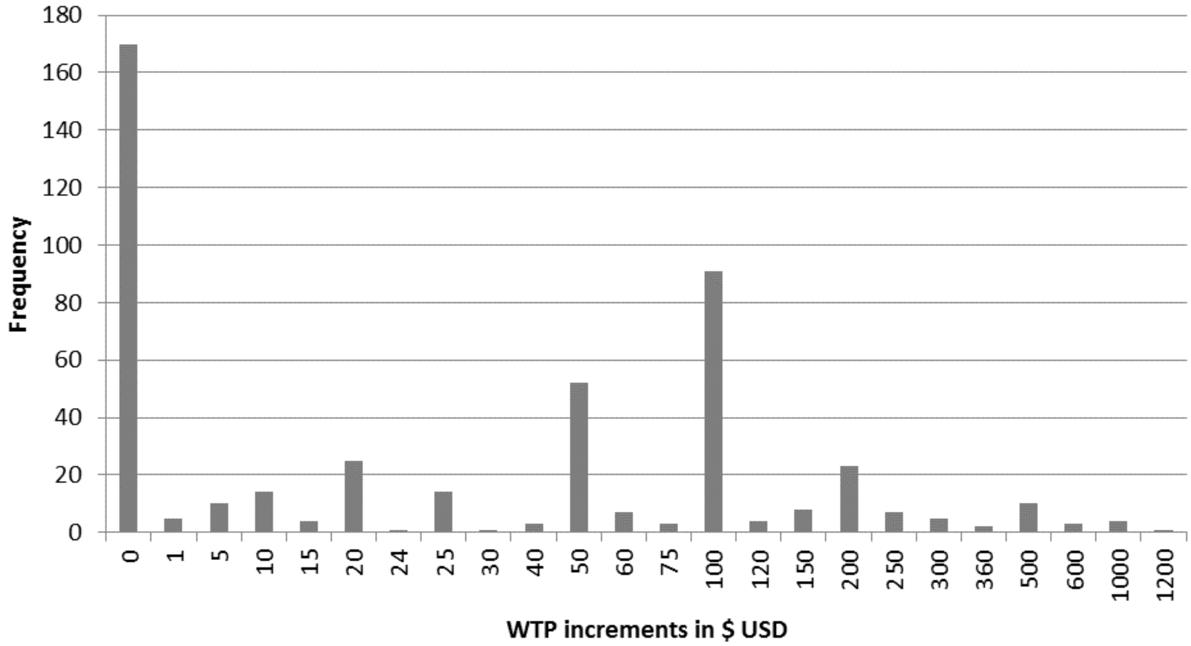

Figure 2.5. Distribution of Willingness-to-Pay to Plant Additional Urban Trees
(per household per year over a five-year period)

Table 2.1. Survey Results Compared to 2010 U.S. Census Data, Atlanta

	2010 Census	**Unweighted Survey**	**Weighted Survey**
Households	179,459	470	470
Average Household Size	2.18	2.13	
Households with Individuals 65 years or older	17.8%	16.4%	
Female persons	50.2%	47.9%	51.8%
White alone	38.4%	70.1%	39.8%
Black or African American alone	54.0%	23.9%	54.4%
Other (includes American Indian and Alaska Native alone, Asian, and Two or More Races)	5.3%	5.8%	5.8%
Hispanic or Latino, percent	5.2%	5.3%	
Bachelor's degree or higher	46.1%	82.3%	44.8%
Homeownership rate	47.0%	64.0%	
Median household income	$45,946	$87,500	

Table 2.2. Construction of Post-Stratification Adjustment Factors

Sex	Education Level	weighted # black adults	(a) % black Census	(b) % black survey	(c) black weights (b)/(c)	(d) weighted # other adults	(e) % other Census	(f) % other survey	(g) other weights (e)/(f)	(h) weighted # white adults	(i) % white Census	(j) % white survey	(k) white weights (i)/(j)
Male	Less than Bachelor's Degree	18	18.16	3.85	4.7216	3	1.40	0.64	2.1840	18	5.80	3.85	1.5080
Male	Bachelor's degree or higher	17	4.98	3.63	1.3710	10	1.89	2.14	0.8845	178	16.19	38.03	0.4257
Female	Less than Bachelor's Degree	31	22.03	6.62	3.3258	2	1.16	0.43	2.7144	11	5.26	2.35	2.2379
Female	Bachelor's degree or higher	47	6.06	10.04	0.6034	12	1.86	2.56	0.7254	121	15.21	25.85	0.5883
	Totals	**113**	**51.23**	**24.15**		**27**	**6.31**	**5.77**		**328**	**42.46**	**70.09**	

Table 2.3. Belief in Climate Change Occurring (n=470)

Response	Number	Unweighted Percentage	Weighted Percentage
No	24	5.11	5.40
Yes	416	88.51	88.0
Do not know	30	6.38	6.61

Table 2.4. Overall Effects of Climate Change (n=470)

Response	Number	Unweighted Percentage	Weighted Percentage
Negative	340	72.34	68.48
Neutral	62	13.19	14.60
Positive	7	1.49	2.60
Do not know	61	12.98	14.31

Table 2.5. Climate Change News Sources (n=470)

Source	Unweighted Percentage	Weighted Percentage
ABC/CBS/NBC	43.19	52.42
AM/FM Radio	13.19	16.90
Family/Friends	21.70	20.30
Fox News	14.68	19.53
NPR	50.21	41.18
Newspapers/Magazines	54.26	42.73
Other Cable News	32.77	31.88
Surfing the Internet	47.45	39.76
The Weather Channel	30.85	40.74

Table 2.6. Valued Attributes of Urban Forests (n=470)

Attribute	Number	Unweighted Percentage	Weighted Percentage
Aesthetic beauty	366	77.87	62.78
Cleaner air or water	386	82.13	78.88
Heat reduction	330	70.21	63.70
Increased property value	208	44.26	35.62
Increased wildlife habitat	295	62.77	56.56
Mitigate or adapt to climate change	178	37.87	37.03
Noise and glare reduction	240	51.06	44.92
Recreation activities	217	46.17	36.40
Storm water control	266	56.60	47.48
Value for future generations	343	72.98	37.98
Wind control	191	40.64	68.03
None – no value	8	1.70	1.72
None – negative value	3	0.64	0.93
Other	23	4.89	7.08

Table 2.7. Willingness-to-Pay, Zero, and Missing Responses

WTP Response Type	Number
Protest zeros	58
Valid zeros	92
Positive but unknown WTP	22
Positive WTP	298
Total responses	470

Table 2.8. Descriptive Statistics for Sociodemographic Variables in Tobit Regression

Variable	Description	Number	Unweighted Mean	Weighted Mean
black	Dummy Variable, 1 for Black/African American, 0 otherwise	112	0.239	0.531
age	Age of Respondent	461	48.275	50.271
median_inc	Natural Log of Median Income	468	11.013	10.758
tree	Percent Tree Canopy Cover	468	0.381	0.386
educ_bach	Dummy Variable, 1 for Bachelor's Degree or Higher, 0 otherwise	468	0.823	0.448
educ_env	Dummy Variable, 1 for Environmental Education, 0 otherwise	109	0.232	0.212

Table 2.9. Results for Weighted Tobit Regression of Willingness-to-Pay for Increasing Urban Forests in Atlanta on Climate Change News Sources and Other Demographic Variables, Including Protest Zero Bids (n=436)

Variables	Description	Weighted Coefficient Estimates	Std. Error	Partial Effect	Mean X
cc_news1	ABC/CBS/NBC	55.980**	25.167	19.462**	0.494
cc_news2	AM/FM Radio	45.547	32.442	16.719	0.173
cc_news3	Family/friends	5.237	25.595	1.826	0.195
cc_news4	Fox News	-96.759**	42.009	-30.032***	0.185
cc_news5	National Public Radio	-40.859*	22.235	-13.990*	0.415
cc_news6	Newspapers/ Magazines	49.041	35.669	17.230	0.434
cc_news7	Other Cable News	-36.854	25.789	-12.454	0.313
cc_news8	Surfing the Internet	-4.969	20.999	-1.720	0.422
cc_news9	The Weather Channel	-70.531***	21.470	-23.887***	0.403
uf_reas1	Aesthetic Beauty	-15.683	23.237	-5.482	0.639
uf_reas2	Cleaner Air/Water	33.752	30.937	11.294	0.780
uf_reas3	Heat Reduction	-6.301	23.146	-2.191	0.639
uf_reas4	Property Value	4.709	27.504	1.636	0.356
uf_reas5	Wildlife Habitat	4.960	19.259	1.717	0.571
uf_reas6	Noise and Glare	-12.790	21.212	-4.407	0.377
uf_reas7	Climate Change	35.534*	22.228	12.390*	0.461
uf_reas8	Recreation	12.508	25.688	4.360	0.386
uf_reas9	Storm Water	6.604	26.108	2.290	0.493
uf_reas10	Future Value	-3.135	23.681	-1.085	0.388
uf_reas11	Wind Control	-46.158	26.753	-16.494	0.668
ce_bal	Cost Increase to Reduce Carbon Emissions	34.197***	8.152	11.854***	2.620
black	Black or African American	-9.221	31.221	-3.197	0.509
age	Age of Respondent	-1.795***	0.758	-0.622**	50.522
median_inc	Natural Log of Median Income	37.681***	32.439	13.062	10.755
tree	Percent Tree Canopy Cover	132.815*	78.647	46.037*	0.386
educ_bach	Bachelor's Degree or Higher	20.059	23.883	6.972	0.467
educ_env	Environmental Education	24.895	33.524	8.872	0.209
_cons	Constant	-463.216	365.793		
/sigma	Standard Error of Regression	159.051***	19.157		

Note: (*) 10% significance level; (**) 5% significance level; (***) 1% significance level

Table 2.10. Results for Weighted Tobit Regression of Willingness-to-Pay for Increasing Urban Forests in Atlanta on Climate Change News Sources and Other Demographic Variables, Excluding Protest Zero Bids (n=382)

Variables	Description	Weighted Coefficient Estimates	Std. Error	Partial Effect	Mean X
cc_news1	ABC/CBS/NBC	56.861**	24.761	21.884**	0.508
cc_news2	AM/FM Radio	54.039	32.863	22.351	0.165
cc_news3	Family/friends	-14.446	25.514	-5.472	0.216
cc_news4	Fox News	-95.813**	41.821	-32.817***	0.177
cc_news5	National Public Radio	-39.353*	21.517	-14.960*	0.414
cc_news6	Newspapers/ Magazines	49.008	38.904	19.138	0.431
cc_news7	Other Cable News	-47.286*	26.068	-17.648*	0.327
cc_news8	Surfing the Internet	-9.787	21.309	-3.758	0.433
cc_news9	The Weather Channel	-56.661***	22.235	-21.297***	0.385
uf_reas1	Aesthetic Beauty	-19.982	22.698	-7.786	0.654
uf_reas2	Cleaner Air/Water	4.499	33.788	1.722	0.819
uf_reas3	Heat Reduction	-14.965	23.257	-5.809	0.642
uf_reas4	Property Value	12.475	26.610	4.836	0.357
uf_reas5	Wildlife Habitat	-0.614	19.297	-0.237	0.590
uf_reas6	Noise and Glare	-16.269	20.516	-6.219	0.389
uf_reas7	Climate Change	43.473*	22.444	16.866*	0.459
uf_reas8	Recreation	17.091	25.024	6.629	0.387
uf_reas9	Storm Water	20.467	24.681	7.879	0.501
uf_reas10	Future Value	-18.464	23.896	-7.064	0.414
uf_reas11	Wind Control	-26.463	27.588	-10.355	0.655
ce_bal	Cost Increase to Reduce Carbon Emissions	29.358***	8.221	11.300***	2.714
black	Black or African American	-11.677	29.646	-4.496	0.506
age	Age of Respondent	-1.693**	0.756	-0.652**	50.041
median_inc	Natural Log of Median Income	55.005*	32.056	21.172*	10.731
tree	Percent Tree Canopy Cover	121.479*	78.926	46.759*	0.380
educ_bach	Bachelor's Degree or Higher	13.297	22.152	5.126	0.471
educ_env	Environmental Education	17.291	33.700	6.781	0.225
_cons	Constant	-592.678*	359.129		
/sigma	Standard Error of Regression	151.921***	18.609		

Note: (*) 10% significance level; (**) 5% significance level; (***) 1% significance level

Table 2.11. Results for Unweighted Tobit Regression of Willingness-to-Pay for Increasing Urban Forests in Atlanta on Climate Change News Sources and Other Demographic Variables, Including Protest Zero Bids (n=436)

Variables	Description	Unweighted Coefficient Estimates	Std. Error	Partial Effect	Mean X
cc_news1	ABC/CBS/NBC	47.851**	23.635	18.629**	0.413
cc_news2	AM/FM Radio	41.717	33.862	16.818	0.138
cc_news3	Family/friends	-0.317	25.605	-0.122	0.216
cc_news4	Fox News	-78.928**	35.035	-27.691***	0.140
cc_news5	National Public Radio	-23.926	21.939	-9.190	0.507
cc_news6	Newspapers/ Magazines	14.393	21.536	5.512	0.548
cc_news7	Other Cable News	-43.898*	23.697	-16.448**	0.326
cc_news8	Surfing the Internet	0.902	20.744	0.346	0.493
cc_news9	The Weather Channel	-39.512*	24.529	-14.792*	0.300
uf_reas1	Aesthetic Beauty	1.132	29.183	0.434	0.789
uf_reas2	Cleaner Air/Water	-5.806	29.117	-2.241	0.814
uf_reas3	Heat Reduction	6.480	25.147	2.477	0.697
uf_reas4	Property Value	-0.883	23.646	-0.339	0.443
uf_reas5	Wildlife Habitat	38.855*	23.277	14.665*	0.638
uf_reas6	Noise and Glare	-10.736	22.671	-4.105	0.388
uf_reas7	Climate Change	47.684**	24.293	18.303**	0.505
uf_reas8	Recreation	0.475	23.574	0.182	0.475
uf_reas9	Storm Water	-0.210	25.684	-0.081	0.571
uf_reas10	Future Value	-23.191	24.353	-8.843	0.411
uf_reas11	Wind Control	-15.710	25.952	-6.100	0.727
ce_bal	Cost Increase to Reduce Carbon Emissions	37.138***	8.498	14.254***	2.773
black	Black or African American	22.864	32.236	8.957	0.225
age	Age of Respondent	-1.981***	0.766	-0.760***	48.005
median_ inc	Natural Log of Median Income	77.678***	25.200	29.813***	11.029
tree	Percent Tree Canopy Cover	33.789	68.780	12.968	0.377
educ_bach	Bachelor's Degree or Higher	11.569	30.391	4.386	0.830
educ_env	Environmental Education	-6.525	23.946	-2.491	0.248
_cons	Constant	-882.112***	270.456		
/sigma	Standard Error of Regression	184.519***	8.176		

Note: (*) 10% significance level; (**) 5% significance level; (***) 1% significance level

Table 2.12. Results for Unweighted Tobit Regression of Willingness-to-Pay for Increasing Urban Forests in Atlanta on Climate Change News Sources and Other Demographic Variables, Excluding Protest Zero Bids (n=382)

Variables	Description	Unweighted Coefficient Estimates	Std. Error	Partial Effect	Mean X
cc_news1	ABC/CBS/NBC	47.779**	23.613	20.554**	0.416
cc_news2	AM/FM Radio	57.473*	33.934	26.181*	0.128
cc_news3	Family/friends	-20.434	25.043	-8.513	0.233
cc_news4	Fox News	-79.165**	35.123	-30.518***	0.131
cc_news5	National Public Radio	-19.113	22.033	-8.110	0.503
cc_news6	Newspapers/ Magazines	12.607	21.454	5.337	0.550
cc_news7	Other Cable News	-53.912**	23.702	-22.214***	0.332
cc_news8	Surfing the Internet	-0.573	20.654	-0.243	0.497
cc_news9	The Weather Channel	-30.425	24.664	-12.639	0.291
uf_reas1	Aesthetic Beauty	6.794	28.812	2.863	0.791
uf_reas2	Cleaner Air/Water	-37.803	29.963	-16.729	0.835
uf_reas3	Heat Reduction	-11.006	25.429	-4.704	0.707
uf_reas4	Property Value	4.782	23.292	2.030	0.445
uf_reas5	Wildlife Habitat	43.081*	23.230	17.906*	0.647
uf_reas6	Noise and Glare	-13.282	22.453	-5.609	0.398
uf_reas7	Climate Change	59.608***	24.252	25.316***	0.500
uf_reas8	Recreation	-0.108	23.349	-0.046	0.476
uf_reas9	Storm Water	6.567	25.611	2.781	0.573
uf_reas10	Future Value	-25.082	24.089	-10.570	0.419
uf_reas11	Wind Control	-10.585	26.391	-4.527	0.730
ce_bal	Cost Increase to Reduce Carbon Emissions	32.396***	8.600	13.742***	2.859
black	Black or African American	17.935	31.492	7.734	0.225
age	Age of Respondent	-1.712**	0.763	-0.726**	47.476
median_inc	Natural Log of Median Income	92.272***	24.996	39.142***	11.016
tree	Percent Tree Canopy Cover	27.694	68.678	11.748	0.372
educ_bach	Bachelor's Degree or Higher	0.994	30.511	0.421	0.832
educ_env	Environmental Education	-2.338	23.905	-0.990	0.251
_cons	Constant	-984.961***	266.321		
/sigma	Standard Error of Regression	175.464***	7.672		

Note: (*) 10% significance level; (**) 5% significance level; (***) 1% significance level

Table 2.13. Summary of Willingness-to-Pay Results

Model	Household WTP	Aggregate WTP (all Atlanta households)	Aggregate WTP (10.5 percent Atlanta households)
Weighted Tobit including protest bids	$57.41	$9,719,340.77	$1,020,502.29
Weighted Tobit excluding protest bids	$68.21	$11,547,748.37	$1,212,444.08
Unweighted Tobit including protest bids	$82.36	$13,943,300.92	$1,464,046.52
Unweighted Tobit excluding protest bids	$95.29	$16,132,311.13	$1,693,929.75

CHAPTER 3

THE ROLE OF THE U.S. MAYORS IN ADDRESSING CLIMATE CHANGE AND URBAN FORESTS

Introduction

Addressing climate change is a great challenge in economics and policymaking in the United States. This arises in part from the international dimension of the problem and the inability of individual countries to solve the problem on their own. First, the countries with high levels of greenhouse gas (GHG) emissions impose costs on countries emitting less GHGs, allowing high emitters to "free ride" on others' efforts. In addition, current generations enjoy the wealth that emissions-producing activities bring, while most of the consequences of their actions will be consigned to future generations. The benefits of GHG reduction could be viewed as global public goods because one country's efforts to curb emissions will benefit societies beyond their own (Nordhaus, 2007). In addition, the costs and benefits of addressing global warming accrue to different groups, presenting distribution and equity concerns. Because of the non-rival and non-excludable nature of GHG reduction, a global policy is often suggested as the only viable strategy, but some governments have refused to commit to reductions in their emissions because of the inherent free-rider problem (Congressional Budget Office, 2003). As a result, some countries' governments have examined different mechanisms to facilitate collective action, with the most popular being a cap-and-trade and a carbon tax approaches (Stern, 2006; Congressional Budget Office, 2008), but it is important to not ignore the small but positive steps that many local-level public actors, such as cities and municipalities, are taking to address climate change issues (Ostrom, 2012).

Over the past several years, the United States and other major emitters seemed poised to adopt a coordinated set of climate change policies that could have included cap-and-trade systems. International public support for climate change legislation and for the creation of carbon markets were high when the Kyoto Protocol set binding targets for 37 industrialized countries to reduce GHG emissions in 2005 (Kyoto Protocol, 1997). Policymakers and regulators have intervened with policy at different scales and levels of government. The U.S. Conference of Mayors developed the Climate Protection Agreement (MCPA), which currently has more 1,000 mayoral signatories, in support of national climate change legislation and the ratification of the Kyoto Protocol (US Council of Mayors, 2005). Sovacool and Brown (2009) illustrate the multiple overlapping scales of jurisdiction of U.S. climate change policy from global down to the city level (Figure 3.1). Those in favor of relying on the local or state scale of climate action believe that it is best to promote efficient responses through innovation and those in favor of national or global scale of climate action believe that solution best promotes uniformity with economies of scale (Sovacool and Brown, 2009).

Some estimate that more than three-fourths of global carbon emissions come from urban areas (Satterthwaite, 2008; Stern, 2006). State and local governments, especially more affluent and urban locales, are pursuing more localized policies that may have a marginal impact on climate change, reducing GHG at different rates and different costs. A number of researchers have already turned their attention to local governments' response to climate change (Feiock and Bae, 2011; Krause, 2010; Sharp et al., 2011). These smaller policies have other goals including: subsidies for installation of low carbon energy sources, low carbon infrastructure and services, increases in urban forests, and regulations to requiring energy efficient standards in buildings and motor vehicles. However, these efforts will vary according to geography, political economy, social practices, and available funding. Local action promotes variability and flexibility, which can be important because each community may have different mixes of GHG sources and geographical factors that determine the nature of climate change concerns and their remedies.

Cities can respond to climate change concerns through emissions mitigation or by adapting to its possible impacts (United Nations Habitat, 2011). Most climate change mitigation strategies are focused on emissions-oriented approaches, primarily driven by international policies, such as the Kyoto Protocol. Localized climate action plans tend to fail at addressing rapidly rising temperatures (United Nations Habitat, 2011). Stone (2012b) suggested that rather than focusing purely on emissions, land-based approaches, such as adaptation strategies, should also be employed. According to Stone's and other studies, the most effective way to reducing city-wide temperatures has been shown to be tree planting and other strategies involving vegetation (Lynn et al., 2009; Zhou and Shepherd, 2009; Stone, 2012; Stone et al., 2013). Many emissions-oriented approaches, such as forest carbon offset strategies, are closely related to land-based approaches. Climate change adaptation strategies can include increasing options for water retention and infiltration, reducing the heat island effect, and reducing vulnerability to natural hazards such as storms and hurricanes. However, relatively few cities have developed and implemented coherent adaptation strategies, partly as a result of existing incentives for mitigation activities (United Nations Habitat, 2011; Jabareen, 2013). Mitigation approaches can be synergistic with adaptation approaches. For example, urban forests could be part of a mitigation strategy to reduce greenhouse gas emissions as well as part of an adaptation strategy to reduce heat-island effects (United Nations Habitat, 2011).

This study investigated local government initiatives in climate change and urban forests, as well as how local governments are prioritizing these investments. Also examined was why cities pursue policy initiatives at the local level and what factors contribute to such action. This study attempted to answer the following questions:

1. What climate change policy initiatives do MCPA cities pursue at the local level and what factors contribute to such action?
2. How do MCPA city officials prioritize environmental investments, particularly climate change and urban forests?
3. How do MCPA city officials prioritize climate change adaptation strategies and how do urban forests factor the strategies?

Municipal Government Climate Change Protection Networks

Networks play a role in how information is exchanged and economic action is embedded in structures of social relations (Granovetter, 1985). Whether they play a significant role in climate change adoption and level of commitment is debatable. For example, Krause (2011; 2012) determined that membership within climate protection networks was more symbolic in nature and it did not effectively stimulate cities to take additional steps to reduce their GHG emissions. Two networks were examined in Krause's (2011; 2012) studies: the U.S. Conference of Mayors Climate Protection Agreement (MCPA) and the International Council for Local Environmental Initiatives' Cities for Climate Protection (CCP). Krause (2010) also suggested that local, demographic, government, and economic characteristics correlate with cities' adoption of MCPA rather than state policies. Despite this, Feiock and Bae (2011) asserted that elected mayors and civic entrepreneurs promote carbon reduction in the larger community, but managers and bureaucratic entrepreneurs focus their efforts on carbon emissions of governmental operations. Another study also examined the MCPA and CCP specifically, but to the extent that mayoral participation in climate change agreements drive sustainable green building as a mechanism to reach climate change goals (Lee and Koski, 2012). The study results suggested that the role of local leadership is important to furthering the issues of energy sustainability and climate change. Local policies in creating green buildings are more important than those at the state level because mayors and city leaders are the ones who enact and implement green building mandates within their jurisdictions.

The CCP was initiated in 1993 as an international voluntary program for local governments to enact and implement step-by-step climate mitigation policies within five categories: inventory, reduction target, action plan, implementation, and monitoring and disclosing policy outcomes. As of 2009, CCP had more than 1,000 local government members globally that were adopting climate change mitigation strategies. The CCP campaign includes assistance for cities to adopt and implement policies to reduce GHG emissions.

