Assessing Urban Trees and Urban Forests Management

by

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Abstract

Urban green space and forest play a special role in building a livable community. The purpose of this dissertation is to examine the preferences for and attitudes towards urban trees regarding not only the biophysical presence of trees but also governance and financing. From a biophysical perspective, individual's preference to tree characteristics and spatial configuration such as tree size, amount, shape, location and visually neatness was assessed. From an institutional perspective, the development of tree ordinances in Alabama was analyzed. Public and municipal officials' attitudes towards urban trees and institutional arrangement were further investigated. A visual preference survey including residential landscape designs was conducted to capture the diverse preferences as regard to the variation of tree attributes. Both on-line and in-class survey data were collected. Data from Alabama urban forestry survey for citizen and public officials were also used. Econometric methods such as linear regression, multinomial logistic model, ordered logistic model and other statistical methods were applied.

This study provides ample information regarding people's preference to trees, tree management, financing forestry programs and other regulation instruments. Findings suggest that the important role of urban trees in community has been widely recognized by both local officials and residents. People in general prefer to live in houses and communities with more trees. Large trees with a wide round canopy are favored. Clean and well-maintained living environment is generally preferred while some "cue of care" can be used to improve the appearance of residential landscape. Findings also indicate the diversity of preference among

people. Municipal officials concern more about the social-economic benefits of trees (such as increase property value and increase in community pride), while residents usually favor the aesthetical and health value. Individual donation and tax are important sources for financing urban forests program. However, the financial support is highly related to the social economic situation of the community, such as population, poverty rate and the well-beings of the citizens. The role of education in preference shaping is highlighted. The results of this study meet the pressing need of information among a variety of stakeholders of landscape designer, resource managers, land-use planners, developers, environmental policy makers, and private land owners on a variety of topics regarding residential land development.

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Introduction

There is a long history for using trees in gardening and landscaping. In historical Europe, landscaping, trees, and green space used to be the privilege of rich people. The poor could only enjoy the trees and open spaces in public places. In modern society, the uses of land are highly competitive, and landowners try to maximum the use of the land by closely packing their house together and thus there was no much space for trees (Bradshaw et al., 1995). In America, it was not until late in the 19th century that trees and lawns were intentionally established in colonial villages. The emerging middle and upper class promoted the need of park-like residential landscapes and home buyers started to place high premiums on wooded parcels (Payne & Strom, 1975). At the beginning of the 20th century, people realized that trees should be an integral part of cities. Most large cities and many medium sized communities initiated city forestry programs to plant and care for urban forestry. Nowadays, trees have become well known as an elemental design factor and have been widely used in residential landscapes. Advertisements for a new house usually have a carefully drawn tree somewhere in the picture.

Urban green space and forest play a special role in building a livable community. It has been widely recognized that trees can improve human beings' health and well-being. The management of trees is critical for resident's social well-being. Trees provide a lot of socio-economic and ecological benefits in urban areas, such as improvement of air quality, groundwater recharge, modification of microclimate, reduction of noise levels, saving of electricity use, and provision of wildlife habitat. They also make neighborhoods aesthetically

appealing and provide community residents mental and physical benefits from a visual pleasure environment. These values are reflected in higher real estate prices, lower water bills, and an influx of tourists, as well as talented people and businesses.

However, trees also can cause problems if not well managed and maintained. Destruction of property, personal injury and even death can be caused by falling trees. During the storm season, urban trees are more prone to disruptive results due to clogged streets and accesses, disrupted utility service, damaged property, loss of city services, increased debris removal, increased recovery costs, and a threat to public safety. The wildfire risk and potential threat for bugs or snake habitat around residential area can also be a concern.

More challengingly, trees may also cause many potential conflicts within the community. Firstly, individual preferences to tree (such as tree type, tree size and location) are different; secondly, residents, business men, city planner and other stakeholders may have different concerns for urban trees. These externalities and conflicts usually result in a call for development of urban tree program in community as well as regulations such as tree ordinances as legal provisions adopted by local or community governments. As a consequence, understanding individual's preference to urban tree, assessing financial support for urban forest program and developing the tree ordinances are together contributing to urban forest management and governance.

Considering the broadness and complexity of urban trees, the management and governance of urban forest is a challenge work. How to use urban trees to promote community development is a critique issue to city planners, policy makers, academicians and the general public. Public's positive attitudes and supports for urban forest are important for urban trees development. Local municipal officials also play an important role in initiating and promoting

urban forestry. Most of them are responsible for financing and managing urban forestry program. As a payer, local officials may hold a different preference or concern on urban trees comparing with general public. Thus, information of the local officials' perception and publics' preference may help to promote public involvement in urban tree management activities.

Assessing individual's preference is very important for understanding people's choice in economic behavior (Kahneman & Tversky, 2000; Kahneman et al., 1991), empirical demand analysis (Samuelson, 1948; Sen, 1971, 1973, 1977) and welfare analysis (Ng, 1979, 1999, 2003). Researchers started to address the question of individual's preferences to our environment since the 1960s. The collective evidence from environmental psychology and landscape research has shown that individual preference is an influential factor in shaping land use change (Schroeder, 1989; Luzar & Diagne, 1999; Erickson et al., 2002; Zhang et. al., 2007). Preference study is also a powerful tool in determining human response to policies and planning decisions (Kaiser, Wölfing, & Fuhrer, 1999). However, preference is formed and influenced by a complex of socio-economic, cultural, and biophysical interactions which cannot be directly observed (Balram & Dragićević, 2005; Bourdieu, 1984; Fraser & Kenney, 2000; Home, Bauer, & Hunziker, 2010). For example, some evidence suggests that knowledge can influence preference and behavior (McFarlane & Boxall, 2003; Wall, 1995). Gender, age, education level and income were also widely used as predictors in preference study, but the literature is less consistent on their effects on environmental attitudes and landscape preference (Mohai, 1992; Stern, 2000; MaFarlane & Hunt, 2006).

This dissertation is aimed to assess the biophysical presence of trees and urban forest program as well as institutional arrangement of managing urban trees. The information and analyses from this study will help to promote effective policies and planning in future housing

development and community forest programs. The overall goal of our study is to help to better manage the urban forest and build a livable community which is environmental friendly, aesthetically appealing and economically viable. To achieve this objective, the study is specified:

- To explore and understand public preferences of trees in residential landscapes;
- To explore individual and community's economic and demographic characteristics contributing to the attitudes in green space;
- To analyze general public and officials' support for urban forest program and institutional arrangement.

To achieve the objectives, five related chapters have been conducted. They are independent studies but are also integrated together. As shown in Figure 0-1, chapter I and chapter II assessed trees and landscape designing primarily using visual preference survey. The line, size, form, texture and color of trees are important design elements. Chapter I focused on the analysis of biophysical characteristics and spatial configuration. Tree attributes such as amount, size, shape and location were assessed. Chapter II further discussed the preference to a wild look environment versus a well-maintained landscape. Individual's social-economic background and demographic characteristics were accounted for preference assessment. Understanding people's preference to those tree characteristics as regard to their social economic factors may help city planner and landscape designer better manage urban trees in residential area.

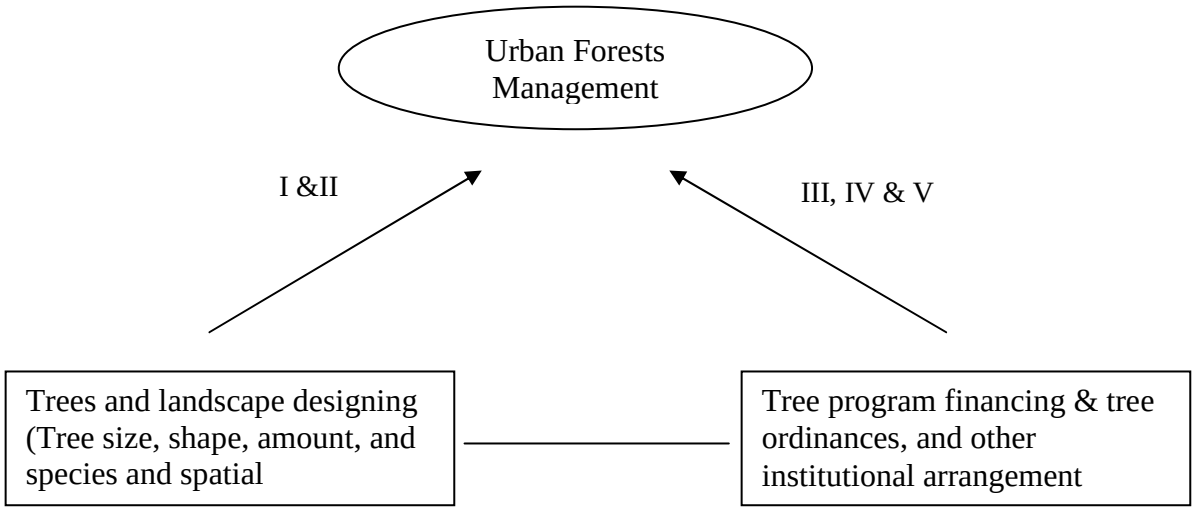

Figure 0-1 Dissertation structure

Chapter III, chapter IV and chapter V assessed not only the perceived value of trees but also institutional design including the study of tree ordinances, trees program financing and municipal officials' perception to urban tree program. More specifically, chapter III focused on the important aspect of urban tree governing—the development of tree ordinances. It offered guidance to residents, and specify the rights and responsibilities and minimum standards to regulate human relationships regarding trees, and to frame and coordinate individual interests concerning trees. Chapter IV assessed the preference to trees and financing urban forest from the view of residents. Local residents supported urban forest program through many ways such as voluntary activity and private donation. Understanding their attitudes was important for regulation and policy making. Similarly, chapter V addressed the preference issue from municipal officials' perspective. Those managers and policy makers' perceptions are also important. The demographic, socio-economic background and tree preference factors were accounted for prediction of financial support for urban forest program.

Chapter 1 Tree Preference to Residential Landscape in Suburban Communities

Introduction

Concerns have been raised regarding the aesthetic value and ecological function of landscape, and how human beings perceive nature has been investigated from various perspectives. For example, Danial et al. (1978) focused on the scenic beauty estimation method. Kaplan and Kaplan (1989) studied the information processing model of environmental aesthetics, and Urlich (1983) worked on the development of affective theory. Carlson (1999) indicated that appropriate appreciation of human environments depends on their functions and their roles in our lives. Falk (1977) argued that human landscape preferences could be strongly affected by our evolutionary adaptation to life on the savannas of East Africa. It is argued that Preferred landscapes would be those subjectively perceived to contain features favorable to human survival and landscapes that (unconsciously) appeared to afford access to subsistence resources and pose minimal threat (Falk & Balling, 2010). One line of argument is that beautiful things should provide benefits to human being --"what is good is beautiful", and some empirical studies have confirmed their results of this kind of beauty preference (Owens & Ford, 1978; Dion, Berscheid & Walster, 1972; Rhodes, 2006).

Trees in urban areas provide a lot of socio-economic and ecological benefits, such as improvement of air quality (Nowak, 1993; Nowak & McPherson, 1993; Akbari, 2002; Rowntree &Nowak, 1991), groundwater recharge (Sanders, 1986), modification of microclimate (Heisler, 1986; McPherson, 1990; Meier, 1991), reduction of noise levels (Cook, 1978), and provision of

wildlife habitat (Johnson, 1988) such as birds (Emlen, 1974; DeGraaf, 2002). The shade from trees for residential houses can also save summertime electricity use (Donovan & Butry, 2009). The mental and physical benefits from a visual pleasure environment were widely discussed (e.g. Ulrich, 1984; Kaplan, Kaplan & Ryan, 1998; Kaplan & Kaplan, 1989; Ode & Fry, 2002; Price, 2003). More recently, a number of studies have established a direct relationship between human health or well being and the long term exposure to natural landscape (e.g. Lafortezza et al., 2009; O'Brien & Murray, 2007; Hartig & Cooper-Marcus, 2006).

Apart from the objective function, tree influence individual's feeling subjectively. Trees in a community humanize the residential landscape and make neighborhoods aesthetically appealing. When confronted by hard surfaces, the eye is restless. Trees break up these artificial lines and planes and related people to their environment. In other words, trees add a natural element to the physical landscape (Nadel, Oberlander & Bohm, 1977). More importantly, an aesthetically appealing landscape usually reflects the emotional resonance and help to build a sense of community. While adding beauty, health, and comfort to the home, trees in a home's landscape usually are meaningful to the owner. For example, to a child, trees represent adventure. To a grandmother they represent a memory. For young couples, planting a tree in their new house means a beginning of a new life (Willeke, 1989). In this way, trees add a feeling of home to the house and bring harmony to the community. Meanwhile, home owners show their taste of art and their personality through housing landscape design. A well-maintained front yard usually suggests a good family and a good citizen. As Garrett Eckbo (1950) said," Trees, rather than a building, are the best measures of a civilized landscape. A community in which many mature trees survive and more are planted regularly demonstrates a sense of time, history, and continuity on the land" (cited from Walhein, 1977, p.7).

The visual contribution of trees is largely a function of design. The line, size, form, texture, and color of trees are important design elements. A right size tree can provide a framework for the entire landscape and make the scene spark. A large tree helps create a sense of establishment and permanence. Trees, especially round trees planted at the corners of houses can help to soften the entire picture and define the space (Streich & Rodie, 2007). Tree rows in regimented configurations may create outdoor rooms by their sense of enclosure (Anlian, 1989).Trees can also be used as accents by varying their forms. For example, tall and narrow trees add height and drama to the landscape. They also put color in the sky. The evergreen trees usually make the house outstanding on the white snow background in winter. The reflection of a tree from glass and water surfaces can produce beautiful shadow patterns, which gives a vivid imagination of the scene. Trees give residents a sense of natural time and rhythmic change which is not artificial and imposed.

The condition, posture, and form of trees in a design will influence the mood of observers. Many researchers have tried to reveal people's preference towards some specific tree figures. Willeke (1989) pointed out that trees provide a sense of security, and most Americans prefer homes that are surrounded by "the umbrella of trees". Sommer and Summit (1996)'s findings also indicate a preference across nationality for spreading and globular trees, and conical and columnar forms were less favored. Summit and Sommer (1999) did further studies on tree shapes and show that people prefer acacia-like characteristics with large canopies and short trunks. Nelson et al. (2001) tested the preference to tree canopy and found that the visual attractiveness of a tree reflects the completeness of its canopy: trees with the most complete canopies were the most attractive and trees in bare branch will be less attractive than trees in leaf. Lohr and Pearson-mins (2006) suggested that scenes with trees were more attractive than scenes

with inanimate objects, and spreading trees were more attractive than rounded or columnar trees. This finding was consistent with savanna hypothesis.

Preference to city trees and street trees were also discussed in previous studies. Wolf (2005) conducted a survey to explore the trees in business district preferences. The presence of a full-canopy forest was found to be associated with higher visual quality ratings of the retail district. Todorova et al. (2004) also focused on the preferences of street vegetation, especially the compositions of flowers and trees. He found that flowers were the most preferred element beneath street trees. Behe et al. (2005) conducted a survey and tried to find which attributes in a "good" landscape a consumer valued most. Participants viewed 16 photographs that depicted the front of a landscape residence. Results showed that the relative importance increased from plant material type to plant size to design sophistication.

Since public has specific preference to green space, adding trees to residential landscape can produce economic value. Early experience has shown that in the sale of homes in a new residence district, trees are as essential as sidewalks and paving, and second only to sewer, water, gas and electric connections (Pack, 1922). Recently, how urban trees may add to the value of property has also been widely discussed (Mansfield et al., 2005; Schroeder, 1989). Previous hedonic price analyses showed clearly that trees increase the value of residential properties and that people are willing to pay more for housing with trees (Anderson & Cordell, 1985/1988; Tyrväinen, 1997; Morales, 1980; Payne & Strom, 1975). More recently, Crompton (2001) concluded that a quality forest or green space has a positive economic ripple effect on nearby properties. Appraised property values of homes that are adjacent to parks and open spaces are typically about 8 to 20 percent higher than those of comparable properties elsewhere. Rental

rates of commercial office properties were about 7 percent higher on sites having a quality landscape, which included trees.

However, there is little systematic information about the public's preferences towards features and spatial configuration of urban trees. This information would be very useful to managers, planners and developers. Characterizing the complexity of individual attitudes can better support the integration of all interest groups, maximize local benefits, and increase success in community tree programs. Respectively, public preference attitudes are often not same as the planners'. Community planning still rarely involves the public directly nor is it typically based on systematic data about public needs and interests (Porteous, 1977). A better understanding of public preference to urban trees will help policy makers and developers make better decisions on urban forest management and also help residents manage their residential area.

This paper is organized as follows. First, it explains how the visual preference survey was conducted. Then, the rating report of 14 single house landscape designs is presented and the preference between students and local residents is compared. the impact of tree characteristics on landscape preference is explored by regressing tree characteristics on Likert score of landscape designs. The typical landscapes presented this study are the single family residential areas in new communities in the Southeastern United States. However, it is anticipated that the observations and findings will be transitive nationwide. The final results provide important information that can be used to compare with other regions. Therefore, the expected results have nationwide applicability.

Survey Design

The common questionnaire approaches to studying landscape-related attitudes include a range of semantic-differential (with good/bad options) and Likert items (with agree/disagree options) (Kerlinger, 1992). Both of these methods help to construct the attitude structure. In this study, a combination of a visual preference survey (VPS) and a questionnaire is used to obtain a full scope of individual preferences for trees in a residential landscape.

VPS methods have been widely used as a research tool by forest managers, environmental psychologists, and landscape architects. Typical uses of VPS include helping the community define preferences for architectural style, signs, building setbacks, landscaping, parking areas, size/scope of transportation facilities, surfaces finishes, and other design elements (see Ulrich, 1983; Schroeder, 1988; Kaplan & Kaplan, 1989; Shaffer & Anderson, 1983; Ewing, 2001).

As the name implies, this technique is based on the development of one or more visual concepts of a proposed plan or project. With computer-alteration we simulate alternative tree compositions on an otherwise identical residential lot, which permits us to hold constant all other factors that might influence the relative desirability of a property. Then we conduct a series of choice experiments with prospective homeowners to infer public perceptions of the relative desirability of each forest composition. It allows us to derive a set of homeowner preferences for different types and configurations of trees. Because the design is hypothetical, it is free to design different configurations of expansion of the green space and woodlots.

To begin with, 200 different housing landscape photographs from thousands of color photographs are selected. These slides are taken around Alabama, Georgia and Florida without any specific aesthetic considerations or constraints. The selection of the photographs is based on

the following criteria: the presence of natural landscapes and a common housing style; good photographic quality with little distortion; and horizontal photographic shots taken at approximately eye level without looking up or down. All the photographs were taken from August to September, 2007.

Scenes are designed based on these 200 photographs. House style, sky, lawn, and path way are almost the same in each design in order to exclude the influence of other visual factors. To explore the influence of different combinations of trees in housing landscapes, the following attributes are assessed: (1) the amount of trees; (2) wilderness (e.g., different species) versus managed (e.g., the neatness, even aged, planted and well trimmed); (3) the shape of the trees; (4) the size of the trees; (5) the location of trees. The description of the combination of these five design factors is listed in Table 1-1. In this way, we created the full factorial design, i.e., all of the possible combinations of attribute levels. This gave a total of 14 alternative scenes for single house community landscape (See Figure 1-1).

H1

H2

H3

H4

H5

H6

H7

H8

H9

H10

H11

H12

H13

H14

Figure 1-1 14 Designs of single house landscape

Table 1-1 Descriptive statistics of designed trees factors and students majors

Variables	
	Mean (Std. err)
Amount	0.42 (0.27)
	Frequency %
Big	57.14
Medium	21.43
Small	21.43
Far away	52.86
Neatness	64.29
Round	35.71
Conoid	28.57
Columnar	35.72
Forestry	30
Wildlife Science	22
Agricultural economics	17
Horticulture	16
Social Science	15

There are different ways to display the scenes to participants. Some visual preference studies use ordinal ranking method and forced choice between scenes in paired comparisons. However, ranking is not often used because the common medium alternative precludes side-by-side comparisons of more than a few scenes. Similarly, although paired comparisons are more commonly used and considered more reliable than rating methods, a large number of comparisons might be required when there are many pictures. Therefore, a rating/scaling method is used in this study, and the study design also emphasizes the comparisons among different landscape designs. Instead of paired comparison, 6-scenes are displayed in a slide. Three of them are replaced in the next slide. Such a procedure allowed us to provide various combinations of scenes. In total, 10 slides are developed based on different combinations of the 14 housing landscape scenes.

Students take the survey in a classroom equipped with a projection machine and Office PowerPoint 2007. Prior to starting, instructions are given based on a slide of example pictures. Each slide is shown for a limited time, and then it is replaced by a new slide automatically. A short beeping sound is set up to remind the switch of slides. After some pretest, timing is set up based on the following rules: the first 5 slides for individual homes are shown for 30 seconds, and the other 5 slides are shown for 25 seconds each. The time is shortened based on the experience that individuals get familiar with the designs after the first 5 slides. Students have enough time to make a choice. The speed is increased as people became more comfortable with the procedure and scenes. Students are asked to assign a rating to each scene using a Likert scale from 1 to 5 (**1** = least preferred; **5**= most preferred).

Participants take the questionnaire after they finished the visual survey. The questionnaire was designed to elicit information on the size, species, number of trees, and the level of open space and wilderness/nature. The viewers are asked to rate the importance of some characteristics of trees (e.g., seasonal color, shape of trees and growing rate). Socio-demographic information including respondent's education level and family background are also collected.

Besides the university students with different majors, local community residents are also surveyed. Residents' survey is conducted in a rest area close to Montgomery on Interstate 85S. Considering the restriction of outdoor environment, a poster of 14 landscape designs is used for scene display instead of PowerPoint showing.

Regression Models

Most VPS studies use analysis of variance to test for significant differences across scenes and use multiple regression analysis to explain differences in terms of contributing factors (see

Herzog et al., 1982/1986; Briggs & France, 1980; Nasar, 1981-1982; Anderson & Schroeder, 1983; Schroeder & Anderson, 1984; Ulrich, 1986). Multiple regression analysis enabled us to relate housing landscape ratings to features of the trees and their surroundings. Building on the well-established literature, the empirical model of the preference rating is a function of tree characteristics and personal characteristics.

Housing landscape preference = f (tree characteristics, personal characteristics) (1-1)

Originally the personal background information includes family income, number of brothers/sisters, presence a of child less than 18 years old, race, gender, if the respondent is a member of an environmental group, student's grade and student's academic major. However, the OLS regression results indicated that most of the personal characteristics did not have a statistical significant contribution to the preference rating except for student's grade and student's academic major. Therefore, only grade and major are kept included in the final model.

Four models are estimated in this study. In the first model, Y^1 refers to both students and residents' average rating on the 14 scenes, and X_i includes the tree attributes of amount, shape, size, and location of tree and the cleanness of the environment. In the second model, Y^2 refers to only students' average rating and X_i includes the tree attributes. In the third model, Y^3 still refers to students' average rating, but X_i includes not only tree attributes but also the grade and its interaction with tree attribute (amount, neatness). In the fourth model, Y^4 only refers to the average rating of forestry and wildlife science students. Students with these two majors account for most of our response. Thus, X_i includes tree attributes, major, and interaction between them. The OLS models are as below:

$$Y^j = \alpha + \beta_i X_i + \varepsilon \qquad j=1\ldots4 \tag{1-2}$$

where

Rating (Y)	=	Respondent's Likert score rating to each housing landscape scene (1-5);
Amount	=	By the percentage of the trees canopy in each scene;
Round	=	1 if the shape of tree canopy is round, 0 otherwise; reference category is columnar ;
Conoid	=	1 if the shape of tree canopy is conical, 0 otherwise; reference category is columnar
Big	=	1 if the tree is big, 0 otherwise; reference category is small size;
Medium	=	1 if the tree is medium, 0 otherwise; reference category is small size;
Faraway	=	1 if the location of tree is far away from the house, 0 if the tree is close to house;
Neatness	=	1 if the trees are clean and well-maintained, 0 otherwise;
Senior	=	1 if the student is not a fresh student, 0 if the student is a fresh student;
Forestry	=	1 if student is majoring in forestry, 0 if the student is majoring in wildlife science;
Senior*Amount	=	Interaction term between Senior and Amount;
Senior*Neatness	=	Interaction term between Senior and Neatness;
Forestry*Amount	=	Interaction term between Forestry and Amount;
Forestry*Neatness	=	Interaction term between Forestry and Neatness;
ε	=	the disturbance term;
β_i	=	estimate parameters.

Results

There are 365 respondents from the in-class student survey, 137 respondents from the resident survey and 54 responses from the on-line survey. In total, the sample size is 556. The descriptive statistics are reported in Table 1-2. The average annual household income of the total sample is 64,780 dollars. Most of them have 2-3 children in their family. Thirty percent of the

families have a child less than 18 years old. In the sample, 64% of them were male. Whites account for 87% of the sample. Also, 25% of the responses are a member of an environmental group (See Table 1-2).

Table 1-2 Descriptive statistics of respondents

Variable	Total (N = 556)	Student (N =365)	Resident (N = 191)
Family income $ (Std.dev)	64,780 (29,140)	63,160 (30,420)	67,880 (24,360)
# Siblings	2.71 (1.37)	2.73 (1.37)	2.69 (1.32)
Presence of child < 18 yrs	30.04%	29.04%	31.94%
White	87.20%	87.88%	85.40%
Male	63.67%	72.60%	46.60%
Environment Group	25.54%	23.84%	28.80%

Around 83% students are over 20, and 65% of them are higher than junior level. Students come from different academic disciplines. About 22% of students are majoring in wildlife science, 30% in forestry, 17% in agricultural economics, 16% of them in horticulture, and 15% of students are majoring in social science. (See Table 1-1).

The average ratings of each single housing landscape design for student surveys and resident surveys are reported in Table 1-3. Our results suggested that H3, H13, and H11 are the top 3 favorite residential landscape scenes. H1, H5 and H4 are the least preferred scenes respectively. A t-test is conducted to compare the rating score from students and residents. Results indicate that the ranking of the designs from students and residents are closing, suggesting a similar preference of students and residents toward housing landscapes.

Table 1-3 Mean value of Likert score of landscape designs of students and residents

Variables	Student rating (Std.dev) N=365	Resident rating (Std.dev) N=191	Overall rating (Std.dev) N=556
Single house			
H1	1.89 (1.23)	1.64 (1.02)	1.80 (1.17)
H2	3.29 (1.22)	3.24 (1.26)	3.28 (1.23)
H3	3.84 (0.90)	4.05 (0.93)	3.91 (0.92)
H4	2.33 (0.86)	2.05 (0.84)	2.23 (0.86)
H5	2.25 (1.13)	2.16 (1.14)	2.21 (1.13)
H6	3.25 (0.79)	3.21 (0.92)	3.23 (0.84)
H7	3.19 (0.88)	3.17 (1.09)	3.18 (0.95)
H8	3.33 (0.91)	3.36 (1.11)	3.34 (0.98)
H9	2.51 (1.03)	2.32 (1.08)	2.44 (1.05)
H10	2.58 (0.90)	2.53 (1.13)	2.57 (0.99)
H11	3.57 (0.93)	3.89 (1.05)	3.68 (0.98)
H12	2.34 (1.10)	2.20 (1.20)	2.29 (1.13)
H13	3.62 (1.40)	3.95 (1.33)	3.73 (1.38)
H14	2.89 (0.85)	2.94 (1.18)	2.91 (0.97)
t-value	t = -0.12		
p-value	p = 0.9087		

When the fourteen designs are ordered from higher value to lower value, it has been found that the most popular landscapes usually contain a lot of green trees around the house. Also, in the questionnaire, most of the respondents prefer to live in a house surrounded by many large trees. Most of the respondents do not like a lot of open space, and prefer a landscape with trees close to the home. This preference may ascribe to the concern of exposure of privacy. Trees provide shadows and cover which make privacy protected. Moreover, 300 of the respondents indicate that they like a natural and wild-look landscape while 237 of them prefer a clean and well-maintained one.

However, what people say might not truly reflect what they really think. By using a multiple regression model, we try to reveal the relationship between tree attributes and landscape preferences under the different scenes. Four models are estimated. The first model has 7784 observations from both student and residences' survey, including 556 responses for 14 designs.

The second model and third model had 5110 observations from the student survey, including 365 responses for 14 designs. In the fourth model, only 181 students majoring in forestry and wildlife science were included, that is, 2534 observations in total.

Table 1-4 Tree characteristics regression results

Variables	Model (1) N=7784 Coefficient (Robust Std. err)	Model (2) N=5110 Coefficient (Robust Std. err)	Model (3) N=5110 Coefficient (Robust Std. err)	Model (4) N=2534 Coefficient (Robust Std. err)
Intercept	0.964***	1.139***	1.316***	0.959***
	(0.064)	(0.079)	(0.099)	(0.122)
Amount	0.055***	0.050***	0.046***	0.058***
	(0.003)	(0.003)	(0.003)	(0.005)
$Amount^2$	-0.000343***	-0.000316***	-0.000316***	-0.00033***
	(0.00003)	(0.00003)	(0.00003)	(0.00004)
Round	0.230***	0.191***	0.191***	0.158***
	(0.033)	(0.039)	(0.039)	(0.053)
Conoid	-0.212***	-0.207**	-0.207***	-0.247***
	(0.047)	(0.055)	(0.055)	(0.076)
Big	0.206***	0.219***	0.219***	0.253***
	(0.045)	(0.053)	(0.053)	(0.073)
Medium	0.461***	0.457***	0.457***	0.392***
	(0.053)	(0.063)	(0.063)	(0.086)
Faraway	-0.043	-0.036	-0.036	-0.043
	(0.030)	(0.036)	(0.036)	(0.049)
Neatness	0.397***	0.352***	0.352***	0.302**
	(0.035)	(0.041)	(0.061)	(0.075)
Forestry				-0.029
				(0.109)
Forestry*Amount				-0.003**
				(0.002)
Forestry*Neatness				0.090
				(0.086)
Senior			-0.271***	
			(0.087)	
Senior*Amount			0.007***	
			(0.001)	
Senior*Neatness			0.0002	
			(0.067)	
F-Value	330.92***	194.11***	145.16***	118.14***
Adj-R^2	0. 253	0.232	0.237	0.337

Note: Astricks*** and** denote significance at 5% and 10% levels, respectively.