The MCPA was launched in 2005 to reduce GHG emissions as part of the Kyoto Protocol target. MCPA members consist of more than 1,000 local governments in the United States. The agreement had three objectives: 1) to meet or exceed Kyoto Protocol targets, 2) urge state and federal governments to enact GHG emissions reduction policies and programs, and 3) urge Congress to pass bipartisan GHG legislation to establish an emissions trading system. Membership to these networks represented an appeal to a more liberal demographic in urban settings as well as real commitments to purchasing, energy consumption, and land use (Lee and Koski, 2012).

MCPA Studies

Previous studies performed by MCPA on its members were descriptive in nature with no statistical analyses. The first survey conducted by the U.S. Conference of Mayors in 2007 benchmarked the climate protection activities of all the signatories (US Council of Mayors, 2007). The survey found that responding cities' efforts included alternative fuels or hybrid-electric city fleets (72 percent), energy-efficient lighting (97 percent), renewable energy use for city buildings (80 percent), encouragement of private sector construction of energy efficient buildings (75 percent), staff assigned to climate protection (67 percent), and encouragement of other mayors to sign onto MCPA and/or take action on climate protection (75 percent). The second survey was performed in 2008 to assess resource constraints on climate protection strategies (US Council of Mayors, 2008). The study found that rising gas prices led to more emphasis on the transportation sector in their climate strategy (75 percent), inadequate financial resources were the biggest obstacle to climate efforts (82 percent), collaboration with other jurisdictions, state and federal governments, and school systems were important to climate protection goals, and 36 percent of the responding cities had completed an inventory of GHG emissions. A third survey was performed in 2014 to assess the climate change mitigation and adaptation actions of mayors (US Council of Mayors, 2014). The study found that 53 percent of the respondents officially committed to reducing GHG emissions with 48 percent having conducted a GHG inventory (up 12 percent from 2008). Many of the responding mayors included directing engaging local residents in reducing GHG emissions as a priority in community engagement initiatives. Energy efficient lighting was selected as the top technology to reduce energy use and carbon emissions. Most of the respondents had energy emergency response plans to maintain service during power outages (76 percent).

Theories Explaining Policies for Public Goods

Cities are a natural place to start a policy discussion concerning climate change as well as urban forest policies. People tend to choose to live and cluster in urban areas, but because of the concentrated nature of their pollution and increased consumption of resources, urban areas tend to heavily contribute to environmental problems. To explain local policies and why local governments provide public goods, Lubell et al. (2005) used a “political market” theory of policy change that combined the Tiebout theory with an “interest group” framework. Tiebout’s (1956) seminal work on public goods posited that household mobility will induce jurisdictions to provide efficient mixes of local public goods and taxes, or they will fail to attract residents. Consequently, communities have an incentive to compete with each other to provide the best services at the lowest prices to attract taxpayers. Bae and Feiock (2013) examined factors for both the demand and supply sides of climate change policies in U.S. cities and what explained the variation and adoption of climate change policy and level commitment (Bae and Feiock, 2013). This framework could be used to better understand factors contributing MCPA members’ desire to address urban forests and climate change issues locally.

The “interest group” framework of local politics predicted that groups that are better able to deliver political resources to local elected officials are more likely to receive their preferred policies (Clingermayer and Feiock, 1993). Fischel (1975) examined the number and structure of governments in U.S. urban areas and concluded that the ingredients for a Tiebout process seemed present. He found evidence that a wide range of choice among jurisdictions existed in a large number of places. Studies have examined whether the wide range of choice results in Tiebout-sorting behavior among households by observing the extent of heterogeneity in income and housing in local communities (Pack and Pack, 1978; Sinha and Cropper, 2013). The implication of Tiebout's theory is that consumers can reveal demand preferences for local public goods by choice of municipality in which they reside. On the supply side of the Tiebout model, Epple and Zelenitz (1981) showed that competition among a large number of jurisdictions can limit the rent-taking capacity of local officials. However, the Tiebout theory does not take into account city structure, interest groups, or altruistic motives in political action; therefore, this study used the political market theory of policy change, which combines the Tiebout theory with the interest group theory into a supply and demand model to test what variables contribute to the number of climate change actions taken by MCPA cities.

Climate change actions could be categorized as addressing climate change mitigation or climate change adaptation. The International Panel on Climate Change (IPCC) defined climate change mitigation as "anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases," and adaptation as "adjustment in natural human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (Klein et al., 2007). There has been increasing attention given to climate change adaptation which has resulted in international adaptation finance mechanisms established through the UNFCC and the Kyoto Protocol (Measham et al., 2011), with local governments representing the core institutional units (Crabbé and Robin, 2006; Naess et al., 2005). However, the current knowledge of the motives, capacity, barriers, and leadership for climate change adaptation is limited Measham et al., 2011; Laves et al., 2014). This could be due to lack of information pertaining to vulnerability of cities to climate impacts (Crabbé and Robin, 2006), institutional limitations and lack of resources (Bulkeley, 2010), and a culture of reactive management (Crabbé and Robin, 2006). Studies have shown that climate change mitigation and adaptation have different sets of motivators and barriers (Wheeler, 2008; Bulkeley et al., 2009;

Wang, 2012). A subset of variables in the supply and demand model and additional variables potentially related specifically to climate change adaptation was used to test what variables contribute to city officials' prioritization of adaptation as a method to address climate change.

Study Area

Since this study focused on domestic, local-level climate change investments, the MCPA was selected over the CCP. The MCPA represented 1,054 cities and 93.2 million people, which comprised of 36.9 percent of the U.S. urban populace including Puerto Rico (Table 3.1). The mayors of the MCPA cities represented cities in every state, including the District of Columbia, the Northern Mariana Islands, and Puerto Rico, encompassing about 30 percent of the total U.S. population. Forty mayors represented cities that are state capitals. Eight mayors represented cities with populations of more than one million (listed in descending order by population) including: New York, NY; Los Angeles, CA; Chicago, IL; Phoenix, AZ; Philadelphia, PA; San Antonio, TX; San Diego, CA; and Dallas, TX. There were about 350 cities with populations between 30,000 and 100,000 and about 500 cities with populations fewer than 30,000. The states with the most mayors signed on also represent heavily populated states, including California, New Jersey, Florida, Illinois, and New York.

As population growth in urban areas continues to encroach on forest land, some forests will become urban forests, parks, and open spaces, offering varied amenities to residents. As previously stated, urban forests could be part of climate change mitigation and adaptation strategies. This study examined the climate change initiatives MCPA city officials took at the local level and what factors contributed to such action. The political decision making theories were used to examine the supply and demand factors for MCPA cities to prioritize urban forests within their climate change initiatives. Also examined was how city officials prioritized environmental and climate change investments and how urban forests factored into climate change strategies.

Methods

An electronic survey was developed to address these research questions regarding what climate change policy initiatives MCPA cities take, how they prioritize environmental investments, and if they perceive the agreement as being effective in passing climate change policies. The survey asked the mayor or his/her designated representative to respond to questions gauging their familiarity and perspectives of the U.S. Conference of Mayors Climate Protection Agreement, their opinions and actions on climate change issues and urban forests, how environmental issues are prioritized in their respective cities, how much is budgeted for environmental activities, and general demographic information. A pre-test was first implemented on 50 randomly selected mayors from the list. This helped ensure the survey was clear, concise, and met the objectives of the study. This also provided an opportunity to determine if there were any questions or topics missing from the survey. The pre-test yielded a response rate of 20 percent.

An electronic survey was created using the Qualtrics[1] survey tool and implemented during the winter 2013-2014 (Appendix F). An email invitation (Appendix G) to participate in the survey including a link to the survey was sent directly to the mayor of each city listed under the MCPA. The identity and contact information for each individual was obtained by reviewing the MCPA list and municipal websites or by contacting city hall. A follow up reminder was sent one week later (Appendix H). The survey and email templates received University of Georgia Institutional Review Board authorization prior to distribution (Appendix I). Nonrespondents

[1] Qualtrics software, of the Qualtrics Research Suite. Copyright © 2014 Qualtrics.

received two additional follow up emails. Because tests for nonresponse are typically non *ex post* (Korinek et al., 2007), they are addressed in the results section.

To gain a benchmark understanding of current mayors' or their designated representatives' familiarity of and attitudes toward the U.S. Conference of Mayors Climate Protection Agreement (MCPA), respondents were asked to indicate their level of familiarity with and support of the MCPA and how successful they thought the agreement had been using a five-point Likert scale response (Very Unsuccessful = -2, Unsuccessful = -1, Neutral = 0, Successful = 1, and Very Successful = 2). The survey respondents were then asked about their attitudes on MCPA and climate change policy in general. They were also asked to provide information about their city's priorities and investments in environmental activities, especially urban forestry and climate change mitigation. This was essential to understanding the state of local environmental and climate change efforts. To further evaluate participants' attitudes and opinions, they were asked to rank the level of prioritization for different environmental projects using a five-point Likert-scale (1=lowest priority, 5=highest priority).

The respondents were asked to rate their level of agreement with a number of statements about climate change efforts and policies. A Likert scale was used to measure the respondents' level of agreement: Strongly Disagree = -2, Disagree = -1, Neutral = 0, Agree = 1, Strongly Agree = 2, and to assess respondents' preference for urban forests as part of a climate change mitigation and adaption strategy: Definitely Not = -2, Probably Not = 1, Unsure = 0, Probably Yes = 1, and Definitely Yes = 2. To determine if attitude differences existed between respondents who were mayors and respondents who were designated representatives, the attitudes of each group were compared by performing a Kruskal-Wallis test, which has been used in previous research to compare groups (Solomon and Lewis, 2002). Differences may exist depending on whether the respondent was responding based on personal attitudes and opinions or based on the city-wide objectives determined by the city council, or similar governing body. Since the test was done *ex post,* it is discussed in more detail in the results section.

Participants were asked what factors were most important to his/her city's decision to pursue environmental policies using the Likert scale: -2 = Not Important, -1 = Of Little Importance, 0 = Neutral, 1 = Important, and 2 = Very Important. Respondents were also asked if they had enough funding to address climate change actions, if they had staff assigned to climate change-related actions, carbon emissions and targets, and details about their environmental budget. Demographic data was also requested of the respondents. Information on each city's land area in square miles, population, racial demographics, education attainment level of residents, median household income, and median home values were obtained from 2010 United States Census datasets. Information on the percent local votes cast for Democrat candidate in 2012 presidential election was obtained from the Congressional Quarterly Voting and Elections Collection (2003).

Investments in urban forests have increased with cities and research studies generally assert that any increase in urban forests is desirable and will mitigate pollution problems (Manning, 2008; McPherson et al., 2013; Roy et al., 2012). To gauge the importance of urban forests in climate change strategies, respondents were asked if urban forests should be part of climate change policy strategies using the Likert scale: -2 = Definitely Not, -1 = Probably Not, 0 = Maybe, 1 = Probably Yes, and 2 = Definitely Yes. Respondents were then asked if urban forests were part of their city planning and if so, did the city plan on increasing the urban forests within the next year.

To understand a city official's decision to pursue the increase of urban forests as part of climate change actions, it is important to understand the factors that affect the decisions of local policymakers. Using the "political market" framework used by Lubell et al. (2005), this study examined the supply side of factors and the demand side factors of increasing urban forests. Supply side factors included government form, size of the city's general funds, importance given to environmental decisions of other cities, and importance given to climate change adaptation.

The number of climate change actions (carbon emissions inventory, carbon offset programs, disaster preparedness planning, educational/awareness programs, increase of urban green spaces, land use planning, retrofitting buildings with energy efficient materials, storm drain and water-absorbing capacity improvements, or other) a city took was tallied. The standard model for count data is a Poisson regression model, which estimates the expected count of each unit of analysis (King, 1988). This model was also used by Bae and Feiock (2013) to determine the effect of council-manager government systems on climate change policies. A random variable Y is said to have a Poisson distribution with parameter μ if it takes integer values $y=0, 1, 2,$ with probability

$$Pr\{Y = y\} = \frac{e^{-\mu}\mu^{y}}{y!} \qquad (1)$$

for $\mu>0$. The mean of this distribution is equal to the variance. The likelihood function for n independent Poisson observations is a product of the probabilities given in equation (1). The log likelihood equation is

$$logL(\beta) = \sum\{y_i \log(\mu_i) - \mu_i\} \qquad (2)$$

where μ_i depends on the covariates x_i and a vector of parameters β. Using the link function to transform y:

$$G(y) = log(y) \qquad (3)$$

Adding (3) to a regression equation yields the Poisson regression:

$$Log(Y_i) = \beta_0 + \beta_1 X_1 + \cdots + \beta_{13} X_{13} \quad (4)$$

where *Y* represented the number of climate change actions taken by a given city.

The supply-side independent variables in the Poisson regression were government form (*govt_form* = X_1), whether climate change staff existed (*cc_staff*=X_2), the amount of general fund available per capita (*lgfund_per* = X_3), and the importance the city official placed on addressing climate change issues (*cc_imp* = X_4). Scholars have argued that the council-manager form of government produces greater efficiency in local government policy and operations than the traditional mayor-council form of government (Bae and Feiock, 2013; Clingermayer and Feiock, 2001). The form of the municipal government may shape the choice to pursue climate change actions. The mayor-council form of government was expected to be related to the number of climate change actions, since it has been shown the mayor-council structure tends to focus on the community-at-large and the council-manager form tends to focus more on administrative organization (Bae and Feiock, 2013). The form of the government was found by looking up the charter for each city and the variable was coded 1 for council-manager and 0 for mayor-council or other structure. The presence of climate change staff may be an indicator of the ability for a city to undertake climate change activities, since advancing such activities would be difficult without staff developing and implementing plans. Resources and fiscal health of a city can be represented by per capital general fund (Krause, 2011). Therefore, the size of a city's general fund may be an indicator of the ability to increase climate change actions and also urban forests. The amount of importance a city official places on taking action on climate change activities would also be an indicator of how many climate change activities are undertaken. City official's belief in climate protection could generate more leadership and motivation in increasing climate change activities. To control for the effect of differences in respondent (mayor versus designated representative), the variable *mayor*=X_5 was added, which was coded for 1 a mayor and 0 for a designated representative responding on behalf of the mayor.

The demand-side independent variables in the Poisson regression included were whether the city had been recognized by stakeholder groups with environmental awards (*award* = X_8), population (*lnpop*= X_9), percent white population (*pct_white* = X_{10}), median income of city residents (*med_inc* = X_{11}), median housing value (*med_house*= X_{12}), and educational attainment (*educ* = X_{13}). Environmental awards may be an indicator of support from local stakeholder groups and can influence city government's policy choices (Bae and Feiock, 2013; Feiock and West, 1993). Certain city characteristics can be viewed as motivation for city officials to address environmental issues (Krause, 2010). The community characteristics of median income (Cotrell, 2003), population (Lubell et al., 2005; Zhu and Zhang, 2008), percent white population (Kalof et al., 2002), percent Democratic voters (Krause, 2010), and population density (Bae and Feiock, 2013; Poudyal et al, 2010) have all been linked to demand in environmental protection in previous research.

A probit model was used to understand the factors influencing a city official's decision to pursue climate change adaptation as the priority method to address climate change. The probit model is commonly used to analyze discrete choices (Wooldridge, 2010) and was used in this study the association between city officials' selection of climate change adaptation as the preferred method to address climate change and their commitments, beliefs, and city characteristics. The climate change priority method selected by the respondent, "climate change adaptation projects" was a binary variable (1 for to the respondent's preference for climate change adaption to be the primary method to address climate change and 0 otherwise). The latent variable model, with the latent variable, $y*$ (Wooldridge, 2010), was

$$y_i^* = \beta x_i + e_i \qquad (5)$$

where β was a vector of parameters, e_i ~ Normal(0,1), and $y*$ was not observed, but observed was the binary variable *y,* which represented a discrete choice variable, 0 or 1:

$$y_i = \begin{cases} 0 \text{ if } y_i^* \leq 0 \\ 1 \text{ if } y_i^* > 0 \end{cases}. \qquad (6)$$

The likelihood probabilities were

$$P(Y_i = 1) = \Phi(\beta x_i) \qquad (7)$$

$$P(Y_i = 0) = 1 - \Phi(\beta x_i) \qquad (8)$$

where P represented the probability that the respondent selected yes or no to the climate change activity of the increase of green spaces and Φ represented the standard normal cumulative distribution function.

The independent variables in the probit regression included all the variables in from the Poisson regression including several additional variables that might be factors in prioritizing climate change adaptation. It is expected that the variables of whether a city has already taken action on green infrastructure (*cc_green)* and urban forests (*cc_uf)*, the existence of an urban forest plan (*uf_plan)*, and how urban forests are prioritized if funding were available to address environmental activities (*budg_uf*) would be positively related to a city official's prioritization of climate change adaptation, since the aforementioned actions are related to adaptation (Gill et al., 2007). To understand how the independent variables affect the unobserved latent variable $y*$, the marginal effects of the corresponding variables, which are a function of both the estimated parameters and the values of the explanatory variables, can be calculated using

$$\frac{\partial y_i}{\partial x_k}\frac{\partial P(y_i=1|z)}{\partial x_k} = \phi(\beta' x_i)\beta_k \qquad (9)$$

where ϕ is the probability distribution function of the standard normal cumulative distribution function and z represents $x_1 * x_2 * \ldots x_{15}$. Thus the marginal effect of increasing x_k resulted in a change in y of the magnitude $\phi(x_i\beta)\beta_k$ with respect to all regressors and regression coefficients.

Results

The cities used for this study were reduced to 1,001 because contact information could not be found for 52 mayors and Princeton Township and Princeton Borough in New Jersey merged in 2013. There was a total of 244 survey respondents, representing a 24.4 percent response rate. Out of the 244 respondents, 13 declined survey participation and 29 surveys did not have a sufficient amount of responses to be deemed as usable for the study. Out of those who declined participation, seven cited time constraints, four did not think their participation would be useful to the survey results, one opposed to the survey in general, and one did not provide a reason for nonparticipation. The final number of surveys used for the study was 202. The responding mayors' (or their designated representatives') cities represented 38 states and one territory covering 26.2 million people or about 28.7 percent of the revised sample population (Table 3.1). The population of Puerto Rico was included in this study because there were several mayors from Puerto Rico who signed onto the Climate Protection Agreement, with one mayor from Puerto Rico participating in this study.

In comparison to surveys performed by the U.S. Conference of Mayors, the 24.4 percent response rate was on par with previous studies. The first survey conducted by the U.S. Conference of Mayors in 2007 to benchmark the efforts of all the signatories yielded a 25.3 percent (134 out of 530 mayors) response rate (US Council of Mayors, 2007). The second survey was performed in 2008 to assess resource constraints on climate protection strategies yielded a

15.5 percent response rate (132 out of 850 mayors) (US Council of Mayors, 2008). A third survey was performed in 2014 to assess the climate change mitigation and adaptation actions of mayors yielded a 26.9 percent (282 out of 1,050 mayors) response rate (US Council of Mayors, 2014).

Missing Data and Nonresponse Bias

There were several variables with missing data in the final dataset. Upon further inspection, it was found that questions from the latter half of the survey tended to have more missing data than the first half of the survey. This could be due to participants losing interest as the time spent on answering survey questions increased due to fatigue or boredom as the time spent on answering survey questions increased (Galesic, 2006).

To test for non-response bias, the Kruskal-Wallis test (an ANOVA) was performed on the responding and non-responding mayors using the variables of democratic voters, educational attainment, median income, and population density to test if non-responding mayors' cities had different characteristics from responding mayors. City officials' climate change actions have been presumably caused by or associated with the local sociodemographic characteristics of population size, household income, and political party affiliations of residents (Wang, 2012). The Kruskal-Wallis statistic is based on the sum of ranks for the groups compared (Moore and McCabe, 2006). The statistic is

$$H = \frac{12}{N(N+1)} \sum \frac{R_i^2}{n_i} - 3(N+1) \qquad (10)$$

with n_i representing the number of observations in group i, N representing the total number of observations, and R_i representing the sum of the ranks for the ith sample. For this test, the null is that the two groups (responding and non-responding mayors) are from identical populations. If the calculated value of the Kruskal-Wallis test statistic (10) is less than the critical Chi-square value, then the null hypothesis cannot be rejected. If the calculated value of the Kruskal-Wallis test is greater than the critical Chi-square value, then the null hypothesis can be rejected and concluded would be that the sample came from different populations.

The representativeness of respondents was assessed with the revised MCPA cities that were surveyed (Table 3.2). The average population size of the responding cities was 129,860, which is about 41 percent larger than the revised MCPA average of 92,124. The median household income for the responding cities was $64,789, which is only 5.2 percent larger than the revised MCPA average of $61,583. The percent of residents with education attainment of a bachelor's degree or higher was 40.6 percent for responding cities, which was 4.3 percent higher than the MCPA cities. The political leaning of residents in our responding cities was 57.1 percent Democrat, which is only 1.6 percent higher than the MCPA cities. The population density of the responding cities was about 3,507 residents per square mile, which is s 5.8 percent difference from the MCPA average of 3,314 residents per square mile. The population density was derived by simply dividing a given population by its area. This can be a highly unreliable measure for comparisons, because it is calculated over an entire land area of the city and does not take into account connectivity. The Kruskal-Wallis test confirmed these differences. Using at $\alpha = 0.05$, the test returned a p-value of 0.03 for democratic voters, 0.0002 for educational attainment, 0.75 for median income, and 0.34 for population density, which means the null was rejected based on two of the variables (democratic voters and educational attainment) that the responding cities and non-responding cities are not from identical populations and that there is a significant difference between the two groups. It was concluded that nonresponse bias may exist. Van Goor and Stuiver (1998) found that the most and least successful municipalities respond least, while intermediately successful ones respond most in their study of Dutch municipalities. Their results indicated that the "curvilinear" relationship between performance and response can be interpreted as an interaction effect between interest in the survey topic and evaluation apprehension; and therefore, weighting did not lead to better results (Van Goor and Stuiver, 1998). Other studies examining municipal officials also did not apply weighting strategies (Krause, 2012; Bae and Feiock, 2013), which led to the decision to not apply weights to this study's results.

Differences in Perception between Mayors and Designated Officials

To determine if attitude differences existed between respondents who were mayors and respondents who were designated representatives, the attitudes of each group were compared by performing a Kruskal-Wallis test to determine if any significant differences between the two groups existed. For this test, the null is that the two groups are from identical populations. Differences were found between the responses of mayors and designated representatives for the following variables (p-values): Increase Urban Green Spaces, p-value = 0.016; Land Use Planning, p-value = 0.001; Storm Drain and Water-Absorbing Improvements, p-value = 0.002; and Change in Environmental Budget, p-value = 0.002. This means that there could be a small difference between the responses between mayors and designated representatives. It was concluded that response bias could be a problem and consequently the dummy variable *mayors,* where 1=mayor and 0=designated representative, was added to regression models.

Familiarity and Perspectives of the U.S. Conference of Mayors Climate Protection Agreement

To gain a benchmark understanding of current mayors' or their designated representatives' familiarity of and attitudes toward the U.S. Conference of Mayors Climate Protection Agreement (MCPA), respondents were asked to indicate their level of familiarity and support of the MCPA and how successful they thought the agreement have been. Out of the 202 mayors or their designated representatives, 69.3 percent were familiar with the agreement and 30.7 percent were unfamiliar. The respondents who were unfamiliar were either a new mayor or a staff person filling out the survey on behalf of the mayor. Only 11 of the respondents indicated that they were the original signees of the agreement. Respondents thought the agreement was slightly successful with helping U.S. cities meet or beat Kyoto Protocol targets (mean= 0.28) and urging state and federal governments to enact policies in line with the Kyoto Protocol (mean=0.33). Respondents thought that the MCPA was slightly unsuccessful with urging the U.S. Congress to pass bipartisan greenhouse gas reduction legislation (mean= -0.05). Results showed that the majority of the respondents were neutral on the success of the MCPA goals (Figure 3.2), nearly 57 percent of the respondents would sign or re-sign the MCPA if they were presented with the opportunity to do so today (Table 3.3).

Opinions and Actions on Climate Change Issues and Urban Forests

The respondents were asked to rate their level of agreement with a number of statements about climate change efforts and policies. Respondents agreed most strongly that it was important for their cities to address climate change issues (mean = 1.084) and that local governments should have more of a role in national climate change policy design (mean = 1.025) (Figure 3.3). The lowest level of agreement was that respondents considered approaches mayors in other countries have taken when making environmental decisions (mean = 0.550). The results appear in Figure 3.3.

Respondents were asked to select what actions addressing climate change issues have been taken by their cities within the last five years (Table 3.4). Most respondents' cities have taken action on land use planning (84.2 percent), retrofitting buildings with energy efficient materials (81.7 percent), and improving storm drain and water-absorbing capacity improvements

(81.7 percent). Only 20.8 percent of respondents took action on carbon offset programs. Other actions listed by mayors were varied and included enacting renewable energy sources or incentives, such as solar and hydro generation installations and converting methane gas at wastewater treatment plant to electricity; adopting a climate sustainability or action plan; hiring of climate change or sustainability staff; promoting or making available cost shares for residential energy efficiency upgrades to reduce carbon emissions; improving and promoting increased bike and pedestrian access and use; implementing recycling and waste reduction programs; implementing a local carbon tax to fund climate action efforts; developing a policy that includes climate mitigation; running a landfill for carbon offset credits; purchasing open space; inventorying carbon emissions; providing priority parking for fuel efficient vehicles; and retrofitting streetlights with LED lights.