Ramsey's joint test suggests that a quadratic form of 'Amount' should be included in the model. A White's test and Breusch-Pagan test is performed to check homogeneity. Both tests indicate the presence of heteroskedasticity. Although the OLS estimators are still unbiased and consistent, they become inefficient with heteroskedasticity. More importantly, the standard errors are biased and statistic inferences based on t-test and F test were misleading. Therefore, Robust White estimates are used in the following four models. The regression results are shown in Table 1-4.

The regression results for the first model suggest that the five tree attributes significantly influence the preferences to single house landscapes. The model explains 25% of the rating score variation. The results from the second model with students' data share similar findings. This makes sense because the findings of the t-test in Table 1-3 suggest that the student and local residents have a similar preference toward housing landscape. The adjusted R-square from the third model is 0.2369, which is only 0.0047 higher than the R^2 from the second model. That is to say, tree characteristics explained most of the variation in this model. Personal characteristics are relatively less influential to home landscape preference. From model 1, the amount of trees has a significant quadratic relationship with the preference value. The turning point was 80 percent. It suggests that people prefer landscapes with more trees in general, but that does not necessarily mean the more the better. When the amount of trees is more than 80% in the whole picture, the amount of trees has a negative impact on preference rating.

As for the shape of tree, this study finds that people prefer round trees which are usually accompanied with a large amount of shade. The average rating increased 0.23 compared to those pictures with columnar tree shape. This result adds support to functional and evolutionary theories of landscape preference. Conoid shape is the least preferred style. When considering the

size of trees, medium and large sized trees are preferred. Basically, the pictures with bigger trees get a 0.21 increase in the average rating. Rating for scenes with medium sized trees is 0.46 higher than picture with small trees on average. These results are consistent with respondents' answers in the questionnaire.

The openness of the home landscape has no significant impact on preference rating. This is the same conclusion according to the answer to the question regarding openness. Some respondents indicate that they like more openness for a better view, but they also like some trees in front of the house to get some kind of 'cover'. However, we should avoid placing trees too close to the home, as they can cause damage to the roof and fill gutters with plant debris. Large trees close the house may even be dangerous when tornados come. From an aesthetic perspective, the distance of the tree to the house is very important. Trees can create a variable sense of scale for a house. Large trees planted near a home may make the home appear very small. Trees can screen undesirable views, and help to develop the sense of shelter and security. Therefore, a balance of openness and privacy, the good-looking and safety is more dependent on other factors such as house style, neighborhood structure or local climate. Further studies are needed.

The regression results also suggest that in general, people significantly prefer a neat environment. The pictures which are messy and wild-looking received a 0.39 lower rating on average. This finding conflicts with respondents' selections in the questionnaire in which 300 of the respondents indicated that they like a natural and wild-look landscape. This confliction might reflect an inconsistence between individual's speech and behavior. A messy environment may be better from an ecological perspective. It provides habitat for animals. But a messy environment might not be comfortable for human beings. For example, bushes attract snakes or bugs. On the

one hand, people are willing to express their concern about the natural environment. For example, an environmentally friendly home might be a symbol of a good citizen. On the other hand, people are not willing to sacrifice their convenience. It is a critical issue to balance the ecological environmental health and the visual amenities.

The differences between senior students and first year students are addressed compared in model 3. Finding indicates that the overall ratings from senior students are 0.27 lower on average than the rating from freshman. So there is a bias between senior and first year students in the overall rating. Usually senior students are more critical of the man-made changes in the landscapes which they observed. Also, senior students prefer the landscape with more trees and a cleaner environment compared to first year students.

In model 4, we compare the difference in ratings between forestry students and wildlife science students. While other tree attributes still have similar effects as that on model 1, the interaction term of forestry major and tree amount has a significant positive effect on single house landscape preferences at a 0.05 significance level. The result suggests that forestry students are more inclined to give a lower score (-0.003) to the pictures with more trees compared with students majoring in wildlife science. Thus, even though people prefer residential landscapes with more trees, the preferences might be different within different majors.

Conclusions and Discussions

Urban forest plays a special role in building a livable community for America's new suburbs, which should not only be environmentally friendly, but esthetically as well as cultural and socially appealing. Findings of this study indicate that greening is important in residential landscapes. People prefer to live in houses with more trees in general. Large trees with a wide round canopy are usually favored. This finding supports the savanna landscape assumption in

some previous studies (Summit & Sommer, 1999; Sommer & Summit, 1996). Findings also suggest that people are more inclined to rate the clean and neat environment higher although most of them claim that they love nature and wild-look residential landscape.

Another finding is that most people have similar preferences regarding a residential landscape's aesthetics. There is no difference in preferences to residential landscapes between students and the general public. College students are future buyers. Studies of students' perceptions provide useful information in the planning of future housing developments. Compared with forestry students, students majoring in wildlife science prefer the landscapes with more trees. The educational background shed some light on what shapes individual preferences.

Trees are among the most appreciated plants around the home. Lack of adequate information has led to the use of trees that are poorly suited to Southern landscapes, resulting in poor performance and high maintenance, or high removal costs (Williams et al., 1993). Builders of new homes often go to great lengths to maintain landscape trees. It usually takes a minimum of ten years to grow a tree to useful landscape size. So it is wise to take advantage of existing trees by maintaining them in a state of good health. These old trees have heritage value and should be preserved before landscape construction.

Trees are constantly competing for space in the city. When landscape planners try to integrate new places into established communities, using trees as design elements can help gain public acceptance of the new place. Thus, in areas that are already developed, important questions include how to identify the space available for trees and choose the best trees to fit the site. Our findings provide valuable information to city, community policy makers and planners, developers, non-profit organizations, the general public and academic researchers to enhance

their ability for appropriate tree selection and management in the establishment phase of future urban forests.

More studies need to investigate how the preferences to specific landscapes have been developed as well. Goodchild (2006) defines landscape as a concept, a real or imaginary environment in which the land, natural and semi-natural elements are prominent. However, residential landscape is not only a physical part of an environment; it is also the results of interaction between human and nature. Apparently, amenity value is subjective, but most functional benefits of trees are objective. Are they linked together? More investigation could be interesting.

Chapter 2 Preference to Home Landscape: Wildness or Neatness?

Introduction

Landscape, which includes topography, vegetation and associated plants and soil, water bodies, and their spatial configuration, is one of the most visual needs by people. Human-nature interaction leads human beings to have contrasting preference on the surrounding landscape and environment because a pleasing landscape can bring mental and physical benefits to people (e.g., Kaplan et al., 1998; Kaplan & Kaplan, 1989; Ode & Fry, 2002). Consequently, a landscape is constantly modified due to people's preference (Schroeder, 1988; Luzar & Diagne, 1999; Erickson et al., 2002), causing further complex feedbacks with policy making and planning processes (Kaiser et al., 1999). Clearly, understanding people preference for their surrounding landscapes and how the preferences shaped the environment is not only an academic challenge but also critical for policy making and implementation. For example, knowledge of the preferred landscape would enable planners and developers to construct more appealing neighborhoods while enhancing ecological services.

Scientific investigation of the preference to landscape is challenging due to the complexity of land mosaics, its design and change over time. There are many attributes (e.g., vegetation and associated plants, spatial configuration of landscape elements, the topography, bodies of water, etc.) that determine the quality of a visual landscape. Additionally, the role of each attribute is dependent of the context (i.e., matrix) and its interaction with the other attributes (Lindenmayer & Franklin, 2002; Chen et al., 2006). Another challenge arises from

heterogeneous and dynamics nature of people's preferences for the landscape (i.e., preference is temporally, spatially and personally specific), suggesting that cultural background needs to be included in sound analysis of people-landscape interactions (Nassauer, 1995). In urban landscapes, for example, landscape architectures often struggle with the balance between wildness and neatness in designing a neighborhood in the context of broader urban landscape. In general, neatness seems more appealing, but often has lowered ecological services (Gobster et al., 2007; Martin, 2001; McPherson et al., 1989). This suggests that pleasing alone might not be a good design from an ecological perspective (Gobster et al., 2007). Incorporating urban forestry and greenness into the planning, designing and implementing of public policy pertaining to suburbs (or edge cities) is increasingly challenged to promote not only aesthetically appealing but also ecologically sound communities.

Investigation of people's preference on landscape has been broadly conducted in recent years (Wessels, 1997; Carlson, 1999, 2006), including studies of individual preference. Individuals' tastes on environmental appreciation are often shown to be linked to a person's training, their previous experiences and personal characteristics such as age, emotion, social status and education (Silvennoinen et al., 2002; Brunson & Reiter, 1996; Lindhagen, 1996; Buttel, 1987; Ma & Bateson, 1999; Van den Berg & Koole, 2006). More than two decades ago, Dearden (1984) found that familiarity with general landscape types appeared to have a positive correlation with landscape preferences, but none of the socioeconomic variables - gender, age, income, education and occupation - were significant. Rauwald and Moore (2002) reported that country and gender differences existed in environmental attitudes, while Brody et al. (2004) further indicated that environmental perceptions differed by location because of the information gaps between any two sites. From people's preference perspective, Abello and Bernald (1986)

found that certain aspects of personality had significant correlation with landscape preference. Recently, Nassauer et al. (2009) concluded that cultural norms for landscape appearance may affect preferences for and adoption of ecological design of residential landscape.

Education has been shown to be the most consistent predictor for environmental concern (Wall, 1995). Much of the work indicates that individuals with high levels of education tend to care more about the environment (Ewert & Baker, 2001). Most of the differences in perception with various academic disciplines are also ascribed to the "lack of information." Each academic major is corresponding to some specific "knowledge" and this "knowledge" may act as a mediating variable (Baron & Kenny, 1986) in the preference-shaping process, suggesting that schooling in different majors may serve as a mechanism to "transmit" the beliefs or attitudes of that cultural domain. Assessment of the effect of academic disciplines can be found in a wide array of literature. For example, Smith (1995) found that students majoring in business or economics were less likely to take action to protect the environment. Brown and Harris (1998) also found that professional foresters had a different environmental concept from their colleagues in ecology, wildlife, fishery, geology or recreation. Finally, it seems that different educational backgrounds refer to not only the type of education but also the level of education.

One of important features of landscape in the context the residential landscape is wildness versus neatness. Previous studies support a general conclusion that people in general prefer a neat environment. Nassauer (1988) claimed that neatness is one of the most important factors for an attractive landscape although trimmed bushes are not usually good for biological diversity (Nassauer, 1995). An over-emphasis of the "garden" aspect of the garden city has resulted in the excessive planting of trees (Tuan, 1990). Perfect green lawns may not be ecologically healthy (Steinberg, 2006). Additionally, it is argued that people have different

perceptions about wilderness: “One man’s wilderness may be another’s roadside picnic ground.” (Nash, 2001). Clearly, the bias in preference of our surrounding world might be ascribed to many factors. While the ability to know the world is limited by our knowledge and experience, public preferences are deeply embedded in class position and the relative economic, cultural and social capital (Bourdieu, 1984; Fraser & Kenney, 2000; Grusky & Wheedon, 2001).

To resolve the conflict needs for aesthetically-appealing and ecological services, we studied people’s preferences to natural/wild mosaics and the clean and well-maintained landscapes using both approaches. To explore the potential influential factors, hypothetical landscapes with different green space, designs and policy were generated using multinominal logit models based on our preference survey. We hypothesized that individuals with different educational background and level have different preferences to their housing landscapes.

Methods

Preference Survey

Two approaches are broadly used to investigate individual preference. Surveys using a questionnaire are the conventional method (e.g., Getz et al., 1982; Zhang et al., 2007). The visualization method has also been widely applied to landscape design and investigations of attributes influencing people’s landscape preferences. For example, Tyrväinen et al. (2006) used computer-based visualization and landscape laboratory methods to help the public better perceive the surrounding environment. Ode et al. (2008) established links between landscape aesthetic theory and visual indicators. A computer-generated visualization survey was further conducted and the perceived indicators of naturalness were found to be the more important drivers of preference than demographic factors (Ode et al., 2009). The two methods have their

own weaknesses and strengths. Using verbal questions may not effectively illustrate the real landscape preference, while using a visual survey might lead to misinterpretation of the information of the visual appearance.

In this study, the primary data was obtained from both visual and verbal preference surveys, which include preference rating on visually designed landscapes (i.e., pictures) and providing verbal answers regarding their preference to the landscapes and their socio-demographic characteristics. We created fourteen designs for single-housed landscapes. The photographic materials used for the designs were taken from Alabama and Georgia, indicating that the house style and surrounding environment in these designs are reprehensive of the residential landscape common to the Southern U.S. We modified the picture with Adobe Photoshop 7.0 software to obtain a consistent house style, sky, front lawn and pathway. The landscape designs were shown slide by slide using Powerpoint 2007 in a time controlled manor (30 seconds/slide). For comparison purposes, six designs were presented in the same slide at one time. Three designs in the previous slide were replaced by three new designs in the following slide, creating various combinations of scenes. Altogether, we had ten slides, ensuring that each design was compared with other at least four times. The survey was conducted in various classrooms where students were asked to rate the different landscape designs according to a Likert scale from 1-5 (1 = least preferred; 5= most preferred).

Four out of the fourteen designs were selected to present the variety of tree presence, with a particular focus on cleanliness of the environment and, such as wild vs. natural-looking landscape (Figure 2-1). H1 demonstrated no tree, H2 for a clean, neat and well-maintained landscape; H3 for a natural, ecological, wild-looking; and H4 for a messy, wild-looking landscape. The four landscapes were assumed to be independent in our analysis. Based on the

average rating of these four designs, we ranked them to create a variable (Y^1) to identify the most favorable design. For example, if the first design received the highest average rating, Y^1 was given a value of 1. If the third design received the highest average rating, Y^1 was given a value of to 3.

Respondents were also asked to answer verbal questions to elicit information on people's preference to tree size, species, amount and the level of open space, and wildness/nature. Additionally, participants were asked to rate the importance of some characteristics of trees such as seasonal color, shape, and growth. Each individual's demographic information was also collected to examine the variation due to people's background. The following question was asked:

In your opinion, which is the most important factor in the following kinds of urban trees and landscaping?

1) To increase tree canopy by planting more trees.
2) To keep trees pruned and well-maintained.
3) To plant flowering shrubs, perennials and annuals using more artificial landscape.
4) To keep a more natural and wild-looking landscape.

The dependent variable Y^2 is equal to the most favored alternatives, coding from 1 to 4. For example, if the fourth alternative was chosen, Y^2 was set as 4.

The Models

Two multinomial logit models were separately applied to the four landscape designs (Y^1) and the four verbally stated alternatives (Y^2). The multinomial probit model is not often used due primarily to the practical difficulties in estimating model coefficients (Park, 2005). Both Y^1 and

Y^2 are functions of the characteristics of the individual making the choice. Our purpose was to compare the relative importance among the landscape characteristics (i.e., natural/wild and cleanness). Because the four categories are unordered, multinomial logistic regression was used to answer the central question: "What is a person's preference as compared to the other three alternatives?" In the multinomial logit model, one of the four alternatives was chosen as the reference. The probability of membership in other categories was compared to the probability of membership in the reference category. Our multinomial logit model (Greene, 1993) was:

$$\Pr(Y_i^j = m) = \frac{\exp(Z_{mi})}{1 + \sum_{h=2}^{M} \exp(Z_{hi})} \qquad (2\text{-}1)$$

where m refers to the other categories except for the reference category (equal to 1, 2, 3), i is observation (varies from 1,2...n), and j refers to the two separate multinomial logit models for landscape design and four alternatives in the questionnaire respectively (set as 1, 2). For the reference category,

$$\Pr(Y_i^j = 4) = \frac{1}{1 + \sum_{h=2}^{M} \exp(Z_{hi})} \qquad (2\text{-}2)$$

where Y^j represents the dependent variables in the two models,Y^1 is the corresponding favorite choice of the four landscape designs with the fourth design (coded as 4) set as the reference category. Y^2 is the corresponding favorite selection of the four alternatives and the fourth choice (i.e., to keep a more naturalized landscape) is designated as the reference (coded as 4). The independent variables X_{ik} represent respondents' personal characteristics and family background, such as age, major, grade, race, gender, family income, city of residence, parents' education and if they were a member of an environmental group. The terms β_{mk} are the empirical coefficients to be estimated for the respective variables.

In estimating each model, the coefficients of the reference group are normalized to zero (Maddala, 1990; Greene, 1993). This is because the probabilities for all the choices must sum up to unity (Greene, 1993). Consequently, only three distinct sets of parameters can be identified and estimated for the four choices.

The natural logarithms of the odd ratio of equations (1) and (2) give the estimation as:

$$\mathrm{Ln}\frac{\mathrm{P}(\mathrm{Y}_{\mathrm{i}}^{\mathrm{j}}=m)}{\mathrm{P}(\mathrm{Y}_{\mathrm{i}}^{\mathrm{j}}=4)}=\alpha_m+\sum_{k=1}^{K}\beta_{mk}X_{ik}=Z_{mi} \qquad (2\text{-}3)$$

This denotes the relative probability of each of group 1, 2 and 3 to the probability of the reference group. The estimated coefficients for each choice therefore reflect the effects of "X_i"s on the likelihood of the respondents choosing that alternative relative to the reference group.

SAS 9.1.3 was used to estimate the multinomial logit model. The marginal effects were estimated by differentiating equations (1) and (2) (Green, 1993):

$$\frac{dP_{ih}}{dX_{imk}}=b_k P_{ih}(1-P_{ih}) \qquad (2\text{-}4)$$

Results

Data Description

A total of 360 students of University in Alabama from different departments participated in the survey (Table 2-1). Five of them did not complete the survey because of their early departure. Prior to our analysis, the observations with missing values were deleted, reducing the final sample size to 333. Students were grouped into four programs: wildlife science, forestry, horticulture (including landscape design, building science, recreation management and architecture), and social science (including history, agriculture economics, psychology,

education). Among the students, 84% were older than 20 and 66% were third- and fourth-year students. Twenty-three percent of the students were members of environmental groups.

Table 2-1 Descriptive statistics of choice alternatives and demographic characteristics

Variable	Frequency (%) N=333
Y^1 =1	46(13.81%)
Y^1=2	49 (14.71%)
Y^1=3	196 (58.86%)
Y^1=4	42 (12.61%)
Y^2 =1	77(23.12%)
Y^2=2	71 (21.32%)
Y^2=3	61 (18.32%)
Y^2=4	124 (37.24%)
Major	
Wildlife Science (base)	72 (21.62%)
Forestry	98 (29.43%)
Horticulture	54 (16.22%)
Social Science	109 (32.74%)
Age (<20 years old)	54 (16%)
Family income (in thousand dollars)*	64.05 (30.27)
3rd & 4th yr student	219 (66%)
Male	246 (74%)
White	299 (90%)
City of Residence	
Rural Area (base) (population <2000)	95 (28.52%)
Small City (2000-50,000)	150 (45.05%)
Large City (> 50,000) (base)	88 (26.43%)
Environment Group Member	76 (23%)
Parents' education	
<=High School (base)	33 (9.91%)
College/Bachelor's degree	190 (57.06%)
Graduate degree	110 (33.03%)

Note: * in mean and standard deviation

In the 2008 U.S. Census, whites accounted for 71% of Alabama's population with 48% as male. In this study, the sampled population was 90% white and 74% male. Approximately half of the students were from small cities with populations ranging from 2,000 to 50,000. The family background information indicated that the students were from relatively wealthy families with an average income of $64,050 (the median household income is $42,586 in Alabama). Most of the students' parents had a college degree.

Landscape design H1
Figure 2-1a Mean value=1.84
Std.dev=1.20 (N=333)

Landscape design H2
Figure 2-1b Mean value=3.19
Std.dev=0.86 (N=333)

Landscape design H3
Figure 2-1c Mean value=3.65
Std.dev=1.40 (N=333)

Landscape design H4
Figure 2-1d Mean value=3.33
Std.dev=1.20 (N=333)

Figure 2-1 Landscape design a, b, c, d

H1 contained no tree and received low mean score of 1.84. H2 was well-maintained and neat compared to H4, receiving a mean score of 3.19. H4 presented wildness, with 80% of the picture being covered by trees, or houses hidden behind large trees although they looked messy because of the defoliation, straggly stems, bushes and dead wood. Nevertheless, H4 received the second highest mean score of 3.33.

H3 received the highest score among the four designs. In H3, more than 80% of the slide was covered by trees. The use of white stone edging seemed appealing, likely because the landscape was maintained. While both H3 and H4 had the understory dominated by shrubs and small trees, the white stone fence in H3 served as a good "cue to care" for the students. It seems supported by the argument made by Nassauer (1988, 1995) that perceived care of the landscape is a primary determinant of landscape attractiveness and "cues to care" can improve the appearance of some "messy" landscapes.

Multinomial Logit Model: Landscape Design

Our modeling based on the multinomial logit regression showed significant influence of landscape design ($p=0.05$, Likelihood Ratio = 52.80), with Y^1 as the respondents' choices for the four landscape designs (Table 2-2). H4 was selected as the referenced category. Among the four majors in this study, wildlife science was chosen to be the base category. For the model output, a positive significant coefficient on a variable for a particular equation indicates that the variable is associated with a higher probability of being in the group choice relative to the reference group. Preference differences were found in the students with different academic backgrounds. Horticulture students preferred H3 more than H4. H3 had good edging (i.e., an indication of some maintaining by the owners) and fit the training of horticulture students. Students majoring

in social science preferred the well-maintained and clean designs in H1 and H2. Students majoring in social science appeared to believe clean residential areas were good enough for human beings. Residential landscape is the closest environment surrounding us and it should "work" for humans. A wild, forested look may represent danger and appear uncivilized.

Table 2-2 Maximum likelihood estimation results of multinomial logit regression for four landscape designs

	Multinomial Logit Model N=333		
	1	2	3
Parameter (std.error)	$\text{Ln}\frac{P(Y_i^1=1)}{P(Y_i^1=4)}$	$\text{Ln}\frac{P(Y_i^1=2)}{P(Y_i^1=4)}$	$\text{Ln}\frac{P(Y_i^1=3)}{P(Y_i^1=4)}$
Intercept	0.7829	2.2202	1.2072
	(1.8208)	(1.7293)	(1.4223)
Log(income)	-0.2598**	-0.6368	-0.1185
	(0.4097)	(0.3803)	(0.3091)
Forestry	0.7156	0.6600	0.7710
	(0.7246)	(0.5803)	(0.4915)
Horticulture	1.0389	1.1065	1.0910*
	(0.8428)	(0.7421)	(0.5948)
Social Science	1.8382***	1.3189**	0.9670*
	(0.7007)	(0.6526)	(0.5273)
3rd & 4th yr student	-0.1957	-0.5423	0.0211
	(0.5433)	(0.5167)	(0.4299)
Environmental Group	-0.1561	-1.6153	0.0561
	(0.5800)	(0.5903)	(0.4268)
Male	-0.4283	-0.1991	-0.2803
	(0.5495)	(0.5508)	(0.4515)
AgeLe20	1.2452	0.3042	0.9397
	(0.7732)	(0.8336)	(0.6818)
White	-0.9010	0.2940	0.1989
	(0.7693)	(0.8643)	(0.7007)
Bachelor degree	-0.2388	-0.0416	-0.2564
	(0.8137)	(0.7813)	(0.6326)
Graduate degree	0.9472	1.0542	0.3893
	(0.8696)	(0.8385)	(0.6973)
Small City	0.3707	-0.3589	0.2813
	(0.5689)	(0.5285)	(0.4231)
Large City	0.3374	-0.1270	-0.0359
	(0.6243)	(0.5893)	(0.4917)
Likelihood Ratio	52.80**		

Marginal effects of each variable for the four landscape designs existed among students of different majors (Table 2-3). The marginal value interprets the difference in the predicted probabilities, or the effect of one unit change in X on the probability of each design outcome when all other variables are held constant at sample mean values. For example, the probability that students majoring in social science choose design H1 was 0.18 higher than the wildlife science students. The probability of choosing design H3 is 0.06 higher for wildlife science students than the social science students. Again, wildlife science students seemed preferring natural and wild-looking environments where maintained white stone edging was in the picture.

Table 2-3 Marginal effect estimation for four landscape designs

	$Y_i^1=1$ (Design H1)	$Y_i^1=2$ (Design H2)	$Y_i^1=3$ (Design H3)	$Y_i^1=4$ Reference group (Design H4)
Log(income)	-0.0139	-0.0545	0.0258	0.2680
Forestry	0.0180	0.0070	0.0785	0.1220
Horticulture	0.0208	0.0298	0.0850	0.0897
Social Science	0.1790	0.0340	-0.0617	0.0742
3rd & 4th yr student	-0.0176	-0.0539	0.0515	0.2454
Environmental Group	-0.0055	-0.1138	0.0899	0.2548
Male	-0.0315	0.0031	-0.0270	0.2808
AgeLe20	0.0988	-0.0557	0.0791	0.1032
White	-0.1027	0.0404	0.0735	0.2142
Bachelor degree	-0.0131	0.0180	-0.0434	0.2638
Graduate degree	0.0781	0.0929	-0.0738	0.1282
Small City	0.0381	-0.0599	0.0563	0.1910
Large City	0.0596	-0.0217	-0.0306	0.2181

Preference of an individual differed by academic background (Table 2-3). However, family background and personal characteristics appeared no effect on individuals' perceptions regarding the landscape designs. Interestingly, we found that students from families with higher household income did not prefer H1 (i.e., no trees).

Multinomial Logit Model for Alternatives

The multinomial logit model for the four alternative landscapes showed significant at P value of 0.01, with a Likelihood Ratio of 94.18 (Table 2-4). The dependent variable Y^2 represent respondents' choices for the alternatives where "To keep a more naturalized landscape" was set as the referenced category. Among the four student groups, students of wildlife science were chosen as the base category, which was compared to the other three majors.

Log (income) is a significant factor for Y1 ($P<0.05$). The log of the ratio of the two probabilities, $P(Y^2 = 1)/P(Y^2 = 4)$ was 0.7784, suggesting that higher-income families preferred landscapes with more trees and vegetation. This was consistent with the results of the multinomial logit regression in visual landscape design. The marginal effects (Table 2-5) further suggested that, while Log (income) increased by only one unit (i.e., ten thousand dollars) the probability to choose "planting more trees" increased by 0.13; and the probability to choose a natural and wild landscape increased by 0.12.

Although there was no difference between the wildlife science and forestry students, our models indicated significant differences in preference among students of the four majors. It seemed that horticulture students favored significantly more toward well-maintained landscapes than wildlife science students, as the probability to choose a well-maintained landscape for horticulture students (i.e., marginal effect) was 0.19 higher than wildlife science students (Table 2-5). In another word, horticulture students were less likely to choose "keep a more naturalized landscape" and prefer "to keep trees pruned and well-maintained." This result was consistent with the surveys in visual designs. Similarly, students of social science preferred clean and well-maintained landscapes (marginal value = 0.25).

Table 2-4 Maximum likelihood estimation results of multinomial logit regression for four alternatives

	Multinomial Logit Model N=333		
	1	2	3
Parameter (std.error)	$\text{Ln}\frac{P(Y_i^2=1)}{P(Y_i^2=4)}$	$\text{Ln}\frac{P(Y_i^2=2)}{P(Y_i^2=4)}$	$\text{Ln}\frac{P(Y_i^2=3)}{P(Y_i^2=4)}$
Intercept	-2.6844*	-1.5941	-0.2523
	(1.6223)	(1.6458)	(1.6742)
Log(income)	0.7784**	0.4422	0.1211
	(0.3713)	(0.3686)	(0.3756)
Forestry	-0.3475	0.4684	0.8044
	(0.4770)	(0.5803)	(0.5352)
Horticulture	0.0206	1.1763**	0.6612
	(0.5226)	(0.5946)	(0.5688)
Social Science	0.3501	1.3290**	0.0876
	(0.4611)	(0.5530)	(0.5605)
3rd & 4th yr student	0.8650**	0.9478**	0.6287
	(0.4186)	(0.4487)	(0.4364)
Environmental Group	-0.2003	-1.4455***	-1.1763***
	(0.3704)	(0.5003)	(0.4709)
Male	0.7547**	0.8886**	0.0342
	(0.3848)	(0.4309)	(0.4264)
AgeLe20	1.0371**	0.1542	0.0370
	(0.4662)	(0.5617)	(0.5634)
White	-2.0969**	-2.9219***	-1.3223
	(0.8793)	(0.8766)	(0.9729)
Bachelor degree	-0.7051	-0.4125	-0.9651
	(0.5527)	(0.5765)	(0.5580)
Graduate degree	-0.9748	-1.2297*	-1.7116***
	(0.6110)	(0.6666)	(0.6558)
Small City	0.3923	0.7232*	0.7522*
	(0.3867)	(0.4170)	(0.4307)
Large City	0.5755	0.8236*	1.0542**
	(0.4400)	(0.4842)	(0.5043)
Likelihood Ratio	94.18***		

Note: ***significant at 0.01 level, **significant at 0.05 level and *significant at 0.10 level.