The majority of the respondents (76 percent) believed that urban forests should be part of climate change strategies. Eighty percent of the respondents responded that urban forests were part of city planning and out of those respondents. Out of the respondents that had urban forests as part of city planning, 67 percent planned on increasing urban forests within the next five years.

Prioritization of Environmental Issues in Cities

The factors of legal compliance and residents' requests were found to be the top two most important factors, above environmental responsibility and public image, according to the respondents (Figure 3.4). Participants were asked to select the top priority method to address climate change from a list that included four different methods: emissions trading (limiting the maximum emissions allowed by one business and allowing it to purchase credits from another business that has the technology to emit less carbon), performance- or cost-based credit (tax improvements from purchase or installation of energy conserving improvements), carbon tax (an individual or business tax on per unit of carbon released into the atmosphere), or climate change adaptation projects (managing urban forests, developing climate-proof infrastructure and effective response systems). Based on these four options, the majority of respondents selected climate change adaptation projects (51.6 percent) as the priority method (Table 3.5). An option to select another method was also provided. Some of the participants who selected "Other method" thought that some combination of the methods should be implemented, such as emissions trading and performance- or cost-based credit or they simply did not know which method should be the priority.

When asked what they would most support in terms of regulations of carbon emissions (Table 3.6), most respondents were unsure (41.9 percent), other respondents tended to prefer a carbon tax method if regulations on carbon emissions took effect (34 percent), emissions permitting for large-scale polluters (18.9 percent), and still others offered other ideas (5.2 percent). Other ideas included including the use of other fossil fuels, getting rebates for tree planting, taxing all polluting emissions, fossil fuel tax with clean air fuel credits, taxing both buildings and transportation together, and differentiating on tax rates depending on how energy is generated. When asked about what the best way for a carbon tax to be paid if the U.S. Congress passed legislation on carbon tax, respondents preferred the tax to be split and paid on both electricity consumption and transportation fuel (84 percent). Results are in Table 3.7.

Respondents were asked to rank five environmental programs in the order of preference, with 1 being the least preferred and 5 being the most preferred. Expanding urban forests and green spaces ranked first, with increasing green building practices and purchasing energy efficient or alternative fuel vehicles as second and third, respectively (Figure 3.5).

Budget for Environmental Activities

Respondents were asked questions pertaining to their budget and capacity to undertake climate change efforts (Table 3.8). Most respondents (42.8 percent) thought their cities' overall budget would increase over the current mayoral term. Others thought the budget would remain stable (39.6 percent). Still others thought the budget would decrease (11.8 percent). Changes expected to environmental spending followed similar trends as overall city budgets with 35.7 percent of cities expecting an increase in environmental spending over the current mayoral term, 50.3 percent expecting environmental spending to remain the same, and 6.5 percent expecting it to decrease (Table 3.9). When asked about how much of the environmental budget came from outside sources, the amounts were quite small. Most responded that none of their environmental budget came from outside sources, some (26.9 percent) responded that 1-5 percent of their budget came from outside sources, and 14.5 percent responded that more than 10 percent of their environmental budget came from outside sources.

Carbon Emissions Monitoring and Targets

Most of the cities (69 percent) had staff assigned to climate change issues (Table 3.10) and nearly 42 percent of the respondents' cities had assessed overall greenhouse gas emissions (Table 3.11). Only 35.7 percent of the respondents' cities had greenhouse gas emissions targets in place (Table 3.12), but more than 68 percent of the responding cities had received some kind of environmental award during the past five years. Most of the respondents were designated representatives (56.4 percent) and 43.6 percent of the respondents were the mayors.

Factors Contributing to Climate Change Actions

Table 3.13 reports descriptive statistics of the variables used in the Poisson estimation for the number of climate change actions cities took on demand-side and supply-side policy variables. The estimation of Poisson regression model resulted in significant supply-side factors of government form (*govt_form)*, the availability of staff assigned to climate change activities (*cc_staff)*, and the level of importance a city official assigns to addressing climate change influences the number of climate change activities undertaken (*cc_imp)* (Table 3.14). The results provided support for the political market framework. The government form was negative and significant, suggesting that the mayor-council form contributes to the number of climate change actions taken. The results suggested that the responding city officials' cities' climate change actions taken during the last five years may be more likely aimed at community-wide measures rather than government operations. This is similar to Bae and Feiock's (2013) finding that the mayor-council form of government more likely addressed climate change policies at the community-at-large and that the council-manager form tended to focus more on government operations. Krause (2010) suggested that information sharing among climate change networks and increased public pressure may be contributing factors for signing onto such networks, but they may contribute to increased climate change actions taken as well. Having climate change staff increased the probability of increased climate change actions, as was expected. The amount of importance that a city official placed on addressing climate change issues also was a positive factor in the amount of climate change actions. The demand-side policy variables of environmental awards received (*awards)* and population density (*sqmi_pers)* also resulted in significant coefficients, which indicated that they also influence the number of climate change activities undertaken. Support from environmental stakeholders has been shown to be important to the number of climate change activities according to Bae and Feiock's (2013) research as was population density.

Factors Contributing to Climate Change Adaptation

The results of the probit model of whether the city official thought that adaptation should be the priority method to address climate change appear in Table 3.15. The model yielded and significant coefficient estimates for the following variables: government form (*govt_form),* the importance a city official placed on addressing climate change strategies (*cc_imp*), whether the respondent's city had taken action on green infrastructure (*cc_green*), and whether the respondent's city had taken action on urban forests (*cc_uf*). The coefficient estimate for government form was positive, which is different from in the previous model. This suggests respondents with the council-manager form of government may be more likely to prioritize and pursue climate change adaptation strategies, which makes intuitive sense because many climate change adaptation measures are focused on government operations, such as disaster preparedness and better storm alert systems. Whether a respondent's city had taken action within the past five years on green infrastructure and urban forests also resulted in positive and significant coefficient estimates, which suggest their relationship to climate change adaptation strategies. The level of importance the city official placed on his/her city to address climate change was negative and significant, which is again, different from the last model and not an intuitive result and the reason could only be speculated. An ICLEI report found that 95 percent of ICLEI member U.S. cities reported that securing climate change adaptation funding was a challenge (Carmin et al., 2012), which could be a factor for the negative coefficient estimate. Wang (2012) has shown that the factors predicting a city's adoption of climate change mitigation was different from a city's adoption of climate change adaptation and that the usual sociodemographic predictors of cities' climate change mitigation actions have little power in explaining a cities' prioritization of climate change adaptation actions. The probit model yielded no significant coefficients for the sociodemographic characteristics, which is consistent with Wang's (2012) research.

To assess the magnitude of the effects of the independent variables on the dependent variable, examining the conditional marginal effects is necessary. The conditional marginal effects in Table 3.15 showed that when the government form variable changes from 0 to 1, the probability for the dependent variable, prioritization of adaptation to address climate change, taking on the value of 1 would rise by 18.6 percent. If the level of importance a city official assigns to addressing climate change issues (*cc_imp)* goes up by one unit, the probability of adaptation of taking on the value of 1 lower by 15.1 percent. When the variables of taking action on green infrastructure (*cc*_green) and on urban forests (*cc*_uf) changes from 0 to 1, the probability for the adaptation variable of taking on the value of 1 rises by 28.8 and 11.9 percent, respectively.

Discussion and Conclusion

Several studies have shown that cities join climate change agreements based on population, wealth, and political orientation of voters (Krause, 2010; Wang, 2012). Climate change agreements have been viewed as symbolic action (Krause, 2011). This study used the political market framework, a combination of the Tiebout theory and the interest group framework, to answer the first research question of what climate policy initiatives MCPA cities pursue at the local level and what factors contribute to such action. From this study's results, only the population factor was the same as a factor predicting participation in symbolic policy. Krause's (2011) study showed that population, policy entrepreneur as mayor or city official, educational attainment, median income, and the political representation of the mayor were predictors of whether a city pursues climate change agreements or not. This was mostly consistent with Bae and Feiock's (2013) research. This study found that government form, the presence of staff working on climate change issues, population, population density, whether the city has received environmental awards or not, and median home value were indicators of the number of climate change actions MCPA cities have taken.

Krause (2012) was critical of the MCPA network, asserting that its membership had no significant effect on cities' actions. As a policy, Krause believed that the decision to join MCPA was motivated by credit claiming by the local officials, making it a symbolic policy rather than one effective in generating additional local climate change actions. This could be true given the fact that there was no clear consensus on which direction to take on national climate change legislation among the local level climate change leaders that are part of the MCPA. Most respondents were unsure of how carbon emissions should be regulated, although a carbon tax approach was preferred over cap-and-trade, perhaps suggesting the lack of political feasibility in passing national cap-and-trade legislation. An interesting finding from the survey is that only 20.8 percent of the respondents had taken some sort of action on carbon offset programs, although 47 percent of the respondents had a carbon inventory. This result implies that implementing a local or even regional carbon offset program may be challenging to pursue due to available resources, although cities have inventoried their carbon emissions to prepare for the possibility of a national program.

On the other hand, MCPA may be more than a symbolic policy when viewing it with a bottom up approach. An advantage of being part of the MCPA seems to be as an existing networked structure (O'Toole, 1997), where mayors and cities can learn and support each other. Even this benefit is in question, though, given the surprising amount of respondents, 30 percent, who were unfamiliar with the MCPA. However, designated representatives (not mayors) made up the predominant amount of the percentage, and this lack of knowledge by the staff could reduce the relevancy of MCPA in the future. The agreement was signed by mayors across the nation with the primary intentions of meeting or exceeding Kyoto Protocol targets, urging state and federal governments to enact greenhouse gas reduction policies, and urge the U.S. Congress to pass national greenhouse gas legislation to establish an emissions trading system. Although the agreement was not successful with establishing national climate change legislation, it was successful in urging legislation that established the Energy Efficiency and Conservation Block Grant Program. When asked how successful the MCPA was at attaining these objectives, respondents believed that the agreement was slightly successful with achieving the first two objectives and slightly unsuccessful with achieving the last objective. A few mayors (or their designated representatives) offered changes to the goals of the MCPA. Two suggested increasing the restrictions and the other two had suggestions related to the lack of resources for smaller cities. A specific suggestion to equalize this situation was that reduction goals could be tied to the amount used per capita to aid in determining how energy efficient a community is becoming.

To answer the second research question of how MCPA city officials prioritize environmental investments, several options, one of which was urban forests, were provided and respondents were asked to rank them according to preference if additional funding were available. Urban forests ranked highest on the list and this variable was extracted and used in the probit model examining factors that contributed to the prioritization of adaptation to address climate change to answer the third research question of how city officials prioritized climate change adaptation and how urban forest factor into the strategies. Climate change adaptation was selected as the top method to address climate change and expanding urban forests and green spaces ranked highest from a list of environmental priorities. This is a notable result, because expanding urban forests and green spaces could also be categorized as a climate change adaptation project and the results from the probit model supports this concept. However, the prioritization of urban forests was not significant in the model, although the past actions of increasing urban forests and green infrastructure were. Officials in cities that have taken action on increasing green spaces and urban forests may already be addressing climate change adaptation, although it could be motivated by factors other than addressing climate change, such as city beautification. The location of the city and amount of environmental threats perceived by the city officials could also be a predictor. Wang (2012) found that the coastal location of California cities was a predictor in adaptation actions.

The National League of Cities reported that local fiscal health has not yet fully returned to pre-recession levels, but they are improving as the Great Recession recedes (McFarland and Pagano, 2014). Although respondents were optimistic of increased budgets in the near future due to recovering economic conditions, environmental spending was not expected to increase. Regional and climactic conditions could be at play in this situation. When examining past housing economic research, low-carbon cities tend to be denser in population, located in more favorable climate conditions, and already have high land use regulation (Glaeser and Kahn, 2010). However, it is important to note that strategies to increase urban density may or may not have a positive influence on decreasing carbon emissions and other environmental impacts, but they do provide the potential for access to and greater use of public transportation, and they promote walking and cycling activities (United Nations Habitat, 2011).

Although the MCPA may not increase the number of local climate change actions, assessing their environmental priorities would help guide national climate change policies. Transportation and electricity generation have been shown to be the sectors with the largest shares of greenhouse gas emissions (US Environmental Protection Agency, 2015). The results of this study indicated that cities are pursuing actions to improve land use planning and energy efficiency of buildings, and addressing electricity generation. Transportation improvements are last on the list of environmental priorities for cities, which is not surprising because addressing transportation is more challenging and costly, requiring infrastructure investments affecting both spatial and housing policies and indirectly affecting other markets such as real estate.

Future studies could test for differences in environmental priorities in urban cities with and without the MCPA affiliation. The percent of urban forest cover in each city could also be used as a variable. Local leaders with very large cities publically committing to environmental initiatives may have an effect on other establishment of similar initiatives by other cities, which could be examined in a future study.

Overall, this study shows that multiple and varied local actions to address climate change are being pursued by member MCPA cities. According to Dreyfus (2013), the international climate change regime does not acknowledge the role of cities tackling climate change, even though they are vulnerable settlements and important emitters at the same time. Since the signatories of the MCPA represent the most heavily populated states as well as the majority of the state capitals, international and federal policymakers may choose to seriously consider the role these mayors have in tackling climate change. The mayors of these cities (or their representatives) not only think that it is important to address climate change issues, but also think that local governments should have more of a role in national climate change policy design.

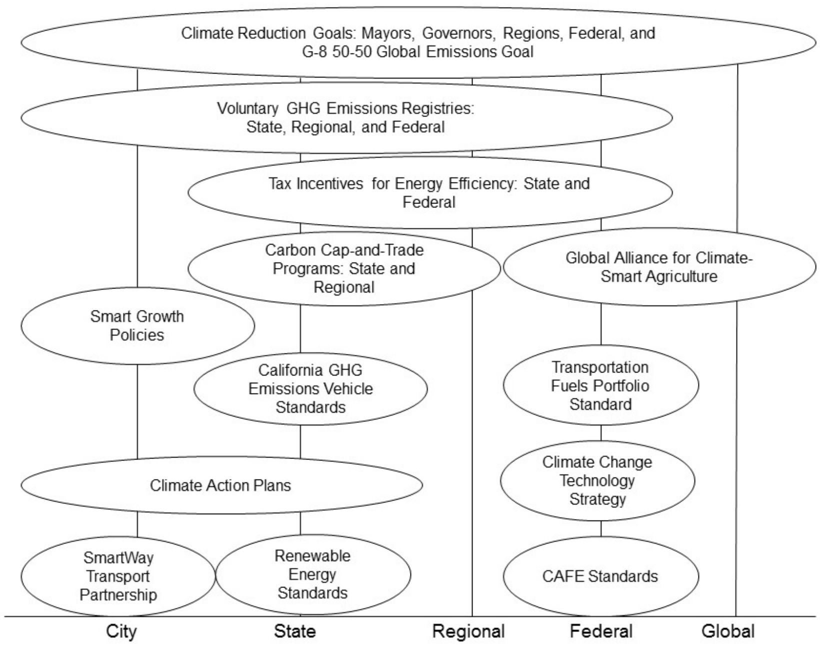

Figure 3.1. Overlapping Scales of Jurisdiction of U.S. Climate Change Policy (adapted from Sovacool and Brown, 2009)

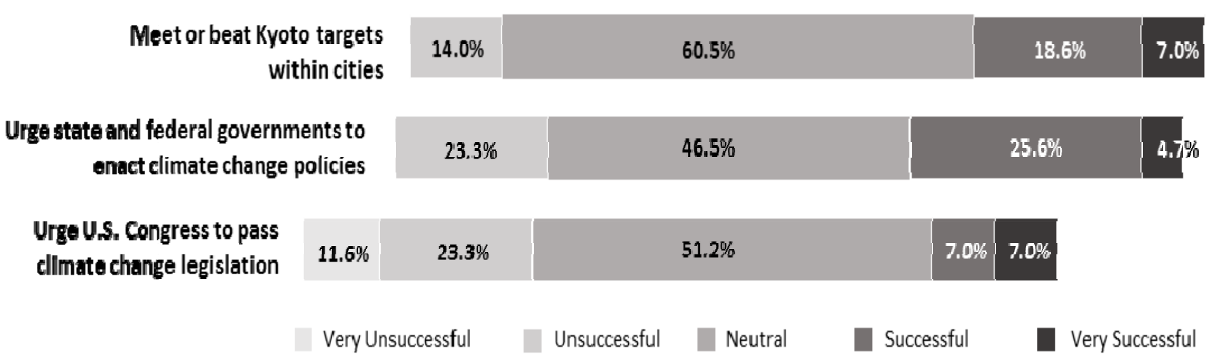

Figure 3.2. Success of Goals of MCPA (n=43)

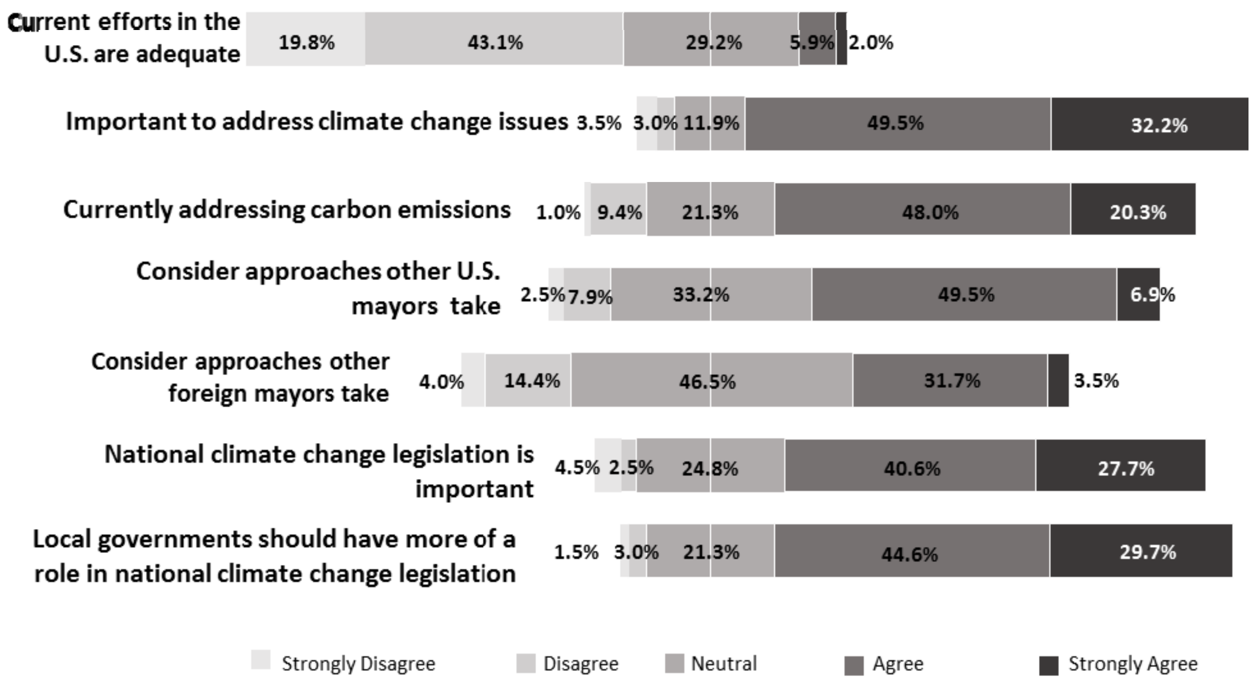

Figure 3.3. Ranking of General Climate Change Statements by Respondents (n=202) [Using the Likert scale -2 through 2]

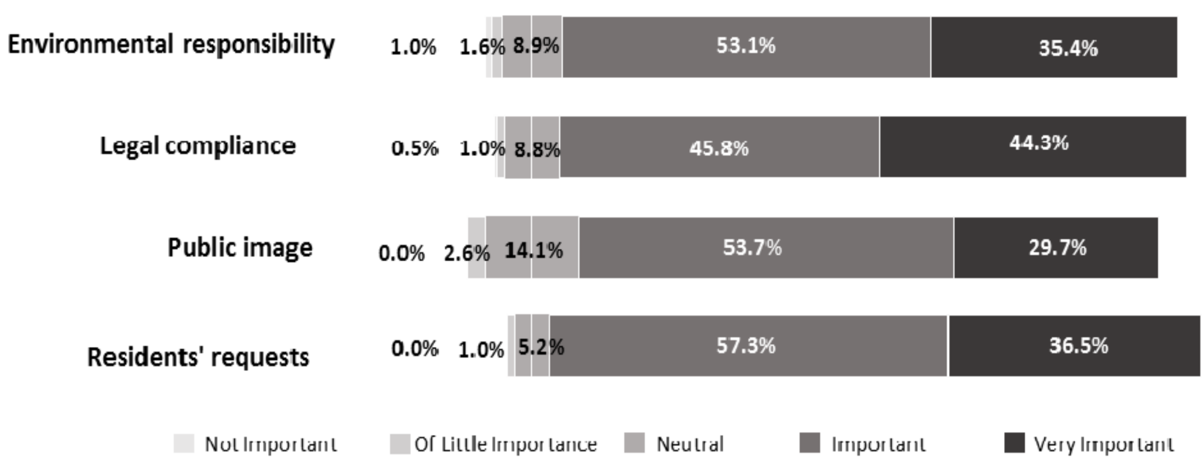

Figure 3.4. Factors in Pursuing Environmental Policies (n=192) [Using the Likert scale -2 through 2]

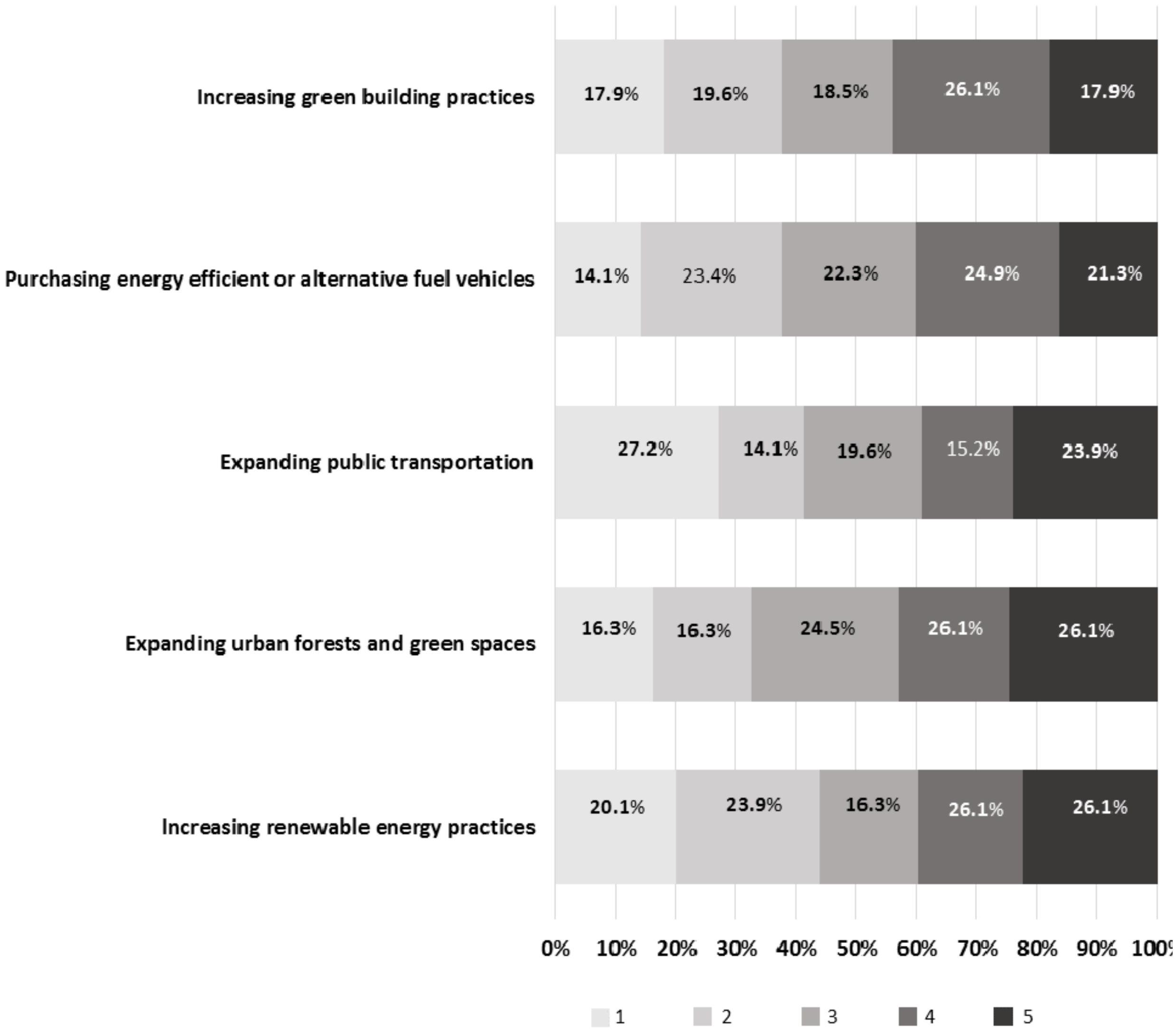

Figure 3.5. Ranking of Environmental Programs (n=184) [Ranked 1=Least Preferred and 5=Most Preferred]