Table 2-5 Marginal effect estimation for four alternatives

	$Y_i^2=1$ (Planting more tree)	$Y_i^2=2$ (Well-maintained)	$Y_i^2=3$ (Artificial landscape)	$Y_i^2=4$ Reference group (Nature and wild landscape)
Log(income)	0.1324	0.0007	-0.0661	0.1215
Forestry	-0.1560	0.0448	0.1598	0.1400
Horticulture	-0.1393	0.1993	0.0222	0.1063
Social Science	-0.0735	0.2567	-0.0978	0.1031
3rd & 4th yr student	0.0531	0.0632	0.020	-0.0922
Environmental Group	0.2279	-0.1622	-0.1387	0.2616
Male	0.0769	0.0991	0.0969	-0.1094
AgeLe20	0.2339	-0.0702	-0.0897	0.1145
White	-0.1965	-0.1987	-0.0316	0.6153
Bachelor degree	-0.0590	0.0238	-0.0892	0.3129
Graduate degree	-0.0379	-0.0758	-0.1398	0.4420
Small City	-0.0399	0.0537	0.0628	0.1119
Large City	-0.0388	0.0313	0.1026	0.0935

Seniority of the student (i.e., education level in our hypothesis) was expected to have some influence on students' attitudes because the junior/senior students would have more advanced knowledge than freshman/sophomore students. This hypothesis was accepted as the "third- and fourth-year student" was significant at p= 0.05 for both models (Equations 1 and 2; Table 2-4). Both logs of the ratio were, suggesting that senior students preferred "to keep trees pruned and well-maintained" or "to plant flowering shrubs perennials and annuals, using more artificial landscape". This was further supported by the marginal value of 0.06, which was higher than that of freshman/sophomore students whose marginal value was 0.02.

Participation of environmental group was a significant factor in Equations 2 and 3. More importantly, the sign of the log of ratio was negative, suggesting that these students would be more likely to choose a natural landscape than other students. The probability to choose a natural and wild landscape increased as high as 0.26 for those without an environmental group membership (Table 2-5). However, to increase tree canopy seemed more important for male

students. The odds (ratio of the probability) of choosing “plant more trees” over a naturalized landscape increased by exp (0.7547) = 2.13 in Equation 1. The marginal value for the first alternative was 0.07. Males also liked well-maintained landscape. The odds of the second alternative over the fourth were 0.8886, and the marginal value was 0.09 for the second alternative.

Variable “AgeLe20” was also significant in Equation 1 and had a positive sign, suggesting younger students were more likely to choose a landscape with more trees. The probability to choose more trees increased by 0.23 for students younger than 20. Race was also a significant factor as both logs of the ratio are negative in Equations 1 and 2. Compared with black students, white students preferred the artificial landscape less often. The probability to choose the natural and wild landscape was 0.61 higher for white students than the black students (Table 2-5).

There were significant differences between students from rural and urban settings. Compared to students from a rural area, those from urban area were more inclined to choose “to keep trees pruned and well-maintained,” and “to plant flowering shrubs, perennials and annuals using more artificial landscape”. The magnitude of the log of ratio became larger as the population increases. Finally, there was an increase in the probability to choose alternative 2 and 3 for students from urban areas against students from rural areas (Table 2-5).

Parents’ backgrounds (i.e., education level) were expected to have some influence on students’ preferences. We found that parents’ education was statistically significant in Equations 2 and 3 with the logs of the ratio of parents’ education as negative, suggesting that the students with well education parents were more inclined to choose a natural landscape. For example,

students' parents who had graduate degrees were less likely to choose pruned trees (marginal value = -0.07) and artificial landscape (marginal value =-0.13).

Conclusions and Discussion

This study explored students preference in urban landscapes with wild or clean characteristics surrounding the houses. To some extent, college students' preferences represent the general public's opinion (Zheng, 2009) and political attitudes (Mutz, 1992; Ceci & Kain, 1982; Kaplowitz et al., 1983). In addition, college students are future home buyers and their preferences will influence the landscape design of the future. Therefore, to understand and interpret their preference has profound implications. Our attention was also given to how preference might be affected by educational background, including students in different grades (first- and second-year students / third- and fourth-year students), affiliation with environmental groups, academic major, as well as family backgrounds such as family income, parents' education and place of residence.

Overall, we found that student s preferred more trees and neat landscapes. Neatness, a feature of aesthetic appreciation, appeared also important. For example, a manicured lawn, clipped shrubs and colorful flowers indicate the owner's care for the community. This is consistent with earlier studies that residents prefer natural-looking but managed landscapes (e.g., Ribe, 1989; Axelsson-Lindgren, 1995). Woodlands with logging residues, dead snags and decayed wood were not appreciated by the students.

Students with wildlife science major were more inclined to choose wildness/natural environments surrounding the houses. Our conclusion was further supported by verbal answers of the wildlife science students. In contrast, horticulture students were less likely to choose a

wild landscape. This difference may come from the education through which wildlife science students are more knowledgeable or more appreciating of ecological systems, or more concerned with wildlife. They were probably better-informed about the notion that “messy is good.”

The affiliation with environmental groups and having advanced parents’ education played important roles for student to choose a preferred landscape. Logically, students with a greater knowledge of nature should prefer more ecologically-sustainable landscape (Daniel, 2001). Recent developments in information theory (Bandura, 2001; Watt et al., 1978; Klapper, 1960; Bandura, 1986) also suggest that preferences can be influenced by media and education -- a potential way to change public preference through awareness and ecological education. In our study, we found male students with a higher level of education showed more preference for neatness; and the students from larger cities also favored a clean and artificial landscape.

The results learned from this study suggested that there exists trade-offs between aesthetic values and ecological services. Considering residential landscape as the closest environment around us, the culture and preference over emphasis of the neatness may be sinister. For example, the obsessive quest for the perfect green lawn in the U.S. has caused environmental problems, such as groundwater pollution (Robbins & Birkenholtz, 2003). Moreover, the pursuit of neatness is costly (e.g., time and maintenance fees). It is suggested that Americans spend $40 billion a year on lawn care (Steinberg, 2006). Meanwhile, landscape design and management might be not acceptable if one ignores the social and cultural requirements. To incorporate people’s preferences (e.g., the neatness-look) with ecological function is consequently needed. Nassauer (1997)’s design strategies, i.e. “vivid care” is a plausible choice in this regard. Vivid care draws attention to the human presence in healthy landscapes in order to sustain ecological health over time. These strategies bring aesthetic expectation in a way that benefits landscape

ecology. Given people perceived attractiveness related with neatness (e.g., white stone edging, pathway and horticultural plants), a landscape designer might explore a way to make "wildness" look "neat."

A more proactive way to coordinate aesthetical landscape and ecological landscape is to use education and information to shape people's preferences toward designing ecologically-sound landscape. Werner (1999) proposed five critical factors for improving sustainability: awareness of the problem, knowledge about behavioral solutions and motivations engaged, forces that make the motivation salient, opportunities to engage in the behavior and skill and perceived competence to engage in the behavior correctly based on our study, education is also needed to achieve our long term goal. One challenge is that future educational material should include both beauty and landscape sustainability. An improved understanding of the consequences of residential landscaping behavior should affect our preference. As Nassauer (1997) stated, "appreciation based on knowledge is the only way to avoid aesthetic omissions and deceptions" (p. 89). Clearly, encouraging the public's participation in ecological activities (i.e., education) would increase the participant's ecological knowledge and thus would change their preferences toward management of urban landscapes.

America's growing population is increasingly spreading into the countryside and expanding to the rural-urban interface. City planners, policy makers, academics and the general public are calling for "smart growth" - in which growth is managed and directed in a sustainable way that minimizes damage to the environment and builds livable towns and cities. Understanding of public preferences will help to avoid the influences of misleading preferences and the information should be helpful for the balance of landscape planning and conservation biology (Nassauer, 2006). The information derived from this study would be useful for policy

makers to design health, sustainable landscapes. Regardless of our efforts in visual preference survey with verbal questionnaires, future research are needed to validated our results in other urban setting with controlled design and extend the sampling to a variety of citizens.

Chapter 3 Tree Ordinances as Public Policy and Participation Tools: Development in Alabama

Introduction

As a legal framework, tree ordinances are developed to provide authority, offer guidance to residents, and specify the rights and responsibilities and minimum standards to regulate human relationships regarding trees, and to frame and coordinate individual interests concerning trees. Tree ordinances can help society adapt to economic and societal forces in a meaningful way by promoting proper urban forest management. When utility companies need to remove or trim trees on private lands, what rights do landowners have? When accidents happen, such as damage caused by falling trees, who is responsible? On public land, what are the rights and responsibilities for local government and each citizen concerning trees? Who is the governing authority and management organization for urban forests and what should the budget level be? Tree ordinances are an effective public policy and planning tool to help local governments and policymakers better manage trees to be more productive and safer for people. Development of tree ordinances requires government support, citizen participation and consideration of local circumstances.

This paper first introduces the nature of public goods of urban trees, which theoretically justify the importance of tree ordinances to urban forestry. Then we briefly review the historical background of tree ordinances in the United States to show practical causes leading to the emergence and development of tree ordinances. We further examine the development of tree

ordinances in Alabama based on our collection of tree ordinances. From above examinations, we observe that tree ordinances evolve in response to change in each city in providing a legal framework. Meanwhile, the process of developing tree ordinances is an effective tool to engage public and stakeholders' participation, and an important educational tool to raise public awareness of urban trees and the environment.

Role of Tree Ordinances for Sustaining Public Goods of Urban Trees

Urban forests are economic goods that provide a variety of benefits. Trees in urban landscapes moderate temperature and microclimates, thereby saving energy (Heisler, 1986; McPherson, 1990; Oke, 1989). Urban trees can improve air quality (Nowak and McPherson 1993; Smith 1981), help stabilize soils, reduce erosion, improve groundwater recharge, control rainfall runoff and flooding (Sanders, 1986), provide animal habitat to sustain biodiversity (Johnson, 1988), make neighborhoods aesthetically more appealing and add to the value of property (Schroeder, 1989). Evidence also shows that urban forests may reduce human stress levels (Ulrich, 1984), promote social integration of older adults with their neighbors (Kweon et al., 1998), and provide local residents with opportunities for emotional and spiritual fulfillment that help them cultivate a greater attachment to their residential areas (Chenoweth & Gobster, 1990). The presence of trees and "nearby nature" in human communities generates numerous psychosocial benefits. Hospital patients were observed to recover more quickly and require fewer painkilling medications when they had a view of nature (Ulrich, 1984). Having trees within high density neighborhoods lowers levels of fear, contributes to less violent and aggressive behavior, encourages better neighbor relationships and better coping skills (Kuo,

2003). Office workers with a view of nature are more productive, report fewer illnesses, and have higher job satisfaction (Kaplan, 1993).

Urban forests can also be a potential detriment if not well managed and maintained. All trees, no matter how long-lived, eventually decline and die. Therefore, trees impose some risk during their life cycles. Destruction of property, personal injury and even death can be caused by falling trees. Some trees create potential hazards to the public and risks to the owners (Mortimer & Kane, 2004). During and immediately following catastrophic storm events, urban trees are more prone to disruptive results due to clogged streets and accesses, disrupted utility service, damaged property, loss of city services, increased debris removal, increased recovery costs, and a threat to public safety (Letson, 2001; USDA Forest Service, 2003). In many regions of the U.S. urban trees contribute to the potential of wildfire hazards (Long & Randall, 2004). The risk of wildfire depends on nearby land use, vegetation near homes and building design and materials. The presence of and spatial configuration of various tree species can also be a concern.

Urban trees have positive and negative impacts on neighborhoods and the surrounding community. Positive (negative) impacts affect what both tree owners and other citizens can enjoy (suffer). Trees are also a type of public good that causes a free rider problem where people obtain the benefits without bearing the costs. There are many potential conflicts involving trees and people within the community. These externalities and conflicts usually result in a call for laws and regulations such as tree ordinances as legal provisions adopted by local or community governments.

Since trees in urban settings are part of the landscape and are used for public and private benefit, tree ordinances often are specified in the context of green laws and landscape ordinances. In many states and communities, a tree ordinance is often a component of a

landscape ordinance that has been enacted to (1) establish urban tree management programs, (2) establish new landscape plantings following construction and (3) preserve existing natural amenities, including historic trees, forest lands, wetlands and unique habitats. In the West and South these laws are usually called ordinances with the exception of Florida, where they are referred to as landscape codes. In other parts of the country they are found in sections of zoning ordinances and municipal codes (Abbey, 1999), which are systematically arranged and /or are a comprehensive collection of laws.

Together with other green laws and landscape ordinances, tree ordinances are used as public policies to shape the urban and suburban landscape. Tree ordinances are also a planning tool. Abbey (1998) argued that "laws are now supporting design, and designers are assisting with the establishment of law. Many of such green laws are being written by design professionals." Tree ordinances have been developed to supplement zoning, tree planting, and conservation, especially for new development sites. Tree ordinances are also used to provide a framework for new home builders and public citizens and to delegate responsibility to a public official, such as a director of parks and recreation or a director of public work, for planting and maintaining street trees (Barker, 1975). Tree ordinances have been approved or considered as effective policy tools to promote urban trees in the United States (e.g., Cooper, 1996; Davis, 1993; Galvin & Bleil, 2004; Schroeder et al., 2003).

Tree ordinances are usually initiated in response to community motivations as well as political will. Public attitude and preference are important when developing or amending tree ordinances. Usually, as a community grows and expands, population density will increase and conflicts rise. Tree ordinances were initially written for protection of public trees, but have gradually moved toward greater regulation. In recent years, serious attention has been given to

the importance of municipal liability (Tereshkovich, 1990). Many tree ordinances have emerged due to a specific, local issue where there is a conflict between trees, people, or some other interests. For example, off-street parking and vehicle use area (PVA) landscape requirements were a very common "first-generation-limited-use" type of landscape ordinance in many U.S. cities (Abbey, 1998). Similar to Frischenbruder and Pellegrino (2006) that use eight recent cases studies to generalize the proposal of using greenways to reclaim nature in Brazilian cities, in the following sections we will first demonstrate the development of tree ordinances in the United States, then provide further information using tree ordinances in the state of Alabama as a case study, and finally to generalize how we can use tree ordinances as public policy and participation tool to promote urban forestry.

Tree Ordinances in Many United States Cities

Legislation has been widely used to protect trees and to develop urban forests for a very long time in Europe (Schmied & Pillmann, 2003). In the United States, the earliest tree ordinance was drafted around 1700 by William Penn, in order to set standards for tree planting in some of the early settlements around Philadelphia (Zube, 1971). This law is also considered as the earliest of all recorded landscape ordinances (Abbey, 1999). The Territory of Michigan enacted a law that specified which trees that could be planted on boulevards and squares in the city of Detroit in 1807. In Mississippi, the commission charged with selecting the state's capital city recommended that every other block be filled with native vegetation or be planted with groves of trees in 1821 (Zube, 1971).

During the late 18th century, trees were established in village greens and streets throughout the eastern United States to emulate those found in European cities. By the 1890s

management of public shade trees had clearly become an important part and duty of municipal governance. To address the ambiguous problem between private property and the public right-of-way, “Nail” laws (using nails to distinguish which shade trees were public) were adopted in New England to enable towns to take definite steps to distinguish which shade trees were public: Massachusetts in 1890, Connecticut in 1893, Rhode Island, and New Hampshire in 1901, Vermont in 1904, and Maine in 1919 (Ricard, 2005). Washington D.C. passed a tree ordinance in 1892 to prevent girdling, bricking, wounding, destroying or harming trees in any manner on public or private property or to use them to tie horses. In Maine, the Supreme Court ruled in 1907 that private property such as tress was subject to reasonable regulatory limitations (Durkesen & Richman, 1993).