Table 3.1. Survey Respondents Compared to Total Urban U.S. and Puerto Rico Populations, 2010

Description	Population Represented	Percentage of Total Urban Population
Population – United States & Puerto Rico	312,471,327	n/a
Urban Population – United States & Puerto Rico, n=3,592	252,746,527	n/a
Population – U.S. Conference of Mayors, n=1,054	93,150,685	36.9
Population – No contact information, n = 52	1,669,273	0.7
Population – Revised, n=1,001*	91,481,412	36.2
Population – Unfinished surveys, n=29	2,519,345	1.0
Population – Refusals, n=13	462,556	0.2
Final Survey Respondents, n=202	26,830,180	10.6

Table 3.2. Survey Respondents and Nonrespondents Compared to All U.S. MCPA Cities

Characteristics	All Cities Receiving Survey (n=1,001)	Responding Cities (n=244*)	Nonresponding Cities (757)
Population	91,481,412	29,213,566	62,2667,846
Average Population	91390.0	119,727.7	82,256.1
Median Household Income (dollars)	61,880.6	65,205.0	60,809.1
Education (percent with bachelor's or higher)	36.4	40.5	35.1
Political Leaning (percent Democrat)	55.5	56.6	55.1
Population Density (population per square mile)	3,309.2	3480.9	3253.8

* Includes unfinished surveys and refusals

Table 3.3. Signing the MCPA if Opportunity Presented Today (n=202)

Response	Number	Percentage
No	12	5.9
Maybe	42	20.8
Yes	115	56.9
Do not know	33	16.3

Table 3.4. Climate Change Actions Taken by Cities within the Last Five Years (n=202)

Action	Number	Percentage
Carbon emissions inventory	95	47.0
Carbon offset programs	42	20.8
Disaster preparedness planning	149	73.8
Educational/awareness programs	144	71.3
Increase urban green spaces	146	72.3
Land use planning	170	84.2
Retrofitting buildings with energy efficient materials	165	81.7
Storm drain and water-absorbing capacity improvements	165	81.7
Transportation improvements	134	66.3
Other	27	13.4

Table 3.5. Top Priority Method to Address Climate Change (n=192)

Action	Number	Percentage
Emissions trading	13	6.77
Performance- or cost-based credit	38	19.79
Carbon tax	24	12.50
Climate change adaptation projects	99	51.56
Other method	18	9.38

Table 3.6. Preferred Method on Emissions Regulation (n=191)

Action	Number	Percentage
Carbon tax on carbon content of fossil fuels	65	34.03
Emissions permitting for large-scale polluters	36	18.85
Other market-based solution	10	5.24
Do not know	80	41.88

Table 3.7. Carbon Tax Legislation Preference (n=188)

Action	Number	Percentage
Electricity consumption	12	6.38
Transportation fuel	18	9.57
Split the amount between the two	158	84.04

Table 3.8. Changes to the City Budget over the Mayor's Term (n=187)

Change in budget	Number	Percentage
Decrease	22	11.76
Stay the same	74	39.57
Increase	80	42.78
Do not know	11	5.88

Table 3.9. Changes to Spending on Environmental Activities (n=185)

Environmental spending	Number	Percentage
Decrease	12	6.49
Stay the same	93	50.27
Increase	66	35.68
Do not know	14	7.57

Table 3.10. Climate Change Staff (n=182)

	Number	Percentage
No	55	30.22
Yes	126	69.23
Do not know	1	0.55

Table 3.11. Assessment of Greenhouse Gas Emissions (n=184)

	Number	Percentage
No	84	45.65
Yes	77	41.85
Do not know	23	12.50

Table 3.12. Greenhouse Gas Emissions Targets (n=182)

	Number	Percentage
No target	87	47.80
Yes	65	35.71
Do not know	30	16.48

Table 3.13. Descriptive Statistics for Variables in Regression

Variables	Description	Obs	Mean	Std Dev	Min	Max
govt_form	1=council/manager form, 0=mayor/council form	202	0.663	0.474	0	1
cc_staff	1=has climate change staff, 0=otherwise	181	0.696	0.461	0	1
lgfund_per	Log of per capital general fund available in 2013	199	6.932	0.741	4.26	9.87
cc_imp	Importance to respondent for city to address climate change	202	1.040	0.935	-2	2
mayor	1=mayor responded, 0=otherwise	200	0.430	0.496	0	1
award	1= received environmental award(s), 0=otherwise	200	0.770	0.422	0	1
lnmedinc	Log of median income	202	10.949	0.472	9.79	13.21
lnpop	Log of population	202	10.438	1.441	6.19	15.93
pct_white	Percent white population	202	0.755	0.162	0.11	0.98
dem	Percent Democrat voters	202	0.571	0.121	0.20	0.84
sqmi_pers	Population density	202	3506.777	2931.800	11.60	27012.50
uf_plan	1=city has urban forest plan, 0 otherwise	195	0.836	0.371	0	1
cc_green	1=city has taken action to increase green infrastructure, 0 otherwise	202	0.723	0.449	0	1
cc_uf	Importance to respondent that urban forests is included in climate change strategies (1=least important, 5=most important)	200	4.235	0.880	1	5
budg_uf	Importance of urban forests to be addressed if funding available when ranked with other environmental priorities (1=least important, 5=most important)	184	3.185	1.398	1	5

Table 3.14. Poisson Regression for Number of Climate Change Actions Taken in Respondent's City (n=176)

Independent Variables	Coefficient Estimates
Intercept	1.829***
	(0.611)
Supply-Side Factors	
Council-Manager Government (*govt_form*)	-0.099**
	(0.047)
Climate Change Staff (*cc_staff*)	0.168***
	(0.058)
General Fund (*lngfund_per*)	-0.027
	(0.028)
Mayor (*mayor*)	-0.009
	(0.044)
Climate Change Issue Salience (*cc_imp*)	0.072***
	(0.025)
Demand-Side Factors	
Environmental Awards (*award*)	0.127**
	(0.060)
Median Income (*lnmedinc)*	-0.018
	(0.052)
Population (*lnpop*)	-0.020
	(0.017)
Population Density (*sqmi_pers*)	1.3e-05*
	(7.0e-06)
Percent White Population (*pct_white*)	0.062
	(0.134)
Percent Democratic voters (*dem*)	0.210
	(0.223)
Pseudo r-square	0.025
Log-pseudolikelihood	-367.369***

Note: (*) 10% significant level; (**) %5 significance level; (***) 1% significance level; robust standard errors are in parentheses

Table 3.15. Probit Regression for City Officials' Motivations to Prioritize Adaptation as Method to Address Climate Change (n=168)

Independent Variables	Coefficient Estimates	Marginal Effects
Intercept	1.792	
	(0.839)	
Supply-Side Factors		
Council-Manager Government (*govt_form*)	0.470*	0.186
	(0.245)	
Climate Change Staff (*cc_staff*)	-0.351	-0.139
	(0.270)	
General Fund (*lngfund*)	0.125	0.049
	(0.150)	
Mayor (*mayor*)	-0.300	-0.119
	(0.224)	
Climate Change Issue Salience (*cc_imp*)	-0.381***	-0.151
	(0.146)	
Urban Forest Plan (*uf_plan)*	0.364	0.144
	(0.315)	
Action on Green Infrastructure (*cc_green)*	0.728***	0.288
	(0.270)	
Importance of Urban Forests to be in Climate Change Strategies (*cc_uf)*	0.300**	0.119
	(0.224)	
Importance of Urban Forests if Funding Available (*budg_uf)*	0.024	0.009
	(0.079)	
Demand-Side Factors		
Environmental Awards (*award*)	-0.209	-0.083
	(0.266)	
Median Income (*lnmedinc*)	-0.404	-0.160
	(0.292)	
Population (*lnpop*)	0.128	0.051
	(0.098)	
Population Density (*sqmi_pers*)	4.1e-01	5.6e-06
	(1.1e-00)	
Percent White Population (*pct_white*)	0.587	0.232
	(0.876)	
Percent Democrat (*dem*)	0.409	0.162
	(1.084)	
Pseudo r-square	0.142	
Log-pseudolikelihood	-99.289***	

Note: (*) 10% significant level; (**) %5 significance level; (***) 1% significance level; standard errors are in parentheses

CHAPTER 4

UNDERSTANDING THE CHARACTERISTICS, MOTIVATIONS, AND MANAGEMENT INTENTIONS OF LARGE FAMILY FOREST LANDOWNERS IN THE U.S. SOUTH

Introduction

It is estimated that 10.3 million family forest landowners own more than 264 million acres of forest land in the United States, about 35 percent of the forests in the nation (Wear and Greis, 2013). According to Butler (2008), family forest landowners own 77 percent of the nonindustrial private forest land in the United States and 86 percent of the family forest land is owned by families with holdings consisting of less than 1,000 acres. Given the large number of family landowners and the amount of land they control, many recent studies have been devoted to learning about them (Bliss, 1989; Butler, 2008; D'Amato et al., 2010). Much of this land is located in the U.S. South, a region with some of the most productive forest land in the United States (Wear and Greis, 2013). The U.S. South represents 44 percent of the nation's total private forest land (Butler, 2008), and it also has the highest percentage of family owned forest land, 58 percent. Although larger forest landowners (1,000 acres or more), own a smaller percentage of forest land than those in the less than 1,000 acres category, how these landowners collectively manage their forest land could still significantly impact timber supply, forest products markets, and public values such as clean air and clean water.

Forest Ownership in the United States

First, it is useful to review how forest land is classified in the United States. The United States has a total land area of 2.3 billion acres and 818.8 million acres of it is forest land (Oswalt et al., 2014). Of the total forest land, an estimated 521.2 million forested acres were categorized as timberland, forests capable and available for commercial timber production. Timberland not available for commercial production (245 million acres) have been removed from timber use by statute or administrative regulation and reserved for recreational use; special purposes such as watershed protection, wildlife habitat, and parks; or land that is less productive for commercial harvest, but produces other produces other tree products such as fuelwood (Smith et al, 2009). The remaining 52.6 million acres of land was classified as "woodland," which contained tree species with less than 16.4 feet in height at maturity and did not meet current international or Federal Geographic Data Committee (FGDC) vegetation classification standards to be classified as "forest" (Oswalt, 2014).

From the total 766 million acres of U.S. forest land, 58 percent was privately owned (individuals, families, Native American tribes, partnerships, corporations, nongovernmental organizations, and other private groups). The remaining 42 percent was owned by federal, state, and local governments. There are an estimated 11 million private forest landowners in the United States with 61 percent of these landowners owning 10 acres or fewer of forest land. Most of the forest land (67 percent) was in holdings of 100 acres or more. Private forest landowners provide timber for more than 90 percent of the nation's wood and paper products (Oswalt, 2014).

In the past, private forest owners who were not in the business of manufacturing forest products or providing public utilities of any type were termed nonindustrial private forest (NIPF) landowners. This term can be found in public law in 1973 in the Agriculture and Consumer Protection Act of 1973[1], which defined NIPF land as "lands capable of producing crops of industrial wood and owned by any private individual, group, association, corporation, or other

[1] Public Law 93-86 § 1009 Agriculture and Consumer Protection Act of 1973

legal entity." According to Butler (2008), family forest owners are a subset of NIPF owners, who include families, individuals, trusts, estates, family partnerships, and other unincorporated groups of individuals that own forest land (Figure 4.1). However, the U.S. Forest Service has since revised their terminology and is no longer using the NIPF term. The ownership classes have been revised to use the term corporate rather than industrial (Wear and Greis, 2013). The private corporate classification includes entities that are legally incorporated, such as industrial forest products companies, real estate investment trusts (REIT), and timber investment management organizations (TIMO) (Wear and Greis, 2013). A REIT is a special corporate tax entity investing mainly in real estate that does not pay federal income taxes on regular business income that it distributes to its shareholders, thereby avoiding the double taxation associated with C corporations (Wang, 2011). TIMOs on the other hand are primarily limited liability corporations (LLCs) that do not own land (unlike REITs), but rather buy land, manage it, and sell it for their clients/investors (Ravenel et al., 2002). With these classifications, family forest landowners who are incorporated at some level fall within the classification of private corporate entities, but unfortunately may not be representative of that asset class. Family forest landowners might own several thousand acres of forest land, while many REITs and TIMOs own or manage millions of acres of forest land (Zhang et al., 2012). Even some of the smaller ones own or manage hundreds of thousands of acres of forest land.

Nonindustrial Private Forest Owners and National Woodland Owners Survey

Regardless of the revision in terminology for U.S. private forest owners, there has been a significant amount of literature concerning the management practices of NIPF owners, driven by the combination of the recent increase in forest product market share and the complexity in explaining their behavior (Beach et al., 2005). NIPF owners have been examined as a group since the early twentieth century because their lands represented a critical component of the national timber supply, which sparked concern over a potential timber famine (Baker, 1933). The impetus for this research was the result of the "cut and run" practices of timber barons, one of whom was the first U.S. Forest Service Chief Gifford Pinchot's grandfather (Miller, 2001). This practice led to smaller private ownerships and the subsequent concern, which still exists today, over how to encourage better management of these smaller forests (Kuipers et al., 2012).

The United States Forest Service's National Woodland Owner Survey (NWOS) collects information on family forest landowners. Recent NWOS results showed that the average size of family forest landholdings was 25 acres with an average land tenure of 26 years (Butler, 2008). Reasons for owning the land vary widely, ranging from beauty/scenery, privacy, and nature protection, to passing the land onto heirs, investment purposes, and hunting/fishing. Although timber production may not be the primary objective, timber harvesting and removals were fairly common among the landowners. Analysis of data from the NWOS showed that family forest owners were heterogeneous in characteristics and management objectives. Objectives and intensity of management were found to vary with the size of the forest land as well as the length of tenure (Butler, 2008) These results have led to concern over how to reach these numerous landowners to provide them with the technical assistance they may need to sustain the supply of timber and ecosystem services.

The published research on nonindustrial private forests (NIPFs) and their owners is substantial. Early works have focused on the role these lands may play in meeting predicted timber shortages (Duerr, 1974; Adams et al., 1982; Newman and Wear, 1993). Later research on the NIPF situation appeared to be more motivated by private forest management than timber management, and was more interested in the NIPF owner as a person than as a timber supplier

(Majumdar et al., 2009; Poudyal, et al., 2012). Understanding these relationships, rather than only the characteristics of landowners could be important, especially if solutions responding to forest fragmentation and parcelization require collective action among landowners (i.e. ecosystem management or landscape-level management).

Research and analysis using the NWOS data, shows that large-scale family forest owners tend to operate more as a business, whereas small family forest landowners primarily own land for other objectives such as recreation, aesthetic purposes, or as a future investment for retirement or for their heirs (Butler, 2008). Bengston et al. (2011) showed that family forest landowners have varied values and motivations, which makes it challenging to examine them as a homogenous group. Kaetzel et al. (2012) further showed that family forest landowners in the U.S. South tend to be motivated by timber production more than in any other U.S. region. In addition, family forest owners with larger land holdings are also more likely to participate in cost share, easement, and certification programs (Ma et al., 2012). These "larger" landowners tend to own 1,000 acres or more, although they are the "smaller" landowners compared to REITs and TIMOs.

The NWOS definition restricts some categories of family forest owners, such as those who might be incorporated, from the dataset. These other family forest owners are left to fall under "private forest owners" and "noncorporate forest owners," implying that these owners are mainly focused on timber production and financial returns (Oswalt et al., 2014), which is generally true of large, publicly and non-publicly traded nonfamily firms with institutional investors (Fernando et al., 2014). However, one could argue that forest land under majority ownership by one family that is also incorporated under a C corporation is a family forest landowner as well. There very well may be a subset of family forest landowners who own a significant amount of forest land who are incorporated and are captured under the NIPF owner subset, but not under the NWOS subset of family forest landowners. Family forest owners who have large tracts of land (1,000 acres and more) may more likely be incorporated because of tax efficiencies, but still share some characteristics of other family forest landowners.

Understanding reasons that drive family landowners to maintain and manage large tracts of forested land would be helpful to understand the larger picture of family forest landowners in the United States and their role in forest management; however, research on larger land tracts has generally focused on timber production or financial returns (Kaetzel et al., 2012). Studies have not fully addressed the different ownership characteristics of large family forest landowners from smaller family forest landowners. A more qualitative approach is necessary to deepen the understanding of this forest landowner segment and whether they merit further study. The goals of this study are to better understand large family forest landowners in the U.S. South, identify salient issues driving these landowners to keep land under family ownership, and identify important variables to guide future research. This study specifically explored:

1. What factors explain why large family forest landowners choose to keep land under family ownership?
2. What factors affect land management decisions for large family forest owners?
3. Are large family forest landowners different from smaller family landowners, and hence, merit further study?

Theoretical Foundation and Relevant Literature

Family Firms and the Agency Theory

Instead of looking to fit large family landowners only into the pre-existing definitions of NIPF or the NWOS definition of family landowners, this study first examined how business literature defined family firms, since large family forest landowners could be categorized as firms. In basic microeconomic theory, a firm is defined as any agent using economic inputs, such as land, labor, and capital, to produce outputs of goods and services sold to households or other firms (Wetzstein, 2005). Family landowners owning forest land to consume as private property, aesthetic value, or recreational activities with no intention for forest goods and services to be sold or exchanged would not be characterized as firms. In other words, family forest landowners who are income producing could be viewed as family firms, which may likely describe most large family forest landowners. However, there may be outliers, which would include the extremely wealthy landowners who might not need or care whether their forest land produces income or not. For example, Ted Turner is currently the second largest individual landowner[2] in the western United States. He may have some limited timber harvesting[3], but it is likely not an important source of revenue or his primary land management objective.

The broader economic landscape is dominated by family firms (Chrisman et al., 2005; Pindado and Requejo, 2014; Zellweger et al., 2012) and there is consensus that owners and managers of family firms are not only driven by financial goals, but also noneconomic goals and other considerations (Chrisman et al., 2005; Gómez-Mejía et al., 2007). Research has suggested that family-owned enterprises are different from nonfamily-owned ones in that family shareholders derive more nonfinancial benefits from their firms such as identity, the ability to exercise power, altruism, and continuation of the family legacy (Zellweger et al., 2012; Gómez-Mejía et al., 2007; Berrone et al., 2012). Governance issues, such as the role of the board of directors, ownership structure, and firm performance in family firms have also been explored,

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[2] 100 Largest Landowners in the United States, Land Report, Winter 2014, http://www.landreport.com/americas-100-largest-landowners (accessed 23 April 2015)
[3] Ted Turner Ranches FAQ, http://www.tedturner.com/turner-ranches/turner-ranches-faq (accessed 23 April 2015)

and suggesting that family firms play a crucial role in financial and management disciplines (Gibson et al., 2013; De Massis et al., 2015; Fernando et al., 2014; Van Den Heuvel et al., 2006). Applying large firm approaches to study decision making in the family firm environment implies that there is little difference between large firms and family firms (large and small); however, Gibson et al. (2013) suggest there are differences between the two. Family firms can be defined as businesses governed and/or managed with the intention to shape and pursue the vision of the business held by a dominant coalition controlled by members of the same family or a small number of families in a manner that is potentially sustainable across generations of the family or families (De Massis, et al. 2015).

An ongoing issue in family firm research is the definition of a family firm. Gómez-Mejía et al. (2001) defined it theoretically: when a family has significant influence over the firms' affairs, then the firm can be considered as a family firm. Berrone et al. (2010) defined a family firm as firm in which a family holds at least five percent ownership, but Chrisman and Patel (2012) argued that a firm can be considered a family firm if it has a family member in a top-management position or as a member of the board. Other researchers define family firms as only those in which one family controls all ownership rights and is simultaneously involved in the management of the firm (Gómez-Mejía et al., 2007; Zellweger et al., 2012). With such little consensus in family firm literature in defining family firms, it does not provide additional direction for the definition of family forest landowners. All family forest landowners fall under the NIPF landowners definition, but not necessarily under the NWOS family landowners definition or the investor-driven corporate forest companies definition. The subset of NIPF landowners of interest for this study were large family forest landowners with 1,000 acres of more of forestland who managed their land with timber production and/or other revenue motivations.

There are different theoretical approaches to examine and explain why family involvement in family firms results in distinctive characteristics when compared to nonfamily firms (De Massis, et al., 2015). Nonfamily forest firms would include publicly-traded forest products firms, TIMOs, REITS, and other institutional investors. The agency (principal-agent) theory assumes that individuals are risk averse, self-interested, and rational (Jensen and Meckling, 1976). The theory also assumes that the agent's utility increases with the amount of compensation and decreases with the effort that he or she has to put in. Therefore, a rational agent accepts the offer as long as the wage adequately compensates for the effort.

The basic elements of the principal-agent model are 1) the technology of production, 2) the set of feasible contracts, 3) the payoffs to the parties, and 4) the timing of events (Gibbons and Roberts, 2013). The principal and agent are engaged in cooperative behavior, but have different goals and attitudes toward risk (Eisenhardt, 1989). In a business organization context, the firm's stakeholders could be considered as the principal and the CEO could be considered as the agent. For a family firm, the stakeholders and the CEO could be all family members. In the simplest of forms, the production function is

$$y = a + u \quad (1)$$

where y is the agent's contribution to the firm value, a represents the action the agent takes to produce output, and u represents the events beyond the agent's control, which could include weather. The unit of analysis typically used for the agency theory is the contract between the principal and agent (Eisenhardt, 1989). The agent's total compensation is a linear function of output

$$w = s + by \quad (2)$$

where w is the agent's total compensation, s can be thought of as the agent's salary, b is the agent's bonus rate (the bonus is b multiplied by y). The theory also assumes that the agent's utility increases with the amount of compensation and decreases with the effort that he or she has to put in. Therefore, a rational agent accepts the offer as long as the wage adequately compensates for the effort. The principal's payoff is simply

$$\pi = y - w \quad (3)$$

where the principal wants to maximize $E(y-w)$, or $E(x)$. The agent's utility is

$$U = w - c(a) \quad (4)$$

where $c(a)$ is the dollar amount necessary to compensate the agent for any action taken. If the agent is risk neutral, the agent will want to maximize the expected payoff, $E(w) - c(a)$, provided that $E(u)=0$. Rent seeking by the agent at the expense of the owner is one agency problem that may arise (Fernando et al., 2014). The higher the percentage of a firm owned by the manager the more aligned are the incentives between the manager and shareholders, which seems to imply that a family-owned firm appears to be an ideal and efficient solution to the problem (Fernando et al., 2014).

The principal-agent theory has been heavily relied upon with the core belief that the governance structure is efficient when a firm is owned and managed by family members (Schulze et al., 2001). It has been suggested that firms run by family executives benefit from lower agency costs as there exists an alignment of interests and minimal information asymmetry between its owners and managers (Gómez-Mejía et al., 2001). However, past research shows that two-thirds of family businesses fail to transition to the second generation (Miller et al., 2003; Schulze et al., 2001; Handler, 1994). This implies that family firms may not be the most efficient solution to the agency problem or that there are unidentified variables contributing to the success of multi-generational family firms. Furthermore, research suggests that the agency theory predictions alone may be inadequate to explain the relationship between ownership structure and firm behavior (Anderson and Reeb, 2003; Thomsen and Pedersen, 2000) and that certain owner attitudes and behaviors that may help to explain firm performance are not accounted for in economic theories (Uhlaner et al., 2007).

Economies of Tract Size and Forest Management

The size and the length of land tenure are important factors in how forest land is managed, according NWOS results (Butler, 2008; Poudyal and Hodges, 2009). The NWOS results showed the average size of family forest holdings as being 25 acres with an average land tenure of 26 years. Fragmentation of land has complicated land management. Understanding large landowners and the challenges they face is only one piece of the puzzle. However, if size does matter, large land tracts should not be neglected. The reasons for owning the land vary, but although timber production may not be the primary objective, timber harvesting and removals are fairly common among the landowners (Butler, 2008). Owners of smaller parcels are less likely to consider timber harvesting and alternatively foresters and loggers are less willing to work these lands because of proportionately higher fixed costs and complex right-of-way issues. Daigle et al. (2012) found that with large private forest landowners (1,000 acres or more) in four northeastern U.S. states, newer owners were more likely to allow public recreation on their land. However, the study included all private forest landowners, including REITs and TIMOs, and was not focused on family owners only. While intuitive, there is no recent quantitative study assessing the forest management differences between larger family forest landowners and smaller ones, and if there are economies of tract size should be a consideration for the study of family forest landowners.

Economies of scale exist if the firm achieves unit cost savings as it increases the production of a given good or service. Economies of scale is related to production technology and does not require economic efficiency (McClelland et al., 1986) and implies that goods will be cheaper when the output increases because fixed costs are shared across more output units. A related concept is economies of size, which is an economic efficiency concept corresponding to the long-run average cost (McClelland et al., 1986). Declining long-run average cost indicates increasing returns to size and vice versa. In forestry, both short run and long run average cost curves are likely to be L-shaped since diseconomies are unlikely until very large acreage sizes are reached (Cubbage, 1982). Row (1978) referred to the economies of tract size as the advantages of size applied to the smallest production units, the tracts and stands of timber, and are thus economies of scale only in a limited sense. Row (1978) found that economies of tract size can be obtained in 80 acre tract sizes for all forest management regimes, but there are acceptable rates of returns for a few management regimes for tract sizes less than 80 acres. Tracts of 20 acres yielded only positive returns when natural stands were intensively managed. For tracts of 10 acres, no management regime yielded positive returns. Cubbage and Harris (1986) suggested that cost reductions occurred on tract sizes ranging from 40-50 acres and that tract size economies are important to large landowners with multiple stands and management units because the cost of supervision, management, and data collection increases with the increase in the number of small firms. Sundberg (1966) examined the cost of forestry operations in Sweden during the 1960s and found that the required size of forest parcels to carry economical operations increased as mechanization increased.

The economies of forest tract size studies suggest that as the size of the forest holdings increase, the probability that timber management is the primary objective also increase. Anticipated for this study was that as the number of acres increased, the more important generating income from the forest land would become; and therefore be more likely managed for timber production. Related to this is the number of landowners that are part of the ownership. This was expected to also be a factor in the importance of income generation. Although recent studies suggest that tract size is important, mostly in parcelization studies (Mehmood and Zhang, 2001), the problem of diseconomies of size is not directly recognized.

Methods

The agency theory may explain why large family landowners choose to keep forest land under family ownership. The economies of tract size may explain how the landowners make management decisions. Large family forest landowners for this study were defined as enterprises with forest land under majority ownership (more than 50 percent) in the same family and that were actively managing their forest resources in accordance to current standards of the forestry profession. This is a common definition used to define family-owned enterprises (Pindado and Requejo, 2014). Active forest management was defined as including practices such as tree planting, harvesting, timber stand improvement, wildlife habitat improvement, and other practices to increase the quality and quantity of forest-related products and amenities. The U.S. South was identified as the states within the 11 states of the Timber-Mart South[4] reporting area. A case study approach was taken and to be selected as participants in this study, individuals had to meet the following criteria:

[4] Timber-Mart South compiles and publishes timber prices for 22 U.S. southern market areas in 11 states on a quarterly basis.

1. Either owned a stake or share in 1,000 acres or more of actively-managed family forest land in the U.S. South OR manage 1,000 or more acres of family forest land on behalf of individuals in the same family and
2. Was a primary decision maker in day-to-day or long-term strategic management of the family forest land.

The 1,000 acre benchmark because this has been used in previous research to represent large NIPF or NWOS family forest landowners (Daigle, 2012; Butler, 2008). It has been estimated that there are about 28,000 private landowners with 1,000-4,999 forested acres (6.3 percent standard error), 2,000 landowners with 5,000-9,999 forested acres (13.6 percent standard error), and 9,000 landowners with 10,000 or more forested acres (47.9 percent standard error in the United States (Butler, 2008). In past studies examining data from NWOS, the unit of analysis was the landowner (Zhang et al., 2009; Ma et al., 2012). The units of analysis for this study were the contractual relationship between the principal and agent, consistent with the agency theory, because certain attitudes and behaviors may help explain firm performance. Respondents were categorized into seven acreage size categories primarily to protect their identities. Size categories were 1,000-5,000 acres, 5,001-10,000 acres, 10,001-25,000 acres, 25,001-50,000 acres, 50,001-100,000 acres, and more than 100,000 acres.

Case studies involving the forest managers of family forest firms were developed based on interviews. Case studies can help to identify and understand the relationships and views of the subjects studied (Thacher, 2006). VanBrakle et al. (2013) used the case study approach to evaluate the impact of management plans on best management practices (BMP) implementation. Reichman et al. (2014) used the case study approach to understand the issues driving landowners and stakeholders to use prescribed fire on their land and to identify the associated challenges they face. This study employed the case study approach to further examine the relationship between land managers and the reasons why land is held under family ownership. Because this study focuses on cases that replicate or extend the theory, the sampling was not random and was focused on participants within the defined parameters (Eisenhardt, 1989; Reichman et al., 2014). The research sample was obtained by the snowball method until conceptual saturation (i.e., no novel data obtained) was reached (Creswell, 2014). This method is also used in political science and the study of elites, where the most influential political actors are not always those whose identities are publicly known (Tansey, 2007). Welch et al. (2002) defined an elite interviewee as an informant who occupies a senior or middle management position, has functional responsibility in an area which enjoys high status in accordance with corporate values, has considerable industry experience and frequently has long tenure with the firm, possesses a broad network of personal relationships, and has considerable international exposure. Gaining access to elite settings and individuals poses different challenges to those encountered when studying non-elites (Welch et al., 2002). Access to elites is regarded as difficult because of the barriers that set their members apart from the rest of society (Hertz and Imber, 1993). Managers of large forest landholdings may be regarded as elite individuals, being private in nature.

Participants were selected using the snowball sampling method, which involved identifying an initial set of relevant respondents, and then requesting that they suggest other potential subjects who share similar characteristics or who have relevance in some way to the object of study (Tansey, 2007). The second set of subjects are then interviewed, and are also requested to supply names of other potential interview subjects. The process continues until the researcher feels the sample is large enough for the purposes of the study, or until respondents begin to repeat names to the extent that further rounds of nominations are unlikely to yield significant new information. Tansey (2007) mentioned that one of the concerns associated with snowball sampling is that respondents often suggest others who share similar characteristics, or the same outlook, and it is thus also incumbent on the researcher to ensure that the initial set of respondents is sufficiently diverse so that the sample is not skewed excessively in any one particular direction. Creswell (2014) noted that the intent for snowball sampling is not to generalize to a population, but to develop an in-depth exploration of a central phenomenon, which is best achieved by using purposeful sampling strategies. Since there is no known database of family-owned land, participants were identified and selected based on known large family forest landowners from the Forest Landowners Association, state forestry associations, and Timber-Mart South subscribers. Interviews were designed to identify as many attitudes and concerns as possible (Merriam, 2009; Bernard, 2006).

Nearly all past family forest landowner studies rely on traditional survey techniques for data collection. Questions generally limit respondents to multiple-choice questions on reasons for owning forest land. These past studies have focused on how market drivers, policy variables, owner characteristics, and plot/resource conditions affect forest landowner management decisions, such as harvesting, reforestation, and timber stand improvement (Binkley et al., 1996; Kaetzel, 2012; Beach et al., 2005). Although there are several strengths to using the survey approach, including analytical tools to generate statistically significant generalizations, there are some limitations. Egan and Jones (1993) show that information taken from surveys alone should not be used as reliable indicators of how lands are managed. One notable finding to their study was the fact that fewer than 50 percent of those who said they had harvested timber on their land “within the last 10 years” had actually done so. Qualitative methods can address survey weaknesses by increasing the reliability of survey questions. The two methods do not replace each other, but they are complementary and can help increase knowledge and understanding of private family forest landowners. Bliss and Martin (1989) took a qualitative approach and found that many family forest landowners own or manage their forests for sentimental reasons, detailing the significance of the forest to ethnic, family, and personal identity. A qualitative approach could help increase knowledge about the relationships between beliefs, attitudes, behavior, and for identifying new parameters of importance for the large family forest landowner group, which would thereby identify issues or variables of interests for future quantitative studies. For instance, Rickenbach and Reed (2002) used a qualitative approach when they examined most the salient reasons among landowners when deciding to participate in their local watershed council. They found that stewardship ethic, property rights amid uncertainty, and action orientation were most salient. Dutcher et al. (2004) also took a qualitative approach to examine Pennsylvania landowner perceptions of protecting and maintaining riparian forests. They found competing considerations, including feelings of community obligation along with the reluctance to abandon established management philosophies. Edwards and Bliss (2003) combined qualitative and quantitative methods to study a watershed in Oregon to better understand stakeholders, their opinions about forestry, and options for reducing conflict.

Semi-Structured Interview Instrument

Participants for this study were referred to as aliases to protect individual identities. The interviews were semi-structured, which encouraged participants to discuss topics of interest to them. They were directed as necessary to clarify certain points and ensure adequate coverage of essential topics such as forest management activities, future management plans, use of public forestry programs, and attitudes toward forests, forestry, and foresters. The interviews were recorded and the recordings were transcribed. The recordings were erased after notes were transcribed and individuals were assigned aliases to keep identities confidential. Once the interviews were transcribed, they were coded and analyzed using a qualitative data management program called MaxQDA. Quantitative data were analyzed using Stata statistical software.

Respondents received an e-mail summary of the study (Appendix J), a consent form (Appendix K), and an interview guide with questions and topics that participants may be asked (Appendix L). The interview guide provided a means for comparing survey data with data elicited from interviews, as well as for comparing informants with other private family forest landowners. This is the type of interviewing most often written about and it works well when dealing with elite members of a community who are accustomed to efficient use of their time (Bernard, 2006). This structure demonstrates that the interviewer is prepared and competent but not trying to exercise excessive control. The consent form, interview guide, and interview procedures received University of Georgia Institutional Review Board authorization prior to project implementation (Appendix M).

The land managers were asked to respond to a number of demographic questions, including land size, age, and occupation. Since the NWOS results are more representative of smaller landholdings (25 acres or less), the NWOS results were compared against the results from the larger landholdings (1,000 acres or more) interviewed for the study. To understand what variables explain why family landowners choose to keep their land under family ownership, respondents were first asked what factors would lead them to acquire or sell their landholdings, which could be a potential indicator of future forest conversion and fragmentation. However, it is impossible to know the intentions of a new landowner taking over the family forest land and whether that person will maintain the forest or convert it. Participants were then asked what would lead them to divest entirely of landholdings. Land managers with larger landholdings may have more flexibility in acquiring or selling land due to increased access to resources and economies of scale. To understand the additional variables that were important for family landowners to actively manage their forest land, respondents were asked questions regarding the ownership structure, tenure, forest management goals and practices, forest management plans, hunting leases, conservation easements, forest certification, use of IRS Section 1031 Exchanges, challenges and opportunities, and where they received information to manage the forest land.

A probit model was used to answer the first research question of what factors explain why large family forest landowners choose to keep land under family ownership. The probit model is commonly used to analyze discrete choices (Wooldridge, 2010). Respondents were asked what conditions had to exist before they would completely divest in their forest land. The results were transformed into a dependent binary variable, where 1 was assigned if the family would divest of their land for market condition reasons (e.g., regulatory burden, loss in markets) and 0 for hardship reasons only (e.g., bankruptcy, health issues, family disagreement). This variable was used as a proxy to measure the noneconomic goals of the families. If a family is only willing to divest of their lands for hardship reasons, then a high level of noneconomic goals, or "socioeconomic wealth" (Gómez-Mejía et al., 2007), could exist. The latent variable model, with the latent variable, y^* (Wooldridge, 2010), was

$$y_i^* = \beta x_i + e_i \qquad (6)$$

where β was a vector of parameters, $e_i \sim$ Normal(0,1), and y^* was not observed, but observed was the binary variable y, which represented a discrete choice variable, 0 or 1:

$$y_i = \begin{cases} 0 \text{ if } y_i^* \leq 0 \\ 1 \text{ if } y_i^* > 0 \end{cases}. \qquad (7)$$

The likelihood probabilities were

$$P(Y_i = 1) = \Phi(\beta x_i) \qquad (8)$$

$$P(Y_i = 0) = 1 - \Phi(\beta x_i) \qquad (9)$$

where P represented the probability that the respondent would divest under market conditions or otherwise. Φ represented the standard normal cumulative distribution function.

The independent variables in the probit regression were variables that represented family firm characteristics, financial control, and nonfinancial control. Representing family firm characteristics was the variable *years*, which measured the extent of existing family control, a necessary condition for a family to possess noneconomic goals (Zellweger et al., 2012) and the another variable *nxt_gen*, was used to measure the intentions for transgenerational control, which could be an indicator of importance attached to family-centered noneconomic goals in family firms (Chrisman et al., 2012). The *nxt_gen* variable was 1 if the ability for the present owner(s) to pass on the family land intact to the next generation existed and 0 if there was no ability or the ability was uncertain. The financial control variables included the variable *timber,* which was 1 if timber production as a primary management goal and 0 otherwise, and the variable *size,* which represented the size of the forested land. Financial control variables served as a proxy for risk, which is difficult to measure in private firms (Zellweger et al., 2012). Risk tends to decrease with firm size, which was measured by the variable *size.* The size categories used are discussed in the results section. Financial value tends to vary by industry, so *timber* served as a proxy for industry. The nonfinancial control variable was the age of the respondents (*age)*, who were all primary decision makers in land management activities. The age of the respondent may affect perceptions of firm value among the family members within the firm (Zellweger and Astrachan, 2008). To understand how the independent variables affect the unobserved latent variable y^*, the marginal effects of the corresponding variables, which are a function of both the estimated parameters and the values of the explanatory variables, can be calculated using

$$\frac{\partial y_i}{\partial x_k}\frac{\partial P(y_i=1|z)}{\partial x_k} = \phi(\beta' x_i)\beta_k \qquad (10)$$

where ϕ is the probability distribution function of the standard normal cumulative distribution function and z represents $x_1 * x_2 * \ldots x_{15}$. Thus the marginal effect of increasing x_k resulted in a change in *y* of the magnitude $\phi(x_i\beta)\beta_k$ with respect to all regressors and regression coefficients.

To understand what factors influence the management intensity of large forest family land, which was the second research question, an ordered logistic regression was run using the management intensity (*intensity)* as the dependent variable. The independent variables included the priority management objective (*timber)*, whether the family planned to acquire more land (*acquire)*, size of the forest land (*size),* age of the respondent (*age*), the respondent's percent of household income derived from forest land (*income)*, and the extent of the family firm measured by number of years (*years*). The variable *size* was selected because Arano and Munn (2006) showed that the larger the ownership, the more likely profit maximization was the primary goal. The respondent's age and percent of income (*income)* directly derived from forest land may indicate the importance of income generated from the forest land, which may increase management intensity (Joshi and Arano, 2009). Likewise, the number of owners may dictate the level of management intensity needed for each owner to receive revenue from the land. The number of years the land has been in the same family (*years)* was added to the model because it could be an indicator of how much noneconomic emotional benefit is derived by the family (Zellweger et al., 2012). An increase in noneconomic benefits may result in less need for income, and therefore, less need for increased management intensity. For the ordered logit model,

$$y^* = \beta_j X_{ji} + e_i \quad (11)$$

y was the ordered response taking on the size values j={1,2,3,4} conditional on the explanatory variables, *x,* with $\alpha_1 < \alpha_2 < \alpha_3$ be unknown threshold parameters, and $e_i|x \sim N(0,1)$. The response probabilities were *P(y=j|x)*. The variable y had three threshold points for the four management intensity categories:

$$y_j = 1 \; if \; y_j^* \leq \alpha_1 \qquad (12)$$

$$y_j = 2 \; if \; \alpha_1 \leq y_j^* \leq \alpha_2 \qquad (13)$$

$$y_j = 3 \; if \; \alpha_2 \leq y_j^* \leq \alpha_3 \qquad (14)$$

$$y_j = 4 \; if \; y_j^* > \alpha_3 \qquad (15)$$

Results

A sample of 36 individuals were interviewed, which is consistent with other studies employing the case study and snowball sampling methodology (Reichman et al., 2014; Baumgartner and Pahl-Wostl, 2013). The 36 participants represented an approximate total of 1.37 million forested acres over ten states mostly in the U.S. South. The participants were decision makers on day-to-day land management issues and could be characterized as land managers. All land managers were family members themselves, except for three. The three non-family members worked very closely with family members and understood the history and challenges that exist among the families themselves. About half of the participants have forest landholdings in Georgia. The other half had landholdings in Alabama, Arkansas, Louisiana, Maryland, Mississippi, South Carolina, Tennessee, Texas, and Virginia (Figure 4.1). Many landowners had land across multiple states, making it difficult to disaggregate acres among the different states.

Land size categories ranged from the 1,000 acres to more than 100,000 acres (Table 4.1). One respondent fell a little short of the 1,000-acre requirement, but the respondent shared many of the similar characteristics as the other respondents, such as multiple generations within the same family and active forest management, providing useful information to extend the theory.

Fourteen of the participants managed land in the 1,000 to 5,000 acre size category, and the average ownership size across all informants was 38,000 acres of forest land. More than 60 percent of the forest land acres came from landowners with land holdings in the 100,000 acres or more category. All of the landholdings were inherited except for one. The number of owners per landholding averaged 11.63, but when compared with size holdings, the average number of landowners in the size categories of 25,001-50,000, 50,001-100,000, and more than 100,000 was the largest.

Characteristics of Respondents

Most of the managers fell in the 55-64 age category; they also managed 64 percent of the total landholding area (Table 4.2). Thirty-eight percent of the land managers were between the ages of 18 and 54 with 33 percent of the total landholding and the remaining 27 percent were 65 years or older with 3 percent of the landholding. It is also notable that 50 percent of the respondents have college degrees and the other 50 percent have advanced degrees, implying that landowners with larger landholdings were more educated. Occupation classifications of the managers were executives/managers (51 percent), professionals (43 percent), and retirees (5 percent). The "professionals" category included professions that generally require licensing, such as attorney, educator, accountant, financial manager, or real estate agent. Of the 16 professionals, nine were either foresters or working in occupations that are very closely related to forestry. Managers were also asked to report what the average percentage of their annual household income was directly derived from the forest land they managed, which resulted in an average of 29 percent among the 32 managers who responded to the question. Answers ranged from 0 to 100 percent.

Changes in Land Ownership from Acquisition or Divestiture

Out of the 36 land managers, three were not actively looking to sell or purchase land in the near future, but 25 landowners were actively seeking to acquire additional acres in the near future (Table 4.3 and 4.4) with reasons such as it being an investment, for commercial timber operations, additional road access, or protection from liability issues. Some landowners have purchased stakes from other family members or were interested in buying other family members out in the future. One land manager purchased land that was sold by a previous generation because of the emotional attachment to the land. This result contrasts with past research, which has shown that U.S. inheritors were more likely to be active forest managers and significantly less likely than other forest owners to purchase additional forest land within the next five years (Majumdar et al., 2009).

Nine managers were actively planning to sell parcels of their forest land in the near future. Six of the managers were interested in selling parcels that were acquired for investment purposes and to obtain better or more productive parcels elsewhere, and the other three stated they will probably need to sell some tracts because of disinterest from other family members in owning the land or the need to pay off debts. One manager said that it was unlikely that there would be a family member choosing to be a forester in the near future as a reason for selling land in the future. All managers who were looking to sell planned to keep core acres, tracts with special characteristics, or those with sentimental attachment. Land managers were also asked if they had used IRS Section 1031 exchanges on the land they managed. Only about 30 percent of the managers stated they had used it with respect to their family land. When pressed with the question of what would it take for the manager to want to divest completely out of forest land or to move away from forestry as an asset class, reasons included only if the family were insolvent or unable to manage the land properly, if hardship were created for the next generation, or if they needed money for unforeseen circumstances. Value statements were also provided as reasons, such as a strong connection or attachment to the land, the desire to keep the land in the family, and the ability to pass the land along to future generations.

Ownership Structure and Tenure

Ascertaining the length of land tenure for each of the land managers was difficult because ownerships tended to be held within the same family for multiple generations with varied and multiple ownership structures in place. All managers were able to trace the ownership to the approximate year that the original tract of land was held in the family. The shortest length of time was about 20 years and the longest length of time was about 240 years. On average, the original tracts of land have been maintained by the same family for 158 years. There were landowners with as few as two years to as much as 50 years of tenure and from one generation to seven generations of working generations at the time of the interview, but tenure is a challenging question when there were multiple generations of family members who were part of the same ownership. The number of owners in the family ownerships ranged from two to 60. On average, each ownership had about 11 owners.

The operating structure varied from simple with joint owners listed on the deeds to very complex with multiple partnerships, trusts, and limited liability companies. Structures in place were generally dependent on the family's goals and objectives. The most popular structures were limited liability companies (LLCs) at 32 percent and Subchapter S corporations at 24 percent (Table 4.5). Sometimes the structure was dictated by historical choices made by previous generations, which was the case for the three owners who are still under the C corporation structure today. Four landowners were able to convert away from C corporation to a Subchapter

S corporation or an LLC structure. When asked why they had the current structure in place, many described mitigating taxes so that land could be passed along to future generations. Many (33 out of 36) (expressed the importance of keeping the land in the same family because of the history of the land associated with previous generations in the same family.

Forest Management Goals and Practices

Most (78 percent) of the participating land managers asserted that written forest management plans were in place, covering 90 percent of the land base in this study. The landowners who did not have written management plans had informal plans and harvesting schedules and most were planning to formalize the process in the future. One-third of the forest management plans were done in-house, by a consulting forester, or with cost-share funding through state forestry agencies and the USDA Natural Resources Conservation Service.

A majority of the land managers (84 percent) stated that timber management was the top priority. This is consistent with the finding that inheritors place a greater emphasis on the production of timber than noninheritors in previous research (Majumdar et al., 2009). Wildlife or hunting was typically the secondary priority for these managers. The remaining 16 percent of the land managers stated that wildlife or hunting was the top management priority with timber management as a secondary priority. Management intensity and practices reported by the respondents were ranked (Table 4.6). Levels of intensity can differ depending on definition and individual perceptions. Respondents were asked to rate the level of intensity based on a scale of 1= low, 2 = medium, 3 = high, or 4 = very high. These responses were subjective, based on respondents' perception of current management intensity on forest land, but in general, the highest intensity consisted of mechanical site prep with improved seedlings and herbicide and fertilizer applications. Seven respondents reported low intensity, nine respondents reported medium intensity, ten respondents reported high intensity, and eleven respondents reported very high intensity. The acreage amounts increase with each step higher in intensity, which suggests that the larger the landholding, the more important it is to maximize timber income.

Regeneration practices varied depending on the species and markets. All hardwood stands were managed with natural regeneration. The planted pine tracts were managed much more intensely with standard practices of chemical site preparation, machine or hand planted improved seedlings, herbicide application, controlled burning, and thinnings. Depending on the site, two- or three-pass mechanical site preparation[5], mid-rotation releases, and fertilizer application were also performed. A few landowners were experimenting with varietal seedlings.

All land managers have harvested timber within the past five years and plan to harvest additional acres over the next five years. Several of the managers use the different approaches interchangeably depending on what is most favorable during the current market conditions. Although timber was not the primary land management goal for each landowner, timber revenue was important to all landowners. This is consistent with findings of past research, which sateed that landowners who have inherited their land were more likely to actively manage their land (Kaetzel et al., 2012).

Hunting Leases

Although large landowners in the northeastern United States traditionally have allowed public access recreation free of charge, landowners in the southeastern United States are more likely to grant fee-based access in the form of hunting leases or licenses (Daigle et al., 2012). Hunting leases are one of the easiest ways for landowners to obtain income from the land.

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[5] Mechanical site preparation can include the activities of slashing, shearing, piling/raking, and chopping/crushing, disking, bedding, and ripping. Techniques used can range from simple chopping to a three-pass system of shearing, bedding, and raking.

Property taxes continue to rise, and offsetting them is an incentive for leasing land. Lease income may serve to offset annual management expenses and property taxes. The regular income from leasing may also fill income gaps between timber harvests or crop failures, and importantly, lease income may permit landowners to avoid selling or developing their land.

More than 90 percent of these managers lease out the hunting rights on their land. An implication of this is the importance of leases as a source of revenue to offset property taxes and other expenses associated with land management. The remaining 10 percent of the land managers use the land exclusively for personal and family hunting and recreation.

Perpetual Easements

Land managers were asked if they considered perpetual easements on their land (Table 4.7). Nine land managers stated they already had easements on some or all of their land holdings. Nine landowners were actively considering perpetual easements, but were looking for the right opportunity with the right financial incentives. The primary reasons were to maintain the ownership while lowering the tax basis on low production land, to prevent land from being subdivided in the future, and for the financial incentives. The remaining 19 land managers were not seeking perpetual easements and do not expect to do so in the future. One manager cited the inability to obtain a perpetual easement because of C corporation status. The other land managers' reasons for not pursuing perpetual easements included not wanting to bind future generations, not wanting to give up control, thinking that perpetuity is too much of a restriction, and a distrust of organizations involved with perpetual easements.