Even though tree ordinances appeared a century ago, only in recent decades have tree ordinances and related green laws become widely adopted in American cities. In 1976 The National Arbor Day Foundation unveiled its Tree City USA recognition program that requires a tree ordinance as one of its four requirements of designated communities. In 2006 there were 3,213 Tree City USA communities, suggesting that an additional number of municipalities have tree ordinances now. Tree ordinances have primarily been used to protect public trees. As of 1984 only one hundred communities nation-wide with tree protection laws on private land could be identified (Coughlin et al. 1984). A Michigan State University survey of over 1000 communities reported that 13% had tree preservation ordinances and restrictions on cutting trees on private property (Kielbaso, 1989). In a Missouri survey 22% of respondents said they had a “comprehensive tree ordinance” on public property, but only 13% of respondents stated that their communities had a “comprehensive tree ordinance” that defined tree preservation requirements during development (Treiman & Gartner, 2004). Since different surveys employed different

standards and for various purposes, interpretation of results has varied application. However, it is clear that the United States is currently experiencing a revolution in green laws and tree ordinances that began in the mid 1980's and has continued to increase.

The field of urban forestry as well as tree ordinances is developing hand in hand with urbanization. After World War II, America's demographics shifted toward urban with more people living in cities than in rural areas for the first time in history. Along with this urbanization was an increase in the amount of developed acres, built space, and impervious surface. Urban sprawl is viewed as a national problem facing American people. A decreasing supply of environmental services is reflected in deteriorated water and air quality as more green space and trees have been replaced by impervious surface. As discussed earlier, tree ordinances are not just for protecting trees. More importantly they are often used for regulating relationships among people. In many cases legal issues and court decisions call for more specific laws regarding tree matters (Merullo & Valentine, 1992). The current generation of regulations is increasingly strident and sophisticated (Duerksen & Richman, 1993).

Urban forestry and tree ordinances have also evolved along with economic development. By the mid 1970s, as Americans were becoming wealthier, urban areas were becoming increasingly crowded. As urban citizens experienced more stress in their daily lives they began seeking outlets. Dickerson et al. (2001) reported strong community characteristics in educational level, annual per-capita income, average price of home, total population and poverty level to have a strong relationship with municipal tree ordinances. Education about the ecological, psychological, and economic value of trees and the environment has also promoted the demand for urban trees. The growing demand for urban trees from both public and private land, and a

growing number of legal issues engage community motivations and political will to have tree ordinances and to use such as public policy and planning tools for community development.

Case of Alabama: the Development of Tree Ordinances

In this section, we use Alabama as a case to further demonstrate the development of tree ordinances in the United States. Alabama is comparatively a rural state with some representative characteristics for most the Southern States. The development of tree ordinances in Alabama to some degree can reflect many other states in the South.

Urban trees are an important part of Alabama's history, with tree planting being the most common "community forestry" activity. Currently Alabama has more than 200 million urban trees, covering 48% of the urban areas, and 6.3% of the state (Dwyer et al., 2000). Since Alabama has such a favorable climate for tree growth and abundant forest resources, the presence of trees is sometimes taken for granted. Many of the state's urban trees were planted and have received some level of management. As early as 1763 the British planted live oaks along the streets of Mobile. In the early 1800s mulberry trees were planted along the streets of Cahaba, the state's first capital city, and evidence exists of experiments with other tree species as well (Letson, 2002). Compared with other states, Alabama has maintained a relatively rural identity longer than most. Therefore its urban forest was relatively less managed even though Alabama had a much better climate for urban trees and did not suffer from the insect and disease pests that devastated large portions of Northern and Eastern urban forests. Only since the 1960s, as Alabama has become more urban, have city trees become even more important to people.

The Town of Silverhill in Baldwin County, passed the first recorded tree ordinance in 1935, which defined the pruning zone around its street trees. In Mobile County, adjacent to

Baldwin County, the City of Mobile, the 3rd largest city in Alabama, was the second city to have a tree ordinance in Alabama. The original tree ordinance was passed and the state's first Tree Commission was formed in 1961. The Mobile Tree Commission holds the distinction of being the only one enacted by a state legislative act. Authority was given to the city to protect live oaks in specific areas. Subsequently, Mobile's tree ordinance was included in the "Zoning Ordinance of the City of Mobile" that was first adopted in May 1967, and amended in April 1992 and November 2005.

Twenty-nine years after the formation of Mobile Tree Commission, Foley became the second Alabama city to create a tree commission, through a local municipal ordinance. Huntsville, the 4th largest city in Alabama, is also one of the early Alabama cities to have a tree ordinance, adopting its tree management ordinance in August 1981. In the 1980s and 1990s a trend developed, spreading tree boards and ordinances across the state (ACES, 2002). Tree ordinances and green laws became more and more important to local governments interested in managing Alabama urban forests.

Since tree ordinances can be incorporated with other acts, regulations and codes, it is often difficult to determine which cities have tree ordinances. The Tree City USA list from the National Arbor Day Foundation, which requires a city to have a tree ordinance for such recognition, has 81 Alabama cities on the list. However, the reality is that some cities do have tree ordinances that are not on the Tree City USA list.

We conducted a survey to collect and assemble comprehensive information regarding tree ordinances in Alabama 1996, followed by a second survey in 2006 to get more updated information. Both surveys used similar methodology, which was essentially to identify tree ordinances in all cities and towns in Alabama. We simply sent letters to each municipal clerk

and/or mayor requesting information regarding landscape and/or tree ordinances, or city codes regulating trees if they did not have landscape or tree ordinances. Meanwhile, we also searched for tree ordinances on cities' websites. In cases when we did not get a response, we followed up by email, phone calls and sending a second letter. A total of 300 surveys were sent to the most populated cities and towns. Since Alabama is comparatively a rural state, all cities and towns with more than or close to 1000 people were contacted. We received about 130 responses in each of the two surveys: some respondents sent us their tree or landscape ordinances or website addresses while some simply informed us that they did not have an ordinance.

Since there were not really many cities having tree ordinances, we were able to combine the two surveys with the extra information we collected from other sources. We determined that 83 municipalities have some type of tree or landscape ordinance addressing matters related to trees. In about 20 cities the City Code contains at least some regulations specifically dealing with trees, landscape and zoning ordinances, city beatification, etc. Only about 20 cities have self-contained and well-developed tree ordinances and/or landscape regulations (that means the ordinance is independent rather than included in the city code). These include Abbeville, Ashville, Auburn, Decatur, Dothan, Eufaula, Fairhope, Florence, Gulf Shores, Helena, Hoover, Huntsville, Mobile, Moundville, Opelika, Red Bay, Tuscumbia, etc.

After reviewing and examining the tree ordinances we collected in Alabama, we summarized the major components (Table 3-1). From our compilation we found that the top six issues addressed were: (1) having a tree commission (board); (2) tree planting, removal and replacement on public land; (3) public trees protection and care; (4) tree species selection recommended to be planted; (5) dead or deceased tree removal on private property; and (6)

definition of street trees. Except Mobile and Huntsville, all other cities have developed their tree ordinances after 1985.

Table 3-1 Major issues addressed by tree ordinances in Alabama Cities

Issues addressed	# of cities
Amended at least once	13
Having tree commission (board)	73
Tree planting, removal and replacement on public land	70
Public trees protection and care	68
Tree species selection recommended to be planted	57
Dead or deceased tree removal on private property	51
Definition of street trees	34
Nuisance trees	32
Private trees protection	32
Spatial requirement e.g., distance from curb, sidewalk, street corners and fireplugs, distance between trees	31
Penalty for violation	27
Arborists licensed and bonded	20
Tree topping, pruning and corner clearance	19
Tree removal and protection on development sites	12
Tree preservation and planting credit	9
Heritage trees	5
Tree protection close to or under utilities line	1

Data sources: Authors' compilation from surveys conducted in 1996 and 2006.

The data set included 81 cities.

Tree Ordinances as Public Policy and Participation Tools

Almost all Alabama cities regulating trees have city tree commissions (or tree boards) that take responsibilities of initiating and amending the tree ordinances (see Table 3-1). In

Alabama, tree ordinances have most often started following establishment of a city tree commission (board). Tree commissions play an important role in engaging public participation technically and politically. For example, the first tree ordinance in Montgomery (the Capitol of Alabama) was passed in 1984. Montgomery formed a five-member tree commission filled exclusively by city personnel to allow the city to meet one of the Tree City USA standards. In 2001, local citizens formed the Montgomery Tree Committee (MTC). The group's intent was to create an informally structured urban tree advocacy group that would promote a municipal urban forestry program. The MTC wrote a project proposal for the City of Montgomery to develop a comprehensive urban forestry plan. The proposal was approved and awarded US Forest Service funds to implement the plan in 2002. With the committee's efforts the City of Montgomery hired its first urban forester in 2004. In September, 2005, Montgomery passed an ordinance providing minimum landscape requirements for off-street parking. The MTC incorporated as a non-profit membership organization and in 2006 was recognized as a non-profit 501(c)(3) corporation by the Internal Revenue Service. The MTC began working with the City of Montgomery to merge ordinances and tree regulations to create a comprehensive and functional tree ordinance in November, 2007. The revised ordinance gave the urban forester and the municipal government policies, guidelines, and authority needed to manage trees on public property.

Tree ordinance development involves various stakeholders, particularly builders, utilities companies and new home owners. For example, Huntsville, the 4th largest city in Alabama, adopted its tree ordinance in August 1981. Huntsville's tree ordinance primarily addressed right-of-way trees and responsibility for their care, causing some conflicts among the utility companies, the owners of right-of-way trees, and the City. At that time the development of the tree ordinance proved to be a complicated process. According to former City Forester Chuck Weber (1982),

Huntsville passed another landscape ordinance "Zoning Ordinance of the City of Huntsville, Alabama" in 1989 which included Article 71, "Off-Street Parking and Vehicle Use Area (PVA) Landscaping Requirements." The essential purpose of this ordinance was to improve the visual appearance of PVA while preserving trees and other landscape elements so as to protect streams and watercourses from excessive runoff.

In February of 2004, Huntsville's City Council adopted a complete revision of the city's standards for tree work, paying more attention on forest management and education than regulation. Negotiations took place for over two years before the Tree Commission arrived at wording up which all parties could agree. The more challenging issue was related with power-line clearances. Huntsville has a long growing season and tremendous species diversity, but these assets mean either severe line-clearance pruning or frequent re-pruning of fast-growing trees. The compromise that broke the logjam was to increase the clearance distance around distribution lines to 15 feet for nine fast-growing species (hackberry/sugarberry, box elder, silver maple, tree-of-heaven, cottonwood, princess tree, Siberian elm, black cherry, and loblolly pine), while leaving the clearance for other species at 10 feet.

The new tree ordinance in Huntsville reflects compromise and collaboration between utility companies, city government and individuals. While the utility companies had an obligation to provide safe and reliable utility service to its customers, some trees were topped and became unsightly. The city and utility company worked out a solution to totally remove old, poorly trimmed trees and replant them with new ones on private property. The new tree ordinance required utility companies to cut and remove trees at their expense, the city to take responsibility for planting new trees, with private households responsible for tree maintenance.

In the City of Auburn, the tree commission, developers and builders worked together, in an attempt to keep mature trees on private property. For every large tree retained, the developer or builder receives credit for two to three trees. The Auburn landscape ordinance is targeted at developers and is designed to encourage the planting and retention of larger growing, long-lived tree species and to discourage problem species such as “Bradford” pears and crapemyrtles.

Tree ordinances are also an important tool in planning and coordinating within governmental agencies and being consistent with other codes and regulation. For example, Mobile’s Tree ordinances are included in several places such as the Zoning Ordinance of the City of Mobile, Subdivision Regulations for the City of Mobile and The Land Use Administration Section of Urban Development. The Mobile Planning Commission requires a buffer planting strip or a wooden privacy fence of six feet in height.

In Auburn, the City’s tree and green ordinances are mostly defined in the Auburn Landscape Regulations and the Auburn zoning ordinance in 2006. Proposals made by the Auburn Tree Commission go to the City Planning Committee which refines and adapts them prior to referral to the Auburn City Council for approval. The City appointed an urban forester in charge of city trees and provides “Best Practices” to developers and private citizens. In the Auburn Zoning Ordinance, the most related components are land use classification, requirement of open space, buffer-yard, plant materials, and minimum plant size.

Public support is critical for the approval and implementation of tree ordinances. According to a survey report (Zhang et al., 2007), over 85% of the respondents would support their local government developing tree ordinances imposing guidelines on builders and developers regarding trees on new construction sites. The survey indicated that about 75% of the public would support a local tree ordinance imposed on public property, with less support for

tree ordinances to govern trees on private property. The survey results imply that prior to passing a tree ordinance to govern trees on private property; a careful and well planned communication plan must be developed to gain public support. This is not surprising since the "taking issue" of private property rights has been a big concern across the United States. Tree and land ordinances face similar "taking issue" challenges (Durkesen & Richman, 1993). As population increases and development expands, trees on private property must be included in tree ordinances. Cooper (1996) demonstrated a successful example of using tree ordinances to protect and replace trees on private lands.

Final Remarks

Tree ordinances emerge and evolve in response to urban, societal, and economic changes. Just as other laws and regulations target specific issues, tree ordinances are governing policies for urban tree management. In the United States and in Alabama more specifically, regulations on public land are more developed and have received more public support compared with private land management. Tree ordinance are gradually evolving to address emerging issues of growth and conflict. Several cities in Alabama have amended their tree ordinances due to these dynamics. When situations change and new conflicts emerge, tree ordinance need to be amended. For example, it was primarily the conflicts among the utilities companies and owners of right-of-way trees in the City of Huntsville that led to the change of the city tree ordinances. Tree ordinances are specifically designed as public policy and planning tools for individual municipalities and must meet local needs (Miller, 1997). From this aspect, we anticipate the integration of tree ordinances with environmental protection (e.g., riparian buffer) and new developments will become more important.

Unlike many laws and regulations, tree ordinances are more successful when they include public participation and citizen leadership. Financial support from federal, local government and private sources often play a critical role in helping non-government organizations and citizens effectively participate. For example, city tree commissions have usually been established through public involvement taking responsibility to develop and amend tree ordinances in the U.S., and especially in the Alabama. As the same time, developing tree ordinances is a great opportunity to engage public participation, solve local issues through negotiation and compromise, and create policy that works for the community.

More importantly, tree ordinance implementation and compliance is largely dependent on public participation considering many tree ordinances contain regulations that are voluntary, and difficult to monitor and effectively enforce. Citizens should be strongly encouraged to participate in administration of tree ordinances with decision-making authority, or in an advisory role. Nichols (2007) suggested citizen bodies such as tree commissions, vegetation committees, tree review boards, urban forestry advisory boards, environmental commissions and planning commissions must be involved. A wide public participation not only can help to address the issues of the stakeholders of a city, but also to provide an education tool to the public about tree ordinances, with eventual help in implementation.

Chapter 4 How People Assess and Willingness to Support Urban Forestry: an Empirical Study from Citizen Survey

Introduction

Amenities have been driving urban growth and becoming magnets of the cities (Clark et al., 2002). For example, a lot of beautiful cities are chosen as technological innovation centers as they are more capable to attract more talented people nationally and internationally. In any specific city, America's growing population is increasingly spreading into the countryside and the rural-urban interface in search of green areas and associated amenities. Trees and green space play a special role in enhancing livability of communities. Urban and community trees, an important part of a city's green infrastructure, provide valuable services just like other forms of municipal infrastructure. The services provided by trees and green space to communities include energy savings, improved air quality, aesthetics, health benefits, habitats for birds and other wildlife, and recreation opportunities. These values are reflected in higher real estate prices, lower electric bills, and an influx of tourists, as well as talented people and businesses (Bradley, 1995; Dwyer et al., 1992; Orland et al., 1992).

Community involvement is critical for the continued vitality of urban forests (Dwyer et al., 2002). The number of local urban and community tree programs and related activities has been increasing over the past years. Hauer and Johnson (2008) found a significant increase in local urban forestry activity which had increased on average by 2.1% annually from 1997 to

2002 through reported Performance Measures and Accountability System (PMAS) data to the federal Urban & Community forestry program. There are more than 3,400 communities that are currently a Tree City USA. The number of Alabama's towns and cities that are certified in Tree City USA has grown from one in 1979 to more than eighty in the 2000s.

Financial assistance has been suggested as the most effective means to promote urban forestry programs (Wray & Prestemon, 1983; Studer, 2003; Straka et al., 2005). Different kinds of activities in urban and community forestry programs are provided from a variety of funding. The most important activities include tree planting, public awareness and volunteer training. Now, many other activities are also occasionally supported, for example, carbon dioxide emission reduction credits, and shade-tree programs for energy conservation, storm water management, and air pollution mitigation. Financial assistance provides money for activities to increase tree inventories and natural resources, develop management plans, and conduct workshops to train community members.

Individuals and business sectors are also an important source, providing an assured source of income for many nonprofit organizations once a solicitation program is in place. An organization supported by its community will also find it easier to secure funding source and corporate support. Corporate entities provide funding to signal the greenness (Majumdar & Zhang, 2009). Traditionally, individuals make gifts of either money or time. Members are volunteers who provide the man-power necessary for membership drives, fundraising events, and lobbying. Volunteers can serve as a link between a nonprofit and a potential donor, especially a corporate donor. For example, Trees Atlanta, founded in 1985, has been a prime force in addressing Atlanta residents' loss, creating increased green space. Nearly 25 years after its inception, Trees Atlanta has inspired thousands of Atlanta citizens to advocate for better tree

ordinances to protect the city's urban landscape. The activities have been largely supported by thousands of volunteers, as well as private donations (Tree Atlanta: http://www.treesatlanta.org/).

Although volunteers, individual and corporate donors provide much needed assistance, financial support for urban forestry is still short and often inconsistent (Center for Urban Forest Research, 2003). Securing financial resources, as well as developing diverse and adaptable long term fund-raising strategies and funding mechanisms is, thus, very important. Current information about the financial sources for community tree programs is lacking, partly due to the diverse sources (a mix of public funding; cost avoidance, reduction and recovery; trust/private funds) and changing organizations involved (Zhang et al., 2009).

In order to facilitate the development of urban and community forestry programs from a financial perspective, and to formulate a workable strategy, we need to explore, assemble, and share information regarding public attitudes toward urban trees and the public's willingness to support urban forestry programs financially. Public attitudes have a significant influence on many aspects, such as budgeting, public involvement and participation, integration of tree programs into social infrastructure, and community identity (see Austin, 2002; Sommer et al., 1994; Barro et al., 1997). Therefore, it is important to consult the public and better understand their attitudes in developing a diverse and adaptable strategy. Obtaining information regarding public preferences to support urban tree programs is, therefore, important.

While many studies on urban forestry have analyzed public attitudes on the benefits of urban trees (e.g., Dwyer & Miller, 1999; Gorman, 2004; Lohr et al., 2004; McPherson et al., 1999; Thompson et al., 1999; Tyrvainen, 2001), a more critical issue is developing a sustainable and adequate community forestry support program (e.g., Lorenzo et al., 2000). The purpose of this paper is twofold. First, we examine public attitudes to urban trees including both amenities

and negative impacts from trees, from the demand side. Secondly, we explore the public's willingness and preferences to financially support urban forestry programs from a supply side. In the next section, we present the data collection and methodology of analysis, followed by results and conclusions.

Data Collection and Methodology

To know public attitudes toward urban trees and to formulate a financial strategy for urban forest programs acceptable to the public, we conducted a household survey with a mail-in questionnaire (see Appendix). Questions related to the following aspects were asked:

- Perceived importance of urban trees on personal and community property;
- Perceived benefits and negative features of urban trees and forests;
- Attitudes to public funding of urban forests and the variety of sources of funding;
- Participation in urban forestry activities;
- Willingness to donate money or volunteer time to urban tree activities
- Socio-demographic information such as age, education, employment status, income, race, gender and number of children.

The survey was conducted from late 2004 to early 2005. We asked Survey Sampling International (One Post Road, Fairfield, CT 06824 USA) to get 3,500 random home addresses (including phone number, addresses and names) from major cities in Alabama (Greenville, Cullman, Mobile, Fairhope, Dothan, Montgomery, Demopolis, Auburn, Hoover, Birmingham, Huntsville, Florence).

We mailed our questionnaires to the 3,500 participants. We received about 280 completed responses and about 350 bad addresses (due to relocating homes or too old database

used by Survey Sampling International). After 3-4 weeks we mailed our questionnaires again to those who did not respond. We received about 220 completed responses and 50 bad addresses. After one month, we randomly selected 250 addresses who never responded. We enclosed the value of 3.7 dollars of stamps as economic incentive. It did work to some degree, since we received about 80 responses out of the 250. In total, we received 582 responses, of which there were 102 incomplete responses. Overall we received a roughly 20% response rate from the 3,100 valid addresses. The response rate was a little lower than we expected considering this kind of survey.

In the data analysis, some simple statistical methods are used to describe the attitudes and preferences to urban trees and financing strategies. OLS regression and ordered logistic model are further applied to investigate what factors might influence the preferences. For example, we are particularly interested in the amount of monetary value that the respondents consider "should" be donated (e.g., using tax to impose the changes to all households) and "would" be donated (voluntary contribution) as a function of family background, personal characteristics, and their attitude indicators. The difference between public choice (should donate) and individual choice (willingness to donate or would donate) has been investigated for a long time (see, e.g., Arrow, 1951). People have one set of preferences that govern their private choices, and another set that governs social actions and choices (Kelman, 1981; Sagoff, 1988; Sen, 1995). For example, individual choice of grazing under open access institutional arrangement would cause the tragedy of the commons due to free rider problem. However open access would not be chosen if public choice arrangement is made.

The purpose we ask "should donate" versus "would donate" is to see the individual behaviors under current institution of voluntary contribution versus public choice of forced

payment on public support to urban tree program. For example, many people would say they would not donate, but they might support to collect additional property tax to support the urban forest program. For this purpose, a question in the questionnaires was intended to ask the amounts of an average family support urban tree program annually through state sales tax, local property tax, estate tax alcohol, tobacco tax, state income tax, corporate income tax and private donations to know the how much the respondents think is appropriate (or should) to support urban tree programs. The second question to ask the amount the respondent would like to donate their money to support urban tree activities in your area annually.

Following research by others (see, for instance, Yen et al., 1997; Saz-Salazar & Garcia-Menendez, 2001), it is hypothesized that an individual's response to support urban tree programs depends on his/her income, education, race, gender, experience, and residential location. The OLS regression models are presented below:

$$Should\ donate = \beta_0 + \beta_i x_i + \varepsilon \quad (4\text{-}1)$$

$$Would\ donate = \beta_0 + \beta_i x_i + \varepsilon \quad (4\text{-}2)$$

where *should donat*e is the response to the answer of Question 1 and *would donate* is the response to the answer of Question 2. The dependent variable equals the mean value of each choice. For example, choice C is corresponding to $115. The dependent variables x_i represent the socio-economic characteristics, such as "family size", "child < 18 years old", education level, race, gender, age and income. The variable of "awareness of tree service" is defined as the total number of forestry agencies he/she knows, including the USDA Forest Service, the National Arbor Day Foundation, the International Society of Arboriculture, the Alabama Cooperative Extension System, the Alabama Forestry Commission and the Auburn University School of Forestry and Wildlife Sciences.

For specific preferences, such as choosing the presence of trees at their home and communities, as well as special financial channels to support urban forestry, the ordered logistic model is applied instead of ordinary linear regression (OLS). Following the work of Zavoina and McElvey (1975) as discussed by Greene (1993), the ordered logistic model is set up in the following way:

$$y^j = \beta' x + \varepsilon \qquad (4\text{-}3)$$

where y^j is the level of choice to measure the preference to the dependent variables: "Having tree on property" (y^1), "Having tree in community"(y^2), and the support for "Alcohol & tobacco tax" (y^3), respectively. The dependent variables are of three choices: low level of importance (scale = 6 or 7); median level of importance (scale = 3 to 5); high level of importance (scale = 1or 2). x is a vector of explanatory variables, β an unknown parameter vector, and ε is the error term. ε is assumed to have a standard logistic distribution with mean 0 and variance $\pi^{2/3}$.

The marginal effects are nonlinear functions of the parameter estimates and levels of the explanatory variables. Hence, they generally cannot be inferred directly from parameter estimates. Marginal effects for distributions can be derived as follows:

$$\frac{\partial[p(y_i = 0)]}{\partial(x_{ji})} = -\lambda(u_1 - x_i'\beta)\beta_j$$

$$\frac{\partial[p(y_i = 1)]}{\partial(x_{ji})} = -[\lambda(u_2 - x_i'\beta) - \lambda(u_1 - x_i'\beta)]\beta_j$$

……

$$\frac{\partial[p(y_i = J)]}{\partial(x_{ji})} = -\lambda(u_J - x_i'\beta)\beta_j \qquad (4\text{-}4)$$

Based on the equation (4), we can see one variable's marginal effect is related not only to its own coefficient, but also to the values of all other coefficients. Moreover, each observation and each level carry a distinct set of marginal effect values. In practice, marginal effects are

generally calculated using the parameter final point estimates and average variable values. In this study, the marginal effects are calculated separately for every observation at three levels, respectively. The results are then averaged to provide a single, average response estimate for every variable, recognizing cumulative effects across the region. Results obtained in this way anticipate more global changes for the population of points and respect the multivariate distribution of parameter values (Wang & Kockelman, 2009).

Results

Table 4-1 lists the descriptive statistics of the data in our study. Half of our respondents are employed full time and one-third of them are retired. The education level is relatively high: 61% with a bachelor's degree or higher. The average income of respondent household is $66,280 which is relatively high compared to Alabama's average level of $42,000 in 2007. About 85% of them are white and 13% are African-American; about 60% of respondents are male.

Table 4-1 Statistical summary of the participants

Variables	Mean (Std. dev)
Should donate $	48 (50)
Would donate $	34 (36)
Annual income (in $ 1,000)	66 (33)
Age	51 (13)
Family size	2 (1)
# of Children <18 years old	0.49 (0.93)
	Frequency (%) N=476
Employee status	
Employed	60
Retired and unemployed	39
Education level	
<= high school	13
Some college	25
Bachelor's or higher	61
Race	
African-American or others	14
White/Caucasian	85
Male	60

The results indicate that people like trees in general (see Table 4-2). “Improve the appearance of the community” and “Improvement in air quality” are considered the most important benefits of trees by the largest percentage of people. Attitudes toward the negative impacts are quite mixed: the potential cause for property damage is the most concerned factor. More importantly, the magnitude of the beneficial responses is never above 3, yet all of the negative impacts are above 3, suggesting the public’s preference for the benefits of trees outweigh the negative sides or costs of maintaining trees.

Table 4-2 Ranking importance of urban forestry and management (N=470)

	Frequency (%)							Mean(Std.dev)
	1 Very	2 important	3	4	5 ----------→	6 not important	7	
	Urban tree benefits and negative impact							
Benefits								
Appearance of the community	48.73	28.18	14.19	7.42	0.42	0.42	0.42	*1.86 (1.08)*
Improvement in air quality	47.97	22.81	17.70	8.53	1.49	0.85	0.64	*1.98 (1.20)*
Control runoff, soil erosion	44.68	22.77	21.06	8.09	2.13	0.64	0.64	*2.05 (1.20)*
Creation of buffer zones	43.10	24.84	19.32	8.49	2.76	1.06	0.42	*2.08 (1.22)*
Increase in property values	37.00	28.75	20.51	10.15	1.48	0.21	1.90	*2.19 (1.26)*
Reduction of noise levels	40.89	24.58	18.86	7.63	4.87	2.12	1.06	*2.22 (1.38)*
Decrease in energy costs	36.40	28.69	18.63	11.35	2.36	0.86	1.71	*2.24 (1.31)*
Increase in community pride	33.90	27.51	22.39	11.09	2.99	1.28	0.85	*2.29 (1.27)*
Creation of wildlife habitat	41.19	18.05	18.90	13.38	5.73	1.06	1.70	*2.34 (1.46)*
Improvement in health	34.70	25.86	20.47	13.36	2.16	2.16	1.29	*2.34 (1.36)*
Recreational opportunities	24.52	22.17	24.95	19.40	5.33	1.71	1.92	*2.72 (1.41)*
Negative impacts								
Property damage	21.15	13.68	18.38	20.94	11.54	8.97	5.34	3.36 (1.79)
Safety problem	19.57	12.34	17.66	21.49	13.62	9.57	5.74	3.49(1.79)
Costs planting & maint.	12.31	10.83	20.17	25.05	14.23	9.13	8.28	3.79(1.72)
	Importance of applying tree ordinances							
New construction site	50.00	21.70	9.57	10.64	2.34	1.91	3.83	2.15(1.57)
Public property	55.25	21.84	10.49	7.49	2.14	0.43	2.36	1.90(1.34)
Individually-owned yard	17.45	13.19	17.23	18.72	8.30	8.09	17.02	3.80(2.04)
Having tree on property	47.61	23.08	14.55	8.52	3.53	1.04	1.66	2.07 (1.36)
Having tree on community	54.47	25.16	10.60	6.44	2.08	0.42	0.83	1.81 (1.16)

The results indicate that about 80-90% of respondents strongly agree that tree ordinances should be required on public property and new construction sites, but only 30% strongly agree

that tree ordinances should be applied to individual-owned yards. Apparently, households prefer more flexibility to manage their own property.

In the survey, respondents were asked to indicate their attitudes toward “having trees on property” and “having trees in a community.” The results show that about 85% of respondents who are looking for a residence such as a house or apartment indicate that having trees on the property is important, and more than 90% of respondents rate “having trees in the community” as important.