Third-Party Certification

Respondents were asked if they had considered third-party certification (Table 4.8). Twenty-seven landowners had considered certification, but only 22 landowners actually had some land certified (Table 4.9). Some land managers mentioned that they pursued certification as a byproduct of obtaining a management plan. Others expressed difficulty in the certification process due to having to go through iterative revisions of their management plan to satisfy certain formulaic certification requirements. The number of acres represented in Table 4.9 does not represent the number of acres of forest land actually certified and only represents the land holdings of the landowners who have some or all of their land under a certification system. The acres were not separated out for SFI and FSC to protect participants' anonymity.

Out of the 14 land managers who were not part of a certification system, 11 of them cited the primary reason was they saw no benefits or incentives to being certified, two cited lack of familiarity, and one was interested but other family members were not on board. Many stressed that their land was already sustainably managed and did not want government or outside groups' interference. Many of the land managers who were certified thought their land was already being managed sustainably prior to certification. Out of the land managers who were certified, only five landowners viewed it as a positive thing with the benefits outweighing the costs. Three cited pride in being part of the American Tree Farm System (ATFS) for a long number of years with promotional benefits, which show to the public that landowners are conserving the land, protecting wetlands, and ensuring streamside management zones are marked. Two land managers felt that the information provided, networking with other like-minded landowners, and moral support provided by ATFS were important benefits. However, the managers who had forestry backgrounds did not find benefit from the ATFS information or network opportunities.

Some land managers felt certification was an intrusion of their private property rights. A general sentiment of distrust was conveyed by interview participants. Each state has a set of voluntary forestry Best Management Practices (BMPs) to ensure proper forest management practices that control water runoff and ensure soil conservation. Although most BMPs are non-regulatory, some states measure and evaluate compliance by randomly selecting inspection sites. Noncompliance can result in civil and criminal fines and penalties.

Nearly all the managers who said they have a certification system in place are enrolled in the ATFS program, although it is important to note that AFTS is SFI affiliated. The ones who have SFI or FSC certification only did it because their clients requested them to be certified. These managers either find that they are receiving a premium paid for their certified wood or are given first preference for their wood. The number of constraints imposed by the certification systems was a factor in not wanting to participate, which included costs and restrictions on clearcut size, chemical use, and genetically improved seedlings. FSC standards can be too challenging to navigate for many forest managers in the U.S. South. Only one manager had FSC certification and plans to re-evaluate if the standards to FSC are changed. This is in reference to the repeated modifications of U.S. FSC standards. The standards for FSC certification were too challenging for many family landowners with less than 2,470 acres (1,000 hectares) of land until the standards were modified in 2004. However, the standards were still too challenging for forest owners in the U.S. South, since much of the forests were planted rather than natural, prompting another modification of U.S. FSC standards in 2010[6] to include planted stands.

Challenges to Maintaining the Land Ownership

The participants were asked what land management challenges they face currently or expect to face in the future. The most frequently mentioned concern was over the issue of taxes (Table 4.10). These included property taxes, estate taxes, and changes to the capital gains rate. The concern over property taxes and ad valorem taxes were particularly high in Georgia. First

[6] FSC-US Forest Management Standard (v1.0) approved by FSC International Center on July 8, 2010

passed in 1990, the Conservation Use Valuation Assessment (CUVA) allows Georgia forest owners enroll up to 2,000 acres to be assessed at 40 percent of its current use value for a period of 10 years (Izlar et al. 2011). In 2009, an amendment known as the Forest land Protection Act (FLPA) expanded the eligibility for CUVA, removing the 2,000 acre cap and instituting a 15-year covenant (Izlar et al. 2011).

Although tax abatement programs help, one land manager still felt that Georgia forest owners were not in a competitive position when compared to neighboring states. For instance, a landowner in Alabama could be paying $2 an acre in ad valorem tax, while and another one in Georgia with similar landholding could be paying $6. The estate tax exemption rate was raised in 2013, but land managers were still concerned that it could be lowered in the future. One manager emphasized that estate taxes could be a multiplying effect for multi-generational land. The C corporation structure can be especially burdensome with multiple layers of taxes, according to another manager. The potential change on capital gains for forest management is an added source of stress for land managers. One manager was worried about capital gains and thought that more tax stability was needed for forest owners to continue to successfully operate.

The next most prevailing concern to continued forest land management was environmental regulations coming from the U.S. Environmental Protection Agency and the U.S. Fish and Wildlife Service as a future challenge for forest land managers. This often was followed by remarks on concerns over increased government intrusion and the loss of private property rights. One land manager warned that the consequences of poorly executed environmental regulations could have the opposite intended effect, particularly for parcels near urbanized locales.

The challenge of managing family expectations was an important concern for land managers, as well. The main concern was keeping current family members engaged and in agreement with management objectives. The prospect of future generations lacking interest in forest land was also a problem with maintaining the land. This problem is magnified as families reached fourth generations or higher, leading to an increased number of family members involved. Two land managers described how taking a proactive and hands-on approach to help younger generations learn the value of forest land early on was essential, teaching them activities such as measuring dbh (diameter-breast-height) and identifying trees species and timber product classes.

Liability concerns encompassed a wide range of issues, including natural and man-made fires, theft, trespassing, dumping, and lawsuits. Concern over markets in response to mill closures over the past several years was also an issue as was depressed pricing for sawtimber. The limited markets have gone hand-in-hand with a decrease in logging capacity. Other challenges cited by land managers included forest health concerns, residing far from the land base, and balancing multiple objectives on the land.

Tools and Assistance to Sustain Forest Management

Land managers were asked what sources they used for assistance in their land management. There was a heavy emphasis on formal and informal education. Many land managers had forestry education or had a family member who had a forestry education. The land managers who did not have a forestry background themselves or within the family often used the assistance of consulting foresters, word-of-mouth through peers, and forestry networks, conferences, and workshops. Some were members of research cooperatives, which helped them with intensive forest management decisions. Other land managers mentioned cost share programs that have been helpful to offsetting costs of replanting or with other conservation activities.

All of the land managers were members of a forestry-related group or association. The most frequently referenced were state forestry associations and the Forest Landowners Association (Table 4.11). The “Other” category included the Association of Consulting Foresters, Forest Landowners Tax Council, Longleaf Alliance, National Alliance of Forest Owners, National Woodland Owners Association, and the Society of American Foresters.

Influence of Noneconomic Benefits Influence Families’ Perception of Firm/Land Value

The descriptive statistics used in the probit model appear in Table 4.12. The model showed the extent of family ownership (*years*) and the size of the acres owned (size) influenced the amount of socioeconomic benefits derived from the land (Table 4.13). The *years* coefficient estimate was negative, indicating that as the years increase by one unit, the probability of divesting of the land for market conditions reasons going from 0 to 1 decreases by 0.4 percent. The *size* variable represents the six size of forest land categories of the landowners. The coefficient estimate was positive, indicating that as the size increases, the probability of divesting of the land because of market conditions going from 0 to 1 also increases by 14.3 percent. The implications of this result is that the larger the size of the landholding, the more likely a family landowner would divest of the forest land because of market conditions. The smaller landowners were not as likely to divest entirely, perhaps because the cost of keeping the land is not as prohibitive. The longer the land had been in the family, the more the noneconomic benefits the family owners derived from it, but it may be likely that the landholding is smaller.

Factors Influencing the Management Intensity of Forest Land

Based on the ordered logit model, desire to acquire additional forest land, a management plan, age, percentage of household income derived from forested acres, and the extent of family ownership are factors in the management intensity of forest land (Table 4.14). Specifically, the variable *acquire* was positive and significant indicating that the ordered log-odds for *acquire* being 1 in a higher *intensity* category is 2.742 more than *acquire* being 0 when all other variables in the model were held constant. This suggested that if a landowner plans to acquire additional acres, this increases the likelihood that the landowner would manage land more intensively. This could imply that the landowner needs to generate more capital to acquire more land. The variables of *income* and *age* were positive and significant, indicating that a unit increase in *income* and *age* would result in a 5.620 and 0.710 increase in the ordered log-odds being in a higher intensity category, respectively. This suggested that the family ownerships with older land managers tend to manage land more intensely. Also the more income derived from forest land, the more intensely the land was managed, which makes intuitive sense. The *years* variable was negative and significant, indicating that a unit increase in *years* would result in a 0.026 decrease in the ordered log-odds being in a higher intensity category. This suggested that landowners with a longer extent to the family land are less likely to manage land more intensely. Ownerships located in areas that are not plantation-managed could be in effect. The *size* and *owners* variables were not significant, which indicated that size of forest landholdings and the number of owners in the ownership may not be a significant factor in management intensity for this group of landowners.

The threshold (or cut) points, derived from equations (12) through (15), indicated differentiation among the low, medium, high, and very high categories when values of the independent variables were evaluated at 0. Subjects with the value of 2.098 (*cut1* in Table 4.14) or less on the underlying latent variable that gave rise to the *intensity* variable were classified as low management intensity, given the other independent variables. Subjects that had a value between 2.098 and 5.112 on the underlying latent variable were classified as medium management intensity. Subjects between 5.112 and 8.512 were classified as high intensity and those that had a value of 8.512 or more would be classified as very high intensity.

Comparison to NWOS Results

The NWOS asked respondents to mark whether their family ownership was individual/joint, a family partnership, a trust, or other. The results for other structural forms (LLC, S Corporation, C Corporation) in this study were higher than the national average. These landowners do not meet the criteria to be within the NWOS family forest landowners group but they still share characteristics prevalent in family firms, which is the amount of noneconomic benefit derived.

The NWOS results showed that the large landowners (1,000 acres or more) were more likely to have longer land tenure and were more likely to transfer land to other others, which is consistent with the results of this study, as many of the large landowners owned land that had been in the same family for multiple generations. The NWOS showed that larger landowners were more likely to engage in timber production, lease out land, and have participated in certification systems and easements, which was consistent with this study's findings. The NWOS also showed that larger landowners were more likely to have forest management plans and receive forest management advice, which is also consistent with this study's results. However, the NWOS results indicated that large landowners were more likely to live more than a mile away from their forest land, indicating absentee ownerships. Absentee landowners have been shown to be less likely to invest in the productivity of their land and they were most likely the landowners largest in size in previous research (Romm et al., 1987; Kendra and Hull, 2005), but all the landowners in this study invested in time and money in the productivity of their forestland.

Discussion and Conclusion

This study offers insight regarding the motivations, attitudes, and values of large family landowners in the U.S. South for owning and managing forests. Their characteristics were for the most part on par with the characteristics of the large landowners in the NWOS study, except in the results in which the vast majority had their forest lands incorporated and were not absentee landowners as the NWOS and previous studies have suggested of large landowners. The principal-agent theory has often been used to explain the existence of family firms, suggesting that family executives benefit from lower agency costs because of alignment of interests and minimal information asymmetry between owners and managers. The results to this study showed that most of the respondents were multi-generational family forest landowning firms, which is contrary to other research that showed two-thirds of family businesses fail to transition to the second generation (Miller et al. 2003). However, this study only examined family landownerships that have been successful in keeping the land in the same family, although the results did show that the existing owners planned to keep the land in the family. Anderson and Reeb (2003) found that family firms perform just as well as nonfamily firms in well-regulated and transparent markets, suggesting that family ownership is an effective organizational structure, consistent with agency theory.

Assuming that forest owners with larger landholdings exhibit rational, profit-maximizing behavior is correct, but understanding the importance of forest land to the personal identities of the landowners (noneconomic benefits derived from owning the land) helps explain why landowners wish to continue owning and managing their forest land, and to pass it onto future generations within the family. Family forest firms with large landholdings are more than profit-maximizing enterprises, which may explain the varying organizational structures of the firms and why they are different from nonfamily-owned forest firms. Future studies should examine not only the income effect, but also whether an increased number of owners per landholding could increase the need to generate income from the land due to disparate interests among family members.

Large family forest landholding firms not only value the production value of their land, but they also derive nonfinancial benefits such as the value of passing the land onto future generations, being able to identify with the land and its history, continuation of the family dynasty, positive family image and reputation, and altruism, which was evident when respondents were asked what conditions would exist for them to divest entirely of the forest land. To answer the first research question of why large family forest landowners keep their land under family ownership, results showed that the extent of family ownership and the size of the landholding positively contributed to noneconomic benefits derived by the owners. In addition, all landholdings in this study, except for one, were inherited, which suggests that inherited land tends to increase nonfinancial benefits for its owners. These nonfinancial benefits have been studied in family business literature and termed as "socioemotional wealth" (Berrone et al., 2012; Gómez-Mejía et al., 2007). Measuring socioemotional wealth and how much it contributes to family landowners' utility merits further study, as does how socioemotional wealth is affected as the succession process moves farther away from the first generation owner.

Extent of forestry education and training was not a question that was directly asked of participants, but after the analysis of interview transcripts, it was evident that most participants either had formalized forestry education or a family member had formalized forestry education, which could be a result of the recruitment process of respondents. Study participants were found to have a high level of forestry knowledge, often with other family members demonstrating similar levels of knowledge. This is consistent with a previous study finding that larger landowners (1,000 acres or more) reported a level of knowledge in the field of forestry that was significantly higher than that reported by landowners who owned fewer acres (Kuhns et al., 1998). In addition, all the land managers in this study were involved in a forestry-related group or association. This may contribute to the effectiveness of forest land succession and reduce family friction on land management issues as well as intergenerational conflict, such as sibling rivalry. Family members often work together in a family firm regardless of educational background and experience and therefore often occupy higher organizational positions than they normally would in a non-family setting (Kellermanns and Eddleston, 2004). The most successful family firms have been found to emphasize the appropriate use of family talent and resources and to invest in the building of effective management teams (McCann et al., 2001). Rather than only asking the landowner to quantify how many years s/he has held onto the land, asking the landowner how many years the landholding been in the same family and what generation the landowner represents is also an important factor to a landowner's decision to maintain and manage the forest land.

Depending on the definition, family firms account for about 90 percent of all firms (Aldrich and Cliff, 2003) and therefore, are the most common organizational form. According to NWOS, family forest owners make up 92 percent of private forest owners (Butler, 2008). The results of this study show that the NWOS definition of family forest landowners should be revisited either to broaden the scope to include family forest owners that are incorporated or family forest owners with large landholdings could be studied as a separate subset of the NIPF landowners.

To answer the second research question of what factors influence how large family forest landowners manage their land, the desire to acquire additional acres (positive), the extent of ownership (negative), percent of income derived from forest land (positive), and age of the land manager (positive) were factors in the intensity of land management. The desire to acquire additional acres may lead to increased need to create revenue. Ownerships that have a longer extent (number of years in the same family) are less likely to manage land intensely, which suggested other benefits are derived from the forest land as it moved from generation to generation of ownership. The significance of the age variable suggests that the older the land manager, the more likely the management intensity. This could indicate that the older land managers could be selected as the land manager by the family for their level of experience to manage the land more intensely. Further study in how large family forest landowners select their CEO or COO could reveal additional preferences for land management goals.

The managers reported having forest management plans for 90 percent of the land covered in this study and many managers reported having some or all of their forested tracts certified, despite a prevailing sentiment among the participants against third-party certification systems. The implication is that family forest landowners with large landholdings are likely to be managing their forest land in a manner that is conducive to being certified regardless of whether it is certified or not. The fact that most of the land managers in this study had business structures in place or were examining options in which to structure their forest land suggests that large landowners are actively planning for the future management of their land.

The strong sense of concern over confidentiality expressed by large landowners resulted in a reluctance to participate in surveys or interviews within the large family forest firms, which may be a reason that this group has not been specifically studied in the past. Seeking participation from respondents presented challenges, even with the snowball sampling case study approach. Many respondents were reluctant to be interviewed unless they were introduced by a credible and trusted source, such as a family relative or longtime colleague. This may be part of the reason for the little data available from this ownership group. The nature of the interviews being semi-structured allowed for respondents to provide details on the issues most important to them, which can identify variables to be included in future survey instruments used to study this population of interest.

Much research on large ownerships has traditionally focused on harvesting, reforestation, and timber stand improvements (Beach et al., 2005), while research on family ownerships has generally focused on smaller parcels (Kaetzel et al., 2012). In addition, most family forest landowner studies are limited and constrained to traditional survey techniques for data collection and analyses. This study connects qualitative data to available quantitative research and helps deepen the understanding of the role of family owned forest land in overall forest management in the U.S. South. Previous authors have discussed the importance of combining a qualitative methodology to survey methodology (Bliss and Martin, 1989), but this has not been done in recent years.

If decreasing sizes of forested parcels is a concern, then it makes sense to understand what drives landowners to sell or acquire additional forested land. The results of this study show that the percent of income derived from forested land is more important for owners with larger landholdings. Rather than asking land managers whether they plan on selling or acquiring additional land in the future, a better question may be asking land managers the overall change in landholdings and whether the change is a decrease or increase in overall acres owned. According to this study, factors such as the availability of IRS Section 1031 and capital gains tax treatment were essential for land managers to continue to maintain and increase acres under forest land management. This is an important implication for forest policy, as actions reducing economically helpful tools may have the negative effect on forest land management. Future studies for this landowner group could analyze economies of tract size and how regulatory factors may increase or decrease long-run average costs.

Requesting information regarding the challenges land managers face in managing their land provided further insight on current and future forest management issues. Most of the land managers expressed concern over the availability of mills to process their wood and the decrease in logging capacity available to harvest land. Many managers expressed concern over future tax increases, liability issues, family disagreements, and increased regulatory burdens that might put at risk their ability to continue managing their forests. As a result, many families have organized into various legal business structures to address some of these challenges. Examining these organizational structures in more depth may provide insight into what incentives families need to operate under long term conditions given the nature of timber as a long-term asset. Economic and financial aspects are important to keeping the land intact and under forest management, as well, but there is also the influence of family ownership and a sentimental attachment to keeping the land. This was evident when respondents were asked under what conditions they would completely divest of their landholdings. This emotional and sentimental attachment may override the decision to maximize profits for economic benefit. This could include unsustainable forest practices, including parcelization of the land to maintain core acres or over-harvesting forested acres to be able to pay for the continued carrying cost of the land. Seven of the landowners asserted that they would sell their land in pieces due to unforeseen circumstances, such as changing market conditions and health issues.

This case study also shows the importance of family forest land managers with large landholdings to forest management in the U.S. South. It is limited to a specific set of large family forest landowners. The small *n* limits the generalizability of the study results, but the results show that factors such as noneconomic benefits, number of owners in the ownership, the extent of the ownership (years in the same family), and the desire to acquire more land could increase understanding of this subset of landowners. They are more likely to be actively managing the forest land for timber income and are more likely to be formally educated and knowledgeable in forest management than NWOS landowners. Therefore, these landholdings are important to forest product markets and consequently provide important amenities in large quantities across the U.S. South. It is possible that the present policy focus on forest owners with smaller landholdings may have a negative effect on those with larger landholdings, particularly if the motivations and role of those with larger landholdings are not well understood. As better metrics are developed to understand the reasons why forested tracts are getting smaller or larger, better definitions will need to be developed to identify forest landowning firms and how to study them.

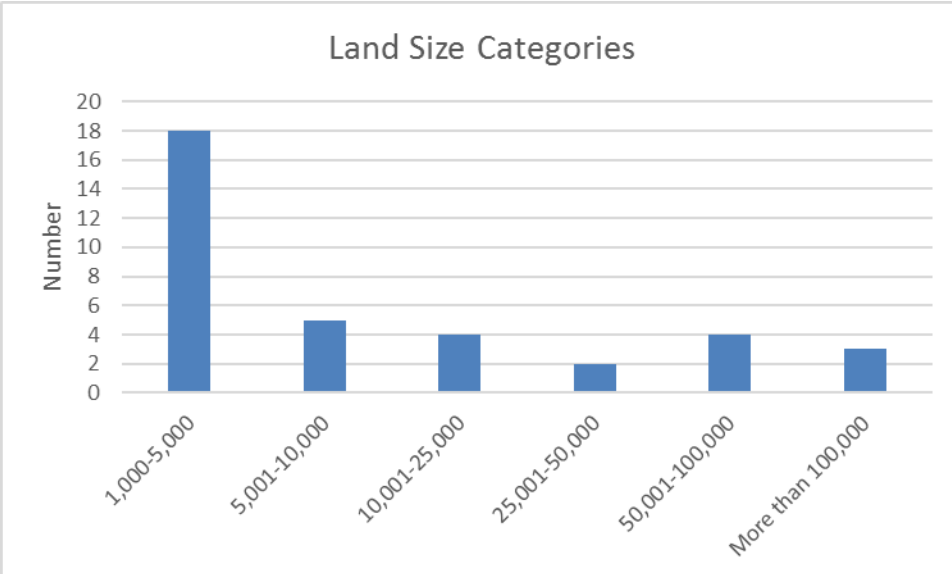

Figure 4.1. Average Number of Owners per Landholding

Table 4.1. Size Categories and Acreages of Interview Participants

Size Category	Size	Owners	Percent Owners	Acres	Percent Acres
1	1,000-5,000	18	50.00	37,841	2.47
2	5,001-10,000	5	13.89	37,500	2.73
3	10,001-25,000	4	11.11	63,216	4.59
4	25,001-50,000	2	5.56	97,042	7.11
5	50,001-100,000	4	11.11	278,000	20.27
6	More than 100,000	3	8.33	856,889	62.56
Total		36	100.00	1,370,488	100.00

Table 4.2. Age Categories of Interview Participants

Age	Owners	Percent Owners	Acres	Percent Acres
18-34	6	16.22	104,368	7.62
35-44	6	16.22	266,300	19.43
45-54	2	5.41	78,216	5.71
55-64	12	32.43	880,431	64.24
65-74	8	21.62	30,173	2.20
75-84	2	5.41	11,000	0.80

Table 4.3. Plans to Sell Forested Acres in the Future

	Owners	Percent Owners	Acres	Percent Acres
No	25	67.57	961,900	70.14
Yes	12	32.43	409,500	29.86

Table 4.4. Plans to Acquire Additional Forested Acres in the Future

	Percent Owners	Acres	Percent Acres	
No	10	27.03	39,000	2.84
Yes	27	72.97	1,332,400	97.16

Table 4.5. Operating Structure of Family Landowners

Structure	Owners	Percent Owners	Acres*	Percent Acres
Individual/joint	7	18.92	19,057	1.27
Trust	6	16.22	161,000	10.71
Family Limited Partnership	5	13.51	32,100	2.14
Limited Liability Partnership	4	10.81	29,800	1.98
Limited Liability Company	12	32.43	373,700	24.87
Subchapter S Corporation	9	24.32	759,000	50.51
C Corporation	3	8.11	128,000	8.52

*Acreage figures differ from actual participant landholding acreage due to some landholdings having multiple ownership structures in place

Table 4.6. Management Intensity

Management Intensity	Owners	Percent Owners	Acres	Percent Acres
Low	7	18.92	15,400	1.12
Medium	9	24.32	126,100	9.19
High	10	27.03	329,600	24.03
Very High	11	29.73	900,300	65.65

Table 4.7. Perpetual Easement Placed on Land Tract(s)

Perpetual Easement	**Owners**	**Percent Owners**	**Acres**	**Percent Acres**
No	30	81.08	1,212,900	88.44
Yes	7	18.92	158,500	11.56

Table 4.8. Consideration of Third-Party Certification

Certification Considered	**Owners**	**Percent Owners**	**Acres**	**Percent Acres**
No	10	27.03	104,000	7.58
Yes	27	79.97	1,267,400	92.42

Table 4.9. Certification System Used on Land Tract(s)

Certification Type	Owners	Percent Owners	Acres	Percent Acres
American Tree Farm	19	51.35	679,100	54.32
Sustainable Forestry Initiative	4*	10.81	571,000	45.68

* One landowner with SFI certification also had dual-certification in FSC

Table 4.10. Challenges to Owning Family Forest Land

Challenges	**Owners**	**Percent Owners**	**Acres***	**Percent Acres**
Family	15	40.54	629,700	14.86
Liability	14	37.84	351,000	8.28
Markets	12	32.43	799,800	18.87
Regulatory - environmental	18	48.65	1,106,600	26.11
Regulatory - taxes	24	64.86	1,066,900	25.18
Other	8	21.62	283,500	6.69

*Acreage figures differ from actual participant landholding acreage due to multiple challenges selected by the land manager

Table 4.11. Forestry Groups or Association Memberships

	Owners	Percent Owners	Acres*	Percent Acres
State Forestry Association	26	70.27	1,238,400	56.81
Forest Landowner Association	24	64.87	583,200	26.75
Other	14	37.84	358,300	16.44

* Acreage figures differ from actual participant landholding acreage due to multiple affiliations selected by the land manager

Table 4.12. Descriptive Statistics of Variables Used in Regressions

Variables	Description	Obs	Mean	Std Dev	Min	Max
divest	1=divest due to market conditions, 0=divest due to hardship	36	0.417	0.500	0	1
years	Number of years in the same family	36	106.444	48.100	20	224
nxt_gen	1=opportunity/ability for family to pass land onto next generation, 0=if no opportunity or uncertain	36	0.694	0.467	0	1
timber	1=primary objective is timber production 0=otherwise	36	0.833	0.378	0	1
size	Size categories of forest land with 1=1,000-5,000 acres 2=5,001-10,000 acres 3=10,001-25,000 acres 4=25,001-50,000 acres 5=50,001-100,000 acres 6=more than 100,000 acres	36	2.444	1.764	1	6
educ	1=four-year degree obtained, 2=graduate degree obtained	36	1.500	0.507	1	2
intensity	1=low management intensity 2=medium management intensity 3=high management intensity 4=very high intensity	36	2.639	1.099	1	4
acquire	1=plans to acquire additional land, 0=otherwise	36	0.722	0.454	0	1
income	Percent of income from forest land	34	0.250	0.269	0	1
owners	Number of owners					

Table 4.13. Probit Regression Examining How Noneconomic Benefits Influence Families' Perception of Firm/Land Value

Independent Variables	Coefficient Estimates	Marginal Effects
Intercept	-1.039	
	(1.768)	
years	-0.029*	-0.004
	(0.016)	
nxt_gen	-0.509	-0.079
	(0.820)	
timber	1.153	0.172
	(1.145)	
size	0.958***	0.143
	(1.145)	
age	0.188	0.028
	(0.269)	
Pseudo r-square	0.595	
Log-likelihood	-9.916***	

Note: (*) 10% significant level; (**) %5 significance level; (***) 1% significance level; standard errors are in parentheses

Table 4.14. Ordered Logit Regression Examining Factors Influencing the Management Intensity of Forest Land

Independent Variables	Coefficient Estimates
acquire	3.153***
	(1.152)
timber	3.835**
	(1.878)
size	0.182
	(0.383)
age	0.843***
	(0.340)
income	7.363**
	(3.843)
years	-0.029**
	(0.013)
	2.098
/cut1	(2.484)
	5.112
/cut2	(2.688)
	8.512
/cut3	(3.0615)
Pseudo r-square	0.501
Log-likelihood	-22.762***

Note: (**) %5 significance level; (***) 1% significance level; standard errors are in parentheses

CHAPTER 5

CONCLUSION

The goal of the three studies was to identify variables that were important to different stakeholders in forest management, including urban residents, municipal governments, and the private family forest owners with large landholdings, taking into account various objectives including climate change mitigation, timber production, aesthetics, and wildlife habitat. The results of these studies could be used in policy by 1) identifying forest attributes urban residents value and the characteristics of residents who are willing to pay to increase and to maintain urban forests, 2) understanding the environmental priorities and investments made by municipal governments, and 3) targeting the efforts to curb land use conversion of the most valuable forest lands by helping working forests productive, both economically and environmentally.

Chapter 2 examined the willingness of Atlanta households to pay for increasing and maintaining urban forests as part of a climate change mitigation strategy. Residents in Atlanta, Georgia were asked to respond to a survey with questions pertaining to their beliefs in climate change and attitudes on urban forests, what urban forest attributes they value, and how much they were willing to pay to increase the urban forest resource as part of a climate change strategy. It was found that Atlanta residents believed that climate change will have an overall negative effect to their quality of life and are willing to pay to increase and manage urban forests as part of a climate change mitigation strategy. The most important urban forest attributes identified by respondents were cleaner air/water (82 percent), aesthetic beauty (78 percent), value for future generations (73 percent), heat reduction (70 percent), and wildlife habitat (63 percent).

Participants were first asked if they would vote “yes” or “no” to ballot referendum seeking to increase urban forests as part of climate change mitigation strategy in Atlanta and then they were asked how much they would be willing to pay for such a project. Important variables for willingness to pay included climate change news source, age, belief in climate change, and the percent tree cover and median income of respondent’s Census tract. The study found that the younger and the more affluent the resident was, the more likely that person was willing to pay. Media preferences also played a role in predicting the attitudes and preferences of residents, which suggested that climate change is a politicized topic and linking urban forests to climate change may not represent urban forests positively to residents who do not believe climate change or its effects should be addressed by policymakers. The willingness to pay, if aggregated over only 10.5 percent of Atlanta households, to increase urban trees to mitigate climate change was estimated to be $1.02 to $1.21 million per year for a five-year period, depending on if protest bids were included or excluded. If the results were aggregated over all Atlanta households, the estimated amount was $9.72 to $11.55 million per year for a five-year period.

A high number of usable surveys (469) were received, with the overall response rate was 10.5 percent. Nonrespondents tended to be black/African American and less educated, which suggested that they may care less about urban forests and climate change. Understanding why this is the case would be important to addressing urban forests and climate change issues in Atlanta, especially since black/African American residents make up more than half of the city’s population. Because nonrespondents tended to be from those who identify with being black or African American and residents who were less educated, future studies in Atlanta should focus on providing survey incentives that might make survey response more attractive to these populations. Future studies should also expand into the greater metropolitan Atlanta area, since forest conversion is occurring in the areas surrounding Atlanta. Finally, further modeling of zero and missing responses could be helpful in discerning the reasons why residents decide to participate surveys concerning climate change and urban forests.

Chapter 3 examined how members of the Mayor Climate Protection Agreement (MCPA) were prioritizing their environmental investments, particularly in climate change and urban forestry. This study showed that multiple and varied local actions to address climate change are being pursued by member MCPA cities. The supply-side factors of a mayor-council form of government, presence of climate change staff, and climate change issue salience were important to the number of climate change actions taken in a city. The demand-side factors of environmental awards and population density were also factors in the number of climate change actions taken. These results were consistent with Bae and Feiock's (2013) study. Climate change adaptation ranked highest as a method to address climate change and expanding urban forests and green spaces ranked highest from a list of environmental priorities. This result suggested that climate change policies pursued on a local level are more focused on climate change adaptation rather than mitigation. The supply-side factors of the presence of a council-manager form of government, climate change issue salience, actions taken on green infrastructure and urban forests within the past five years were positive and significant, which suggested that previous actions taken and the attitudes and values of mayors were important in the level of prioritization assigned to climate change adaptation decisions. None of the demand-side policy variables were significant, suggesting that the sociodemographic factors typically significant for climate change mitigation actions are not the same for climate change adaption, which is consistent with previous findings (Wang, 2012). Public demand, particularly from environmental groups or businesses, likely increase policy actions at the local level. How much forest cover a city already has may be a factor for pursing the increase of urban forests, but this information was not readily available.

When respondents were asked to provide their thoughts on how carbon emissions should be regulated, most were unsure (41.9 percent), although a carbon tax approach (34 percent) was preferred over cap-and-trade (18.9 percent). This result implied that implementing a local or even regional carbon offset program may not be feasible due to available resources, but that cities have inventoried their carbon emissions to prepare for the possibility of a national program. Only 20.8 percent of the respondents had taken some sort of action on carbon offset programs, although 47 percent of the respondents had a carbon inventory. An unexpected amount of respondents, 30 percent, were unfamiliar with the MCPA. These respondents were predominantly designated representatives responding on behalf of the mayor. The lack of knowledge by the staff could reduce the relevancy of MCPA, or action on its behalf, in the future.

Chapter 4 examined the motivations, attitudes, and values of family forest landowners in the U.S. South for owning and managing forests. This study combined qualitative data to available quantitative research that helps deepen the understanding of human interactions with natural resources. Semi-structured interviews allowed for respondents to provide details on the issues most important to them, which can identify variables to be included in future survey instruments used to study this population of interest. Results showed that noneconomic benefits influence families' perception of forest land value, which increased as the extent of ownership was longer and decreased as the size of the forest land increased. Management intensity of land within this subset of landowners was positively affected by the desire to acquire additional forest land, management priority, the age of the primary land management decision maker, and percent of income from forest land. The extent of the family ownership negatively influenced the management intensity, suggesting that the longer the land has been in the family, the less likely the management intensity was higher, suggesting that the generation of income for these holdings may not be as important of a factor and perhaps the increase of noneconomic benefits may be a factor.

The results of the interviews showed that family forest owners with large land holdings are more likely to structure their ownership to ease estate taxes associated with generational transfer of their land, suggesting that planning for future generations is a priority for this segment of landowners. In addition, the results showed that family forest landowners with large landholdings are more likely to be actively managing the forest land for timber income and are more likely to be formally educated and knowledgeable in forest management. It is possible that the present policy focus on forest owners with smaller landholdings may have a negative effect on those with larger landholdings, particularly if the motivations and role of those with larger landholdings are not well understood. Examining these landowners provides a more accurate picture of current forest land management.

Survey variables on future studies should include forestry-specific education and knowledge, additional ownership structures (e.g. limited liability corporation, limited liability partnership, S Corporation) as well as how many owners are part of the ownership. Another important variable was the overall change in landholdings and whether the change is a decrease or increase in overall acres owned. Factors such as the availability of IRS Section 1031 and capital gains were essential for land managers to continue to maintain and increase acres under forest land management. This is an important point for forest policy, as actions reducing helpful tools may have a negative effect on forest land management.

All the participants in this study were actively managing their forests, were not absentee landowners, and often had land tracts spanning multiple generations in the same family. Gaining the trust of land managers in this landownership group was a restraint to this study. It took time to identify and work with individuals and networks with pre-established credibility and trust with land managers. More time should be dedicated to establishing relationships and trust for future studies. Exploring land transfer and organizational structures could better explain tax law implications and probate estate issues as well as the unintended downsides to regulations and certification programs for larger landowners.

In summary, the three studies examined important variables for land use issues affecting forests from three different perspectives: the urban resident, mayors, and forest landowners. Forests have important implications for society and the environment, including stable carbon storage, a sustainable supply of timber and commercial timber products, wildlife habitat, and other ecosystem services. These prospects may diminish due to accelerated rates of forest cutting and the related trends of urbanization and low-density developments in rural areas. Understanding the perspectives and attitudes of U.S. urban populations is critical to understanding factors that may or may not contribute to future land use changes. Understanding preferences of urban residents aid decisions on reducing future sprawl and forest cover loss. Likewise, understanding mayors and their environmental priorities is also as vital as understanding what challenges landowners themselves are faced in owning and managing their forest land.

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APPENDICES

APPENDIX A. SURVEY INSTRUMENT – ATLANTA HOUSEHOLDS

The University of Georgia

Warnell School of Forestry and Natural Resources

2013

Understanding Atlanta Residents' Knowledge and Opinions of Climate Change and Urban Forests

Photo credit: Trees Atlanta

Dear Current Resident:

The purpose of this study is to understand Atlanta residents' attitudes concerning climate change and urban forest policies. This project may help inform public policy to provide services that improve the quality of life for residents.

Your participation will involve mostly multiple choice-type questions and should only take about 10-15 minutes. Your involvement in the study is voluntary, and you may choose not to participate or to stop at any time without penalty or loss of benefits to which you are otherwise entitled. Your individually-identifiable information is confidential, and only aggregated results will be reported.

Please do not fill in this survey if you are not 18 years old or older.

Thank you for your consideration.

GENERAL DEFINITIONS

Climate change: The long-term change in the average climate of a place. This could lead to changes in temperature, precipitation patterns, and sea levels, which are likely to impact human life.

Potential causes of climate change: Studies show that increasing greenhouse gas emissions, especially carbon dioxide, contribute to climate change. Human activities, such as the burning coal and petroleum, have added significantly to the amount of carbon emissions.

Impacts of climate change: The <u>positive effects</u> of climate change may include the need for less energy use during cold weather months, more plant life and milder climates in frozen regions. The <u>negative effects</u> may include more frequent wildfires, longer periods of drought, rising sea levels, and an increase in the number of floods in some regions.

Urban forests: Urban forests include trees and green vegetation within any urban area. Urban forests could help lessen climate change by absorbing carbon from the atmosphere.

Section A: General Climate Change and Urban Forestry Issues

1. Do you believe climate change is occurring?

☐ No ☐ Yes ☐ Do Not Know

2. What do you believe the overall potential effects of climate change are?

☐ Negative ☐ Neutral ☐ Positive ☐ Do Not Know

3. Please indicate how you feel about each of the following statements.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I am concerned with the potential effects of climate change.	☐	☐	☐	☐	☐
My daily activity contributes to the increase in greenhouse gases, adding to climate change.	☐	☐	☐	☐	☐
Climate change is primarily natural and my activity has little effect.	☐	☐	☐	☐	☐
There is evidence that climate change is occurring and I should take action somehow.	☐	☐	☐	☐	☐
I do not know enough about climate change, and more research is necessary.	☐	☐	☐	☐	☐
If I reduce my fossil fuel use now, then climate change will be reduced.	☐	☐	☐	☐	☐

4. Where do you typically obtain information on climate change? (*Check ALL that apply*)

☐ ABC/CBS/NBC
☐ AM/FM Talk Radio
☐ Family/Friends
☐ Fox News
☐ National Public Radio (NPR)
☐ Newspapers/Magazines
☐ Other Cable News (MSNBC, CNN, etc.)
☐ Surfing the Internet
☐ The Weather Channel

5. Which of the following are the most important reasons for increasing urban trees and forests?
(Check ALL that apply)

☐ Aesthetic beauty
☐ Cleaner air or water
☐ Heat reduction
☐ Increased property value
☐ Increased wildlife habitat
☐ Mitigate or adapt to climate change
☐ Noise and glare reduction
☐ Recreation activities
☐ Storm water control
☐ Value for future generations
☐ Wind control
☐ None. I do not value additional urban trees and forests
☐ None. I place negative value on urban trees and forests
☐ Other *(Please specify)*
____

6. How much do you support increasing urban forests as part of Atlanta's climate change strategy?

☐ Not at all ☐ Slightly ☐ Moderately ☐ Very much ☐ Completely

7. Please indicate how you feel about each of the following statements.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Urban forests enhance my city's attractiveness.	☐	☐	☐	☐	☐
Adding more trees to my city should be a priority.	☐	☐	☐	☐	☐
Urban forests increase safety risks (make streets and parks too dark; create hazards from falling trees and branches).	☐	☐	☐	☐	☐

8. How well do you think urban trees and green spaces are maintained in Atlanta?

☐ Not at all ☐ Slightly ☐ Moderately ☐ Well ☐ Exceedingly Well

Section B: Your View of Climate Change Policies

9. How much do you support a cost increase (for example, sales tax, gasoline tax, or other fees) **by Atlanta to reduce the greenhouse gas emissions until the amount of carbon emissions in Atlanta is balanced?**

☐ Not at all ☐ Slightly ☐ Moderately ☐ Very much ☐ Completely

10. If by law you had to pay tax on the amount of carbon emitted by your energy use, how would you prefer the tax to be paid?

☐ Electricity Use ☐ Gasoline ☐ Split the Amount Between Both

11. Please indicate how you feel about each of the following statements.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I prefer purchasing products and services from companies that reduce carbon emissions.	☐	☐	☐	☐	☐
I am willing to pay more for products or services made by a company that reduces carbon emissions.	☐	☐	☐	☐	☐
I am willing to pay an additional tax if it reduces Atlanta carbon emissions	☐	☐	☐	☐	☐

PROPOSED CLIMATE CHANGE AND URBAN FOREST PROGRAM

Suppose the city of Atlanta includes urban forests as part of a climate change strategy to provide shade, remove carbon dioxide emissions, and reduce storm water runoff. Properly placed trees may reduce surface asphalt temperatures by up to 30°F and reduce heating and cooling costs by 10-20% within 10-15 years of planting.

The maintenance of current urban forests is levied through a portion of local and state taxes. Expanding urban forests will require additional funding.

12. Suppose ALL Atlanta households had to pay for this program. **Would you vote in favor of a program that would increase the amount of urban forests and trees in Atlanta by 5% within five years?**

☐ No *(Skip #13 and #14. Answer #15)* ☐ Yes *(Answer #13 and #14. Skip #15)*

13. If you answered YES in #12, what is the maximum you are willing to pay for each year, for five years, for this program? *(Please write in amount)*

$__________

14. Why would you pay the amount you wrote? *(Check only the most important one)*

☐ Contribute to a good cause
☐ Duty to take action on climate change
☐ Pay my fair share to plant and maintain urban forests
☐ Worth at least this much to me
☐ Other reasons *(Please explain)* ___________________________________

15. If you answered NO in #12, what is the main reason? *(Check only the most important one)*

☐ Cannot afford to pay at this time
☐ Do not have enough information to make a comfortable decision
☐ Do not think this program will work
☐ Not worth anything to me
☐ Opposed to any new government programs
☐ Unfair for me to pay for this program
☐ Other reasons *(Please explain)* ___________________________________

16. Below are options to fund urban forests and tree projects. **Which payment is your most preferred?** *(Check only one)*

☐ Increase local taxes (affects all households)

☐ Increase hotel and motel tax (affects tourists and visitors)

☐ Federal grants with matching funds raised by the community or nonprofits

☐ Increase fees paid by businesses and developers

☐ Other *(please specify)* ______________________________________

17. Urban forests may have a positive impact on climate change. **If the city of Atlanta provided you with instructions and assistance to plant urban trees, how <u>many hours per month</u> would you be willing to <u>donate as a volunteer</u> to urban tree projects** (for example, report service needs, watering and mulching, clearing weeds)?

☐ None ☐ 1-5 hours/month ☐ 6-10 hours/month

☐ 11-15 hours/month ☐ More than 16 hours/month

18. If you answered NONE in #17, would you be willing to pay a tax to offset the costs in the previous question?

☐ No ☐ Yes

19. If your city could provide you with services to help you with planting trees <u>on your private property</u>, what services would interest you? *(Check ALL that apply)*

☐ Tree seedlings to plant ☐ Design plan for planting trees

☐ Identifying appropriate tree species to plant ☐ None. I do not have private property where trees could be planted.

20. Would you be willing to pay a small fee to offset some of the costs of the services and information in #19?

☐ No ☐ Yes

21. Are you a registered voter?

☐ No ☐ Yes

22. In which of the following elections did you vote in the past 5 years? (*Check ALL that apply*)

☐ Local (mayor, county commissioner)

☐ State (governor, state senator, state representative)

☐ National (U.S. representative, U.S. senator, president)

23. Are you a donor, employee, member, or volunteer for the following organizations? (*Check ALL that apply*)

☐ Beautification ☐ Forestry or tree care

☐ Landscape architecture ☐ Environmental

Section C: About You and Your Household

24. What is your gender?

☐ Female ☐ Male

25. Are you of Hispanic, Latino, or Spanish origin? *(A person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race)*

☐ No ☐ Yes *(Please specify)* ____________________

26. Which race best identifies you?

☐ American Indian or Alaska Native ☐ Asian or Indian

☐ Black, African American ☐ Pacific Islander

☐ White ☐ Other *(Please specify)* ________________

27. How old are you? ____________

28. How many years have you lived in Atlanta? (*If less than one, enter 1*) ______

29. Please specify the number of people in your household, including yourself.

_______ Total

_______ Below 18 years of age

30. What is your primary form of transportation for getting to work or daily activities? *(Check only one)*

☐ Bicycling ☐ Carpooling ☐ Driving

☐ Public Transit (bus/train) ☐ Walking ☐ Other *(Please specify)* ________________

31. What is your average one-way work commute distance? ________ miles

32. Do you rent or own your primary private residence?

☐ Own ☐ Rent ☐ Other *(Please specify)* _________________

33. Which of the following best describes your current residence facility? *(Check only one)*

☐ Detached Single Family House ☐ Semi-detached/Duplex House

☐ Apartment or Condominium ☐ Townhouse

☐ Multi-family Detached House ☐ Commercial or Institutional (e.g. church or school)

34. Please specify the number of <u>acres</u> on your immediate property *(Please mark "Less than 1 acre" if you live in an apartment building or similar facility)*

☐ Less than 1 acre ☐ 1-5 acres ☐ Do not know

☐ 6-10 acres ☐ More than 10 acres

35. What is your employment status? *(Check ALL that apply)*

☐ Full time ☐ Military ☐ Part time ☐ Retired

☐ Self-employed ☐ Student ☐ Unemployed

36. Which of the following best describes your household's annual income last year?

☐ Less than $15,000 ☐ $15,000-$24,999 ☐ $35,000-$49,999

☐ $50,000-$74,999 ☐ $75,000-$99,999 ☐ $100,000-$149,999

☐ $150,000-$199,999 ☐ More than $200,000

37. What is your highest level of education?

☐ Grade School (Grades 0-8) ☐ Some High School (Grades 9-11)

☐ High School Graduate/GED ☐ Some College or Technical School

☐ College Graduate (4-5 year degree) ☐ Post Graduate Work or Degree

☐ Other *(Please specify)* ____________________

38. Have you had environmental education (degree, major, class) or a career involving the environment in some way?

☐ No ☐ Yes *(Please specify)* ____________________

Please use the space provided below for any additional comments.

____
____
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____

Thank you for completing this survey. Please return this survey in the enclosed postage-paid envelope.

There are no known risks or discomforts associated with this research.
By completing and returning this questionnaire in the envelope provided, you are agreeing to participate in the above described research project.

If you have misplaced the envelope, please return the survey to:

Dr. Jacek Siry, Associate Professor
Warnell School of Forestry and Natural Resources
University of Georgia
180 East Green Street
Athens, GA 30602

If you have any questions about this research project, contact:
Jacek Siry at (706) 542-3060; jsiry@uga.edu
Yenie Tran at (202) 299-6060; ytran@uga.edu

Questions or concerns about your rights as a research participant should be directed to: The Chairperson, University of Georgia Institutional Review Board
629 Boyd GSRC, Athens, Georgia 30602
(706) 542-3199; email address irb@uga.edu

APPENDIX B. PRE-NOTIFICATION POSTCARD – ATLANTA HOUSEHOLDS

Dear Atlanta Resident,

In the next week, you will receive a request from the University of Georgia to complete a brief survey to learn how you feel about climate change and urban forests in Atlanta. We are conducting this survey to help support and understand the needs of Atlanta residents like you. Accuracy of conclusions we make depend on all opinions being represented. We would appreciate you taking a few minutes to complete and return the survey.

Thank you in advance for your time and consideration,

Yenie Tran
Graduate Research Assistant
University of Georgia
ytran@uga.edu

APPENDIX C. COVER LETTER – ATLANTA HOUSEHOLDS

Dear Resident,

We are writing to ask for your help to complete a brief survey to learn how you feel about climate change and urban forests in Atlanta. We are conducting this survey to help support and understand the needs of Atlanta residents like you. The accuracy of the conclusions we make depend on all opinions being represented.

You are part of a small, randomly selected sample of residents in Atlanta. The survey takes about 10-15 minutes to complete and your answers are completely confidential.

Please do not respond if you are not 18 years old or older. We appreciate you taking a few minutes to complete and return the survey.

Sincerely,

Yenie Tran
Graduate Research Assistant
University of Georgia

Jacek Siry
Associate Professor
University of Georgia

APPENDIX D. INSTITUTIONAL REVIEW BOARD STUDY AUTHORIZATION – ATLANTA HOUSEHOLDS

APPROVAL OF PROTOCOL

June 25, 2013

Jacek Siry
706-542-3060
jsiry@uga.edu

Dear Jacek Siry:

On 6/25/2013, the IRB reviewed the following submission:

Type of Review:	Initial Study
Title of Study:	Attitudes and perceptions of urban households on climate change and urban forests
Investigator:	Jacek Siry
IRB ID:	STUDY00000023
Funding:	None
Grant ID:	None
IND, IDE, or HDE:	None
Documents Reviewed:	• Consent - Attitudes perspectives urban households rev. 6-18-13 CleanCopy.pdf, Category: Consent Form;

The IRB approved the protocol from 6/25/2013.

To document consent, use the consent documents that were approved and stamped by the IRB. Go to the Documents tab to download them.

In conducting this study, you are required to follow the requirements listed in the Investigator Manual (HRP-103).

Sincerely,

Larry Nackerud, PhD
University of Georgia
Institutional Review Board Chairperson

APPENDIX E. FOLLOW UP POSTCARD REMINDER – ATLANTA HOUSEHOLDS

Dear Current Resident,

A few weeks ago a survey seeking your opinions about climate change and urban forests was mailed to you. If you have already completed and returned the survey to us, please accept our sincere thanks. If not, **please send it in today**. We are especially grateful for your help because it is only by asking people like you to share your perspectives that we can understand how best to address climate change and urban forest issues.

If you need a replacement survey, please call us at 202-299-6060 or email us at ytran@uga.edu, and we will get you another one in the mail to you today.

Sincerely,

Yenie Tran
Graduate Research Assistant
University of Georgia

Warnell School of Forestry and Natural Resources

2014

Understanding How Mayors View Climate Change and Urban Forest Policies

Dear Mayor or Designated Representative,

The purpose of this study is to understand how local policymakers view climate change and what actions have been or will be taken. The findings from this project may provide information for federal efforts to leverage resources and to formulate complementary policy.

Your participation will involve mostly multiple choice-type questions and should take about 10-15 minutes. Your involvement in the study is voluntary, and you may choose not to participate or to stop at any time without penalty or loss of benefits to which you are otherwise entitled. Your answers are confidential, and only aggregated results will be reported. The results of the research study may be published, but your name will not be used. By completing the survey, you are agreeing to participate in the above described research project.

There are no known risks or discomforts associated with this research.
By completing and returning this questionnaire in the envelope provided, you are agreeing to participate in the above described research project.

Questions or concerns about your rights as a research participant should be directed to: The Chairperson, University of Georgia Institutional Review Board
629 Boyd GSRC, Athens, Georgia 30602
(706) 542-3199; email address irb@uga.edu

Section A: U.S. Conference of Mayors Climate Protection Agreement

39. Are you familiar with the U.S. Conference of Mayors Climate Protection Agreement?

☐ No

☐ Yes, but neither I nor my predecessor signed it.

☐ Yes, my predecessor signed it.

☐ Yes, I signed it.

☐ Yes, but for other reasons *(please specify)* ________________

40. The main goal of the U.S. Conference of Mayors Climate Protection Agreement is to reduce carbon emissions in cities below 1990 levels (in line with the Kyoto Protocol). The Energy Efficient and Conservation Block Grant (EECBG) Program was created because of this agreement. The American Recovery and Reinvestment Act of 2009 provided $2.8 billion for the EECBG Program.

How much do you support the main goal of the Climate Protection Agreement?

☐ Not at all ☐ Slightly ☐ Moderately ☐ Very Much ☐ Do not know

41. Would you sign or sign again onto the Mayors Climate Protection Agreement if given the opportunity to do so today?

☐ No ☐ Maybe ☐ Yes ☐ Do not know

42. How successful do you think the goals of the Mayors Climate Protection Agreement have been carried out?

	Very Unsuccessful	Unsuccessful	Neutral	Successful	Very Successful
Meets or beats Kyoto targets within cities	☐	☐	☐	☐	☐
Urge state and federal governments to enact policies in line with the Kyoto Protocol	☐	☐	☐	☐	☐
Urge U.S. Congress to pass bipartisan greenhouse gas reduction legislation	☐	☐	☐	☐	☐

43. Do you have changes or additions to the goals of the Climate Protection Agreement?

☐ No

☐ Yes *(please specify)* ____

____

____

Section B: Opinions and Actions on Climate Change Issues

44. Please indicate how you feel about each of the following statements.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The current climate change efforts in the United States are adequate.	☐	☐	☐	☐	☐
It is important for my city to address climate change issues.	☐	☐	☐	☐	☐
My city currently is addressing carbon emissions and their effect on climate change.	☐	☐	☐	☐	☐
I consider the approaches other U.S. mayors have taken when making environmental decisions.	☐	☐	☐	☐	☐
I consider the approaches mayors in other countries have taken when making environmental decisions.	☐	☐	☐	☐	☐
I believe national climate change legislation should be enacted.	☐	☐	☐	☐	☐
Local governments should have more of a role in national climate change policy design.	☐	☐	☐	☐	☐

45. What actions has your city taken to address climate change during the last five years? *(Check all that apply)*

☐ Carbon emissions inventory
☐ Carbon offset programs
☐ Disaster preparedness planning
☐ Educational/awareness programs
☐ Increase urban green spaces, such as parks and forests
☐ Land use planning
☐ Retrofitting buildings with energy efficient materials
☐ Storm drain and water-absorbing capacity improvements
☐ Transportation improvements
☐ Other *(please specify)* ____

Section C: Opinions and Actions on Urban Forests

46. Should urban forests be part of climate change policy strategies?

☐ Definitely Not
☐ Probably Not
☐ Maybe
☐ Probably Yes
☐ Definitely Yes

47. Are urban forests part of your overall city planning?

☐ No ☐ Yes ☐ Do Not Know

48. Does your city plan to increase urban forests within the next five years?

☐ No ☐ Yes ☐ Do Not Know

49. How much does your city plan to increase urban forests and green spaces?

☐ Less than 5 percent
☐ 6-10 percent
☐ 11-15 percent
☐ More than 15 percent
☐ Do not know

Section D: Environmental Issues and Policies in Your City

50. How important are the following factors in your city's decisions to pursue environmental projects?

	Not Important	Of Little Importan ce	Neutral	Import ant	Very Importan t
Environmental responsibility	☐	☐	☐	☐	☐
Legal compliance	☐	☐	☐	☐	☐
Public image	☐	☐	☐	☐	☐
Residents' requests	☐	☐	☐	☐	☐

51. Which of the following should be the top priority method to address climate change?

☐ Emissions trading

(i.e. limiting the maximum emissions allowed by one business and allowing it to purchase credits from another business that has the technology to emit less carbon)

☐ Performance- or cost-based credit

(i.e. tax credit from purchase or installation of energy conserving improvements)

☐ Carbon tax

(i.e. an individual or business tax on per unit of carbon released into the atmosphere)

☐ Climate change adaptation projects

(i.e. managing urban forests, developing climate-proof infrastructure and effective response systems)

☐ Other method *(please specify)* ___________________________________

52. If regulations on carbon emissions took effect, which of the following would you most support?

☐ Carbon tax on carbon content of fossil fuels

☐ Emissions permitting for large scale polluters

☐ Other market-based solution *(please specify)* ______________________

☐ Do not know

53. If the U.S. Congress passed carbon tax legislation, what is the best way for the tax to be paid?

☐ Electricity consumption

☐ Transportation fuel

☐ Split the amount between the two

54. If your city budget increased by $100 per household to be used for environmental-related programs only, how would you rank the following programs? Rank the following in order of preference on a scale of 1 to 5 for allocating the additional budget (1 is least preferred and 5 is most preferred).

_____Increasing green building practices, including energy efficient materials and design

_____Purchasing energy efficient or alternative fuel vehicles

_____Expanding public transportation

_____Expanding urban forests and green spaces

_____Increasing renewable energy practices

55. If federal cost share or grants were available, how willing would you be to start a program in your city to help residents plant trees on their private land?

☐ Definitely will not ☐ Probably will not ☐ Do not know ☐ Probably will ☐ Definitely will

Section E: Environmental Budget

56. What is your city's approximate total annual budget? _______________

57. How do you expect your city's total budget to change over the remaining years of your term?

☐ Decrease ☐ Stay the same ☐ Increase ☐ Do not know

58. What are the reasons for the expected changes to your city's total budget during your term?

☐ Decrease in city population
☐ Increase in city population
☐ Decrease in federal, state, or county funding
☐ Increasing in federal, state, or county funding
☐ Other *(please specify)* ____

59. How do you expect the percentage of budget dollars spent on environmental activities in your city to change during your term?

☐ Decrease ☐ Stay the same ☐ Increase ☐ Do not know

60. What percentage of your city's environmental budget is comprised of federal, state, county, and other grants/funding such as from non-governmental organizations?

☐ Less than 1 percent
☐ 1-5 percent
☐ 6-10 percent
☐ More than 10 percent
☐ Do not know

61. Does your city currently have a list of projects to address climate change mitigation or adaptation?

☐ No
☐ Yes, but we do not have enough money in the budget to address the projects.
☐ Yes, but we only have enough money in the budget to address some of them.
☐ Yes, and my city is currently addressing all of the project.
☐ Do not know

62. How much additional funding do you need to accomplish your unaddressed climate change mitigation or adaptation projects?

____

63. Does your city have designated official(s) or unit(s) to oversee climate change-related issues? *(Positions may include urban or city foresters)*

☐ No ☐ Yes ☐ Do Not Know

64. How many full time and/or part time positions do you have working on climate-related activities (positions could include urban or city foresters)? *(Please indicate number and title(s) of positions)*

____

Section E: Carbon emissions monitoring and targets

65. What is the population of your city? ______________________________

66. Has your city assessed total annual greenhouse gas emissions?

☐ No ☐ Yes ☐ Do Not Know

67. What is the estimated annual total carbon emissions for your city?

____

68. Does your city have a target for the reduction of greenhouse gas emissions?

☐ No target
☐ Yes *(please specify)* ______________________
☐ Do not know

69. If you have a greenhouse gas emissions reduction target in place, how have the emissions level changed during your term?

☐ Decrease ☐ Stay the same ☐ Increase ☐ Do not know

70. Has your city ever received an award for environmental activities?

☐ No ☐ Yes *(please specify)* ____________________

Section F: About the Respondent

71. Are you the mayor or a designated representative responding on behalf of the mayor?

☐ Mayor
☐ Designated representative

72. If you are a representative responding to this survey on behalf of the mayor, what is your position? *(Please specify your title below)*

____

73. What is your gender?

☐ Female
☐ Male

74. Have you had formal environmental education (degree, major, class) or a career involving the environment in some way?

☐ No
☐ Yes *(please specify)* ________________________

75. What is your political party affiliation?

☐ Democrat
☐ Independent
☐ Republican
☐ Other *(please specify)* ____________________________

76. How many years have you been mayor? _________________________

If you would like a copy of the results after the study is completed, please provide your contact information. Your contact information will only be used to contact you once the study is completed and will not be linked to your survey responses.

Contact Name: ____

Email Address: ____

Mailing Address (if mail is preferred): ____________________________

City, State Zip: ____

Please use the space provided below for any additional comments.

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Thank you for completing this survey. Please return this survey in the enclosed postage-paid envelope.

If you have misplaced the envelope, please return the survey to:

Dr. Jacek Siry, Associate Professor
Warnell School of Forestry and Natural Resources
University of Georgia
180 East Green Street
Athens, GA 30602

If you have any questions about this research project, contact:
Jacek Siry at (706) 542-3060; jsiry@uga.edu
Yenie Tran at (202) 299-6060; ytran@uga.edu

APPENDIX G. COVER LETTER - MAYORS

Dear Mayor or City Official,

We are seeking your opinions and knowledge about the management of your city's urban forests and your priorities on climate change related activities. The questionnaire is enclosed with a return envelope for your convenience.

Every questionnaire is important. We are surveying U.S. cities that were a part of the U.S. Conference of Mayors Climate Protection Agreement. Without your help, the conclusions that we draw from the questionnaires that we have already received from others may be wrong.

Even if your city does little in urban forestry or climate change, your response is still important. Results will be used to inform strategies at the federal level addressing urban forestry and climate change issues.

Sincerely,

Yenie Tran
Graduate Research Assistant
University of Georgia

Jacek Siry
Associate Professor
University of Georgia

APPENDIX H. FOLLOW UP LETTER REMINDER – MAYORS

Dear Mayor or City Official,

A few weeks ago, we sent you a questionnaire seeking your opinions and knowledge about the management of your city's urban forests and your priorities on climate change related activities. As of today, we have not received your completed questionnaire. If you have completed it, please accept our sincere thanks.

I am writing you again because every questionnaire is important. You are among the U.S. cities that were a part of the U.S. Conference of Mayors Climate Protection Center. Without you help, the conclusions that we draw from the questionnaires that we have already received from others may be wrong.

Even if your city does little in urban forestry or climate change, your response is still important. Results will be used to inform strategies at the federal level addressing urban forestry and climate change issues.

You or your designated representative may fill in the survey by using the link at the bottom of this email or, if you prefer, provide to me with a mailing address and I will send to you a hard copy of the survey.

Sincerely,
Yenie Tran
Graduate Research Assistant
University of Georgia

APPENDIX I. INSTITUTIONAL REVIEW BOARD STUDY AUTHORIZATION – MAYORS

PROJECT NUMBER: 2013-10
TITLE OF STUDY: Climate change and...
PRINCIPAL INVESTIGATOR: Dr. Siry

Dear Yenie,
The University of Georgia Institutional Review Board (IRB) has approved the above-titled human research application that was reviewed by the Exempt 2 review procedure. You may now begin this study. Your approval packet will be sent by campus mail.

Please be reminded that any changes to this research proposal can only be initiated after review and approval by the IRB(except when necessary to eliminate apparent immediate hazards to the research participant). Any adverse events or unanticipated problems must be reported to the IRB immediately. The principal investigator is also responsible for maintaining all applicable protocol records (regardless of media type) for at least three (3) years after completion of the study (i.e., copy of approved protocol, raw data, amendments, correspondence, and other pertinent documents). Any HIPAA-related research documents must be retained for a minimum of six (6) years. You are requested to notify the Human Subjects Office if your study is completed or terminated.

Good luck with this study, and please feel free to contact us if you have any questions. Please use the IRB project number and title in all communications regarding this study.

Best,

Chris A. Joseph, Ph.D.
Department of Anthropology
University of Georgia
Athens, GA 30602

cjoseph@uga.edu

APPENDIX J. SUMMARY LETTER – LANDOWNERS

Research Study on Large-Scale Family Forest Landowners in the United States

Dear Landowner,

I would like to interview you on your role in the forestry sector and what challenges you experience as a family landowner in managing the land.

Specifically, I would like to cover the following areas:

1) How and for what reasons have you structured your land holdings?
2) What are the motivations for you to keep land under family ownership?
3) What are the opportunities and challenges you see in owning the land?

After the study is completed, I will use the results to inform forestry coalitions, associations, and policymakers at the national, state, and regional level, so they can better understand the issues and concerns of family forest landowners. In addition, you will receive a copy of the results, providing you with information on challenges or opportunities similar landowners face. Only aggregated results will be published and no identifiable information will be published without your prior consent.

Requested Permission
Following this cover letter is legal disclosure required by the University of Georgia to undertake this study. Your consent to participate in the study means you understand that as a researcher I am required to take steps to ensure your confidentiality as a participant.

If you are willing to participate, please let me know what day and time is best for me to call you. I anticipate the phone interview to last 30-45 minutes. Please note that I will voice record the interview only for note taking purposes. The recording will be deleted after notes are transcribed.

Sincerely,

Yenie Tran
Graduate Research Assistant
ytran@uga.edu

APPENDIX K. PARTICIPANT CONSENT FORM – LANDOWNERS

UNIVERSITY OF GEORGIA
CONSENT FORM
Large-Scale Family Forest Landowners in the United States

Research Statement
We are asking you to take part in a research study assessing the values and attitudes of large-scale, multi-generational family forest landowners in the United States. Before you decide to participate in this study, it is important that you understand why the research is being conducted and what it will involve. Please take the time to read the following information carefully. Please ask us if there is anything that is unclear or if you need more information. When all your questions have been answered, you can decide if you want to be in the study or not. This process is called “informed consent.” A copy of this form will be given to you.

Principal Investigator: Dr. Jacek Siry, Professor
UGA Warnell School of Forestry and Natural Resources
jsiry@uga.edu; 706-542-3060

Purpose of the Study
The objective of this study is to understand the values, motivations and reasons for large family landowners for owning forest land in the United States. Specifically, this study will cover the following areas: 1) How and for what reasons have family landowners structured their land holdings? 2) What are the motivations for landowners to keep land under family ownership? 3) What are the opportunities and challenges landowners see in owning the land?

Study Procedures
- If you agree to participate, you will be asked to be interviewed by telephone or in person, lasting about 30-45 minutes. An interview guide will be sent in advance to prepare you for questions to be covered in the interview.
- You may choose to skip any questions you feel are sensitive; or tell us to exclude certain information from the final study.
- Interviews will be recorded with a digital voice recorder to ensure correct information is used for the analysis. Once the recordings are transcribed, the recordings will be deleted.
- Any individually-identified information will be confidential; and will not be reported in the final study without your prior consent.
- Only aggregated results will be reported in the final study.

Risks and Discomforts
- We do not anticipate any risks from participating in this research.
- You may choose skip any questions that present discomfort.

Benefits
Understanding the attitudes and characteristics of large family landowners will contribute to the knowledge of their role in forest management and markets in the United States. The results will inform policymakers and the general public so that they better understand the issues and concerns of family forest landowners. An executive summary of the results will be transmitted to forestry coalitions,

associations, and policymakers. In addition, the results of this study will benefit the landowners who participate, providing information on what challenges or opportunities other similar landowners face.

Incentives for Participation
Participants will not receive any monetary or non-monetary incentives for participating in the study.

Audio/Video Recording
All interviews will be recorded using a digital voice recorder. Interviews will be transcribed either manually or using transcription software. The interview transcriptions will be coded and analyzed using qualitative data management software, such as MaxQDA. Transcriptions will be deleted upon the conclusion of the study, unless further direction is given by the participant.

Privacy/Confidentiality
Once the recordings are transcribed, all the personally-identifiable information (e.g., name, contact information) will be stripped from the transcriptions and will be assigned unique individual codes to separate participant interviews. Only the researchers involved in this project will have access to participants' personally-identifiable information. These researchers include Dr. Jacek Siry and Yenie Tran. We will not release identifiable results of the study to anyone other than individuals working on the project without your written consent, unless required by law.

Voluntary Participation
Your involvement in the study is voluntary, and you may choose to not participate or to stop at any time without penalty or loss of benefits to which you are otherwise entitled. If you decide to withdraw from the study, the information that can be identified as yours will remain as part of the study and may continue to be analyzed, unless you make a written request to remove, return, or destroy the information.

If you have questions
The main researchers conducting this study are Professor Jacek Siry and Graduate Research Assistant Yenie Tran at the University of Georgia. Please ask any questions you have now. If you have questions later, you may contact Jacek Siry at jsiry@uga.edu or at 706-542-3060. If you have any questions or concerns regarding your rights as a research participant in this study, you may contact the Institutional Review Board (IRB) Chairperson at 706-542-3199 or irb@uga.edu.

Research Subject's Consent to Participate in Research:
To voluntarily agree to take part in this study, you must sign on the line below. Your signature below indicates that you have read or had read to you this entire consent form, and have had all of your questions answered.

___________________________	_________________________	__________
Name of Researcher	Signature	Date
___________________________	_________________________	___________
Name of Participant	Signature	Date

Please sign both copies, keep one and return one to the researcher.
You may also respond by email your consent to participate in this study.

APPENDIX L. INTERVIEW GUIDE – LANDOWNERS

Interview Guide for Large-Scale Family Forest Landowners in the United States

This interview guide provides you an idea of some of the questions we might be asking you. The questions we ask could vary depending on your values, motivations, and reasons for owning and managing your family forest land. You may ask to skip questions you do not wish to answer.

History and Ownership Structure

- What is the ownership history of your land?
  - Who started the land ownership?
  - How long has the land been associated with your family (years and number of generations)?
  - How has land use changed over time (conversion from rotational crops, pasture land, etc.)?
  - How has the size of the holdings changed over time?
- How is your ownership structured?
  - Corporate or business partnership
  - Limited Liability Company (LLC)
  - Partnership
  - Trust or estate
  - Other (i.e. individual, joint)

- Why is the current ownership structure in place?
  - What historical and current policies or other events have influenced the way your land ownership is currently structured?
  - What would you consider to be the ideal ownership structure for your forest land?

- How many owners are part of the ownership?
  - Who are the primary land management decisions maker(s)?
  - Do you manage your own land or hire a third party?

- What ownership rights are included (i.e. fee simple, surface, or mineral rights)?

- Do you have plans to acquire or sell forested acres throughout your tenure?

- Do you participate in the IRS Section 1031 Exchanges?
  - If so, what are the reasons for participation?

- Under what conditions, if any, would you sell the land?
  - Would you consider selling pieces of the land or all of it?

- Have you ever been in forest products manufacturing?
  - If so, what size and segment?

Land Title Encumbrances

- Do you have any debt or other encumbrances on the land title?
  - If so, what are the reasons for employing debt?

- Do you participate in special state conservation programs, ad valorem tax incentives, or have easements on the land?
  - What type of easement (e.g. conservation, transferrable development rights)?
  - What portion of the land is under easement or encumbered?
  - What are the reasons for putting an easement on land or any other encumbrance?

Land Management

- What are your land management objectives (e.g. timber, wildlife, hunting, conservation)?
  - How much of your land is managed or unmanaged (percentage or acres)?
  - How much of your land is managed for timber (percentage or acres)?
    - What are the primary timber species (e.g. acres of slash pine)?
    - For what products are the timber species managed (i.e. pulpwood, sawtimber)?
    - What is the management intensity of your timber land?
    - What are you management practices (e.g.. planting, natural regeneration, site preparation, type of seedlings used, fertilization)?

- What are your expectations or reasons for owning the land?
  - Timber income
    - Primary source of income
    - Secondary source of income (as an investment, or part of farm/ranch)
  - Nontimber income (i.e. pine straw, berries, other forest products)
  - Recreation (i.e. vacation home, hunting)
  - Future investment (i.e. land investment)
  - Other reasons (i.e. scenery, protect nature or biological diversity, water resources, wildlife, privacy, pass on to heirs, firewood)

- Do you have a forest land management plan?
  - If so, how often is it updated?
  - When did you have it written?
  - Who developed the plan (i.e. consultant, in-house)?
  - Do you have supply agreements?

- Do you collaborate with federal or state agencies on land management (i.e. local forestry agency, extension service, Natural Resources Conservation Service, soil and water conservation districts)?

- Are you a member of landowner groups or associations? If so, which ones (i.e. Forest Landowners Association, state forestry association, National Woodland Owners Association)?
  - What individuals or organizations influence your decisions? (e.g. state forester, forestry associations, family members, other landowners, markets, other)

- Do you need additional assistance now or in the future to manage your forest land? If so, what kind of assistance have you used or what kind is most needed?
    - Technical, such as professional or educational
    - Financial, such as taxes
    - Other

Certification

- Have you considered third-party certification of your forest land?

- Is your land third-party certified (e.g. American Tree Farm, Sustainable Forestry Initiative, Forest Stewardship Council)?
    - If so, what influenced your decision to select the certification system?
    - For how long has the land been certified?
    - What benefits have you derived from the certification?
    - Do the benefits outweigh the costs?

Challenges

- What are the challenges that you have faced while owning the land? (Constraints could include access to capital, access to markets, liabilities, and property taxes)

- How have you addressed the challenge(s)?

- What are some of the future challenges?

- Why continue to keep the land despite the challenges?

Future Plans

- What are some opportunities do you see in owning the land?

- Where do you obtain information that is relevant to your forest management objectives (trade publications, federal or state publications, word-of-mouth)?

- What land management/estate plans are you making for the future generations of your family?

General and Demographic Information

PLEASE FILL THIS INFORMATION OUT IN ADVANCE AND EMAIL OR MAIL THIS BACK TO ME: ytran@uga.edu or to Yenie Tran, UGA Warnell School of Forestry & Natural Resources, 180 E. Green St, Athens, GA 30602

Please note that all demographic information will be aggregated and presented in summary form only. No individually identifiable information will not be used in the study.

1. What is the total number of acres in your ownership? Click here to enter text. acres (or select below)

☐1,000 acres or fewer	☐25,001 – 50,000 acres
☐1,001 – 5,000 acres	☐50,001 – 75,000 acres
☐5,001 – 10,000 acres	☐More than 75,000 acres
☐10,001 – 25,000 acres	☐Prefer not to respond

2. How old are you?

☐18-34 years	☐65-74 years
☐35-44 years	☐175-84 years
☐45-54 years	☐85 years or older
☐55-64 years	☐Prefer not to respond

3. a. What is or was your main occupation? Click here to enter text.
   b. Are you retired? Choose an item.
   ☐Prefer not to respond

4. What is your education level?

☐ High school/GED	☐ Advanced degree (graduate)
☐ College (associate, bachelor)	☐ Prefer not to respond

5. What is the average percent of your household's income derived from your forest land?
   ☐Click here to enter text.%
   ☐ Do not know
   ☐Prefer not to respond

APPENDIX M. INSTITUTIONAL REVIEW BOARD APPROVAL OF PROTOCOL - LANDOWNERS

The University of Georgia

Phone 706-542-3199

Fax 706-542-3660

Office of the Vice President for Research
Institutional Review Board

APPROVAL OF PROTOCOL

May 12, 2014

Dear Jacek Siry:

On 5/12/2014, the IRB reviewed the following submission:

Type of Review:	Initial Study
Title of Study:	Characteristics and Attitudes of Large Family Forest Landowners in the United States
Investigator:	Jacek Siry
IRB ID:	STUDY00000950
Funding:	None
Grant ID:	None

The IRB approved the protocol from 5/12/2014.

To document consent, use the consent documents that were approved and stamped by the IRB. Go to the Documents tab to download them.

In conducting this study, you are required to follow the requirements listed in the Investigator Manual (HRP-103).

Sincerely,

Larry Nackerud, Ph.D.
University of Georgia
Institutional Review Board Chairperson

629 Boyd Graduate Studies Research Center • Athens, Georgia 30602-7411
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