An interesting question is whether the preference is associated with socio-economic and demographic characteristics of the individuals. The ordered logistic model is applied in the investigation. The regression results and the corresponding marginal effects are given in Table 4-3. Ordered logistic regression assumes that the coefficients that describe the relationship between the lowest versus all higher categories of the response variable are the same as those that describe the relationship between the next lowest category and all higher categories. This is called the proportional odds assumption. The test of the proportional odds assumption is not significant, suggesting that the assumption satisfied.

The results suggest that education level is positively associated with the tendency to prefer having trees on a property and within the community. For every one level increase in education (e.g., from high school to some college), we expect a 0.63 increase in the expected log odds of moving to the next higher level of preference to having trees on a property. When the respondent holds a college degree, the probability to choose a high level of importance of having trees on their property is increased by 8.89%. That is to say, people with a high level of educational attainment are more likely to consider having trees on their property as an important

characteristic. Similarly, people with high levels of education also have tendencies to rate having trees within the community as an important characteristic.

Table 4-3 Ordered logistic results and marginal effect for having tree on property & community

Variables	Have tree on property) (Y^1)				Have tree on community (Y^2)			
	Ordered logit	Marginal Effect %			Ordered logit	Marginal Effect %		
		Y^1= low	Y^1= median	Y^1= high		Y^2= low	Y^2= median	Y^2= high
Intercept 1	1.75***				2.01***			
	(0.13)				(0.15)			
Intercept 2	-0.44				-0.37			
	(0.93)				(0.95)			
Benefit of tree	-0.001	0. 03	-0. 01	-0. 02	-0.0004	0. 01	-0. 006	-0. 004
	(0.01)				(0.011)			
Negative impact	-0.04	1.01	-0. 42	-0. 58	-0.07**	1.78	-1.03	-0. 74
	(0.03)				(0.03)			
Awareness of tree service	0.004	-0.10	0.04	0.06	-0.03	0.63	-0.37	-0. 27
	(0.07)				(0.07)			
Family size	0.21	-5.07	2.14	2.93	0.25	-6.06	3.51	2.54
	(0.16)				(0.16)			
Child < 18 yrs	-0.15	3.72	-1.57	-2.15	-0.20	4.72	-2.74	-1.98
	(0.20)				(0.21)			
College	0.63*	-15.39	6.49	8.89	0.70**	-17.00	9.86	7.13
	(0.33)				(0.34)			
Bachelor	0.16	-3.78	1.57	2.18	0.27	-6.55	3.80	2.74
	(0.31)				(0.32)			
White	0.34	-8.26	3.49	4.77	0.43	-10.27	5.96	4.31
	(0.29)				(0.29)			
Male	-0.09	2.10	-0. 89	-1.22	-0.21	5.15	-2.99	-2.16
	(0.21)				(0.21)			
Age	-0.003	-0. 08	0. 03	-0. 04	0.002	-0. 05	0.03	0.02
	(0.008)				(0.008)			
Income (in thousand $)	0.001	-0. 03	0. 01	0. 02	0.001	-0. 04	0.02	0. 02
	(0.003)				(0.003)			
Employed	-0.41*	9.92	-4.18	-5.73	-0.32	7.56	-4.38	-3.17
	(0.23)				(0.23)			
Chi-square	15.22				15.94			
Likelihood Ratio	13.00				14.46			

Note: “Awareness of trees service” is defined as the total number of forestry agency he/she known

In contrast with retired respondents, employed individuals are less likely to consider having trees on their property, holding other variables constant. A one unit increase in the rating of negative impact of trees would reduce the probability to support having trees within the

community by 0.74%, suggesting that respondents who rate highly the negative impact of trees are less likely to support having trees in a community. However, most of the explanatory variables are not significant, such as income, family size, race, age, presence of young child, and gender, suggesting that people in general enjoy trees regardless of their personal characteristics.

In regards to the source of public funding supporting a community's planting and maintenance of trees, the local government is considered by 60% of respondents to be important, while only 50% and 25% for state government and federal government, respectively. "Private donations" is also widely considered being an important source, but using taxes as a financial source is not largely supported with the exception of the "alcohol and tobacco tax" and corporate income tax. The "state sales tax," "local property tax," and "estate tax" each received low support (see Table 4-4).

Table 4-4 The attitudes and preference to finance community trees programs

	Frequency (%)							Mean(Std.dev)
	1 Very	2 important	3	4	5 →	6 not important	7	
State sales tax	7.40	10.76	11.43	18.16	11.21	8.07	32.96	4.71 (2.03)
Local property tax	14.32	14.54	14.99	15.88	8.50	7.38	24.38	4.09 (2.14)
Estate tax	7.34	5.73	8.49	19.04	9.63	10.09	39.68	5.07 (1.98)
Alcohol and tobacco tax	30.46	10.82	11.26	15.67	5.74	4.19	21.85	3.55 (2.30)
State income tax	8.50	9.40	14.77	18.34	9.84	8.28	30.87	4.60 (2.04)
Corporate income tax	23.45	12.83	14.82	15.49	5.53	6.19	21.68	3.72 (2.23)
Private donations	42.64	22.86	13.85	11.87	2.86	1.10	4.84	2.32 (1.61)
Others	38.37	10.47	6.98	9.30	2.33	3.49	29.07	3.35 (2.57)

Since most people indicate that "private donations" is an important source for financing urban tree programs, their willingness to donate became an important question. In the survey, people were asked to rate their willingness to donate money and the willingness to volunteer time to support urban tree activities. We found only 20% of the respondents indicate they are very likely to donate time or money toward a community tree program. This finding suggests that although people notice private donation is important for the establishment of community

trees, they do not have a strong willingness to donate either time or money themselves, simply hoping other people will do that.

Furthermore, when comparing the question of "how much should an average family support urban tree programs annually?" versus "how much would you like to donate annually", we found that, on average, donations for an urban tree program would be $14 less than the money respondents think should be used to support such a program (see Table 4-1). Without specifying the source of funding, most people are inclined to say they like trees in residential areas and strongly support the urban forestry program. However, when they were asked to bear the costs either by all the community members or voluntary manner, the amount of donation is more in question. To investigate what factors affect the amount of donations to urban trees programs, a multiple regression is conducted, and the results are presented in Table 4-5.

Table 4-5 Regression results for donation willingness

Variables	Should donate $ per family	Would donate $ per family
Intercept	22.20 (16.32)	-19.71 (12.04)
Awareness of tree service	1.89 (1.71)	2.29** (1.19)
Family size	0.55 (3.82)	-3.91 (3.00)
Child < 18 yrs	-4.74 (4.99)	-0.50 (3.61)
college	6.10 (8.19)	6.06 (5.97)
Bachelor	9.42 (7.86)	-0.54 (5.73)
white	18.08*** (6.78)	2.07 (4.96)
male	-14.01*** (5.17)	-6.58* (3.76)
age	0.07 (0.21)	-0.01 (0.17)
Income (in thousand $)	0.17** (0.08)	0.27*** (0.06)
Employed	-2.26 (5.76)	5.30 (4.28)
R-square	0.10	0.13
F-value (Chi-square)	2.80	3.52

The results suggest that both models are significant at a 0.01 level. Factors that significantly influence the money that respondents believe **should** be donated to support community trees are race, gender, income. Factors significantly influencing a respondent's

willingness to donate money (or **would** be donated) include gender, income and the awareness of tree service. High income families will donate more for urban tree programs in both "should" and "would" models. However, the magnitude of money is 0.1 dollars higher for "would donate" than "should donate" for each one thousand dollar increase in annual household income. That is to say, an individual's donation decision is more sensitive to their income level. The public's knowledge of tree services significantly influences the amount of donation in the "would donate" model. A better knowing of the forestry service agencies such as USDA forest service will increase the support of public for urban tree program.

Individual characteristics also matter in this case. White respondents, on average, believe that a family should donate $18 more on tree programs than do African-American respondents. Males, on average believe a family should donate $14 less than do female respondents. Family background such as family size, presence of child less than 18 years old, working status, education level and age have no significant influence on the donation amount.

Table 4-6 Ordered logistic results and marginal effect for alcohol & tobacco tax

Variables	Alcohol & tobacco tax (Y^3)			
	Ordered Logistic Estimate	Marginal effect %		
		Y^3=low	Y^3=median	Y^3=high
Intercept 1	0.99*(0.09)			
Intercept 2	-1.31*** (0.92)			
Awareness of tree service	-0.06 (0.06)	1.36	-0.32	-1.04
Family size	0.05(0.16)	-1.13	0.27	0.86
Child < 18 yrs	-0.05 (0.20)	1.09	-0.26	-0.83
College	0.73*** (0.34)	-17.61	4.16	13.44
Bachelor	0.56* (0.33)	-13.58	3.21	10.36
White	0.18 (0.28)	-4.45	1.05	3.40
Male	0.29(0.21)	-7.02	1.66	5.36
Age	0.01 (0.008)	-0.26	0.06	0.20
Income (in thousand $)	0.002(0.003)	-0.05	0.01	0.04
Employed	-0.002 (0.23)	0.06	-0.01	-0.04
Chi-square	31.04			
Likelihood Ratio	14.92			

To explore the level of obtaining financing from the alcohol and tobacco tax, a logistic model is applied. The results of ordered logistic regression are shown in Table 4-6. Our results suggest that education level and being male are positively associated with the tendency to support alcohol and tobacco tax. For every one level increase in education (from high school to some college, from some college to bachelor degree), we expect a 0.5-0.7 increase in the expected log odds as move to the next higher level of support. The probability of having a high level of support increases by 13.44 % and 10.36% for college education and bachelor degree, respectively. That is to say, people with high education prefer the government to add tax to alcohol and tobacco users and the money can be a source of finance for community tree programs. Similarly, males are more inclined to support the finance from alcohol and tobacco tax compared to women based on our findings. Other variables such as race, age, income, working status, family size and children have no significant impact on the support level probability.

Conclusions and Discussions

The findings from this study provide further support for the evidence found in previous studies that humans like trees (e.g., Lohr et al., 2004; Clark et al., 2002; Strata et al., 2005; Zhang et al., 2007). People like to have trees on their property and in the community rather than based on their gender, age, race, income, and family background. The most favored amenity of trees is that trees improve the appearance of the community. Individuals with higher education have a higher tendency to have trees on their property. People with a high concern of the negative impacts of trees, such as the potential damaged caused by trees, would be less likely to prefer trees in their community.

Our further analysis on the characteristics contributing to an individual's willingness to donate money shed light on the policy implications, as people who have more information about urban tree programs and forestry services are more likely to donate money. Managers and planners should take more action to help public access to urban tree program and encourage the public to participate in urban tree activities. Tree agencies also play a role in distributing information and providing technical support. To educate the public on the functions of urban tree programs is an important means of gaining their support, especially for small communities (Thompson & Ahern, 2000). For example, providing public education and more accessible media information can increase public awareness of urban tree programs. Females and whites have a high tendency to donate money to a fundraiser. Family income is a significantly positive influence in the amount of donation. A good economic environment helps in fund raising.

While evidence shows that there is significant demand for urban trees, financial support for urban trees does not match the growing demand. This is not surprising since demand would be high if the cost issue is not addressed. In contrast with many studies that primarily focused on the demand side or the attitudes toward urban trees, this study not only investigate public attitudes to trees but also the preferences to financing urban tree programs. While this study has its limitations in sampling size, response rate, and the questions formulated, the results shed some light on our perception of financing urban trees programs, and provide some results for further investigation. Our survey was targeted to citizens, a further investigation to mayors and city managers would be useful. Another limitation in our study is that the sample could be potentially biased due to the relatively low response rate. Our sample population is from relatively high income, high education level families as compared to the average level in Alabama.

Chapter 5 Managing Urban and Community Forestry: Municipal Officials Perspective

Introduction

Considering the importance of public involvement in order for urban tree programs to bring positive changes in the community (Relf, 1992), many studies have been conducted on the public attitudes and perceptions of urban tree programs (e.g. Summit & McPherson, 1998; Wolf, 2003; Treiman & Gartner, 2005; Zhang et al., 2007; Stevenson et al., 2008). However, local municipal officials play a more important role in initiating and promoting urban forestry as they are directly taking responsibility for the allocation of funding and making policy. Mayors, council members, and public works administrators also play a role in organizing and implementing municipal tree planting and help to regulate the coordination among agencies and groups (Pincetl, 2010; Dwyer et al., 2003). Their perceptions of urban tree programs influence decision making.

Some studies have been conducted to explore the local officials' attitudes toward urban forest programs. For example, Treiman and Gartner (2005) found that most community officials are interested in tree preservation. Green et al. (1998) and Schroeder et al. (2003) conducted surveys in Illinois independently and showed that local municipal officials have strong positive attitudes toward community trees regardless of the community's size. Allen (1995) also reported that municipal employees in Missouri had a positive attitude toward urban forestry regardless of region, population class, metropolitan or rural community, or Tree City USA status. Ricard

(1994) reported that tree activists, chamber of commerce, municipal officials and elected officials shared similar opinion on urban tree and forest management.

Stevenson et al. (2008) collected survey responses from 528 officials in 356 municipalities regarding the developmental status of municipal street tree programs. Three types of officials were asked to complete surveys: elected chief officials, public works administrators, and municipal solicitors. They found that in sustained programs, which had an ordinance, tree commission, inventory, and management plan, officials had more positive attitudes about trees than in developing programs. However, even in the developing programs, half of the officials believed that benefits of street trees outweigh their costs and disadvantages.

Many aspects of municipal official's *attitudes* toward urban trees and management have not been explored in the past studies. For example, how awareness of municipal official to urban tree programs, how they perceive the values of trees contributed to their cities and communities. It has not been investigated whether such awareness would have an impact on how much of the city's budget is allocated toward urban forestry. The objectives of this study are three folded: 1) assessing local officials' perception of urban trees and urban forest management in Alabama, and to determine if there are differences in the attitudes of the three types of officials toward urban tree programs (mayor, council member, administrator); 2) analyzing the influential factors of the budget on urban tree programs; 3) Exploring municipal officials' awareness of the governing and sharing the information regarding to urban tree management.

Data and Methods

This paper uses data from a survey of Alabama Urban Forestry in 2003. This survey reached cities having more than 250 residents. The respondents include municipal clerks,

administrators, and mayors of cities. For cities with more than 1500 residents, the council members are also surveyed. The officials selected in each municipality represent those who could potentially influence the start or improvement of a tree program. The survey contacted 1,862 officials, of which 797 (43%) responded from 336 cities. While only 12 responses are municipal clerks, the number of respondents holding positions of mayor, council member and administrators are 204, 359, and 220 respectively. Among the respondents, 33.12% are from municipalities with a population less than 2000; 23.46% are from a population ranging between 2001 and 5000, 18.32% are from a population ranging between 5,001 and 10, 000, and 25.07% are from a population of over 10,000.

Questions in the survey are related to the following aspects: (a) perceived importance of urban trees to community citizens; (b) levels of problems from urban forests; (c) benefits and disadvantages of urban forests; (e) opportunities offered by the community for its' citizens to be involved (volunteer and donate money) in urban forestry; and (g) awareness of community funding for urban forests and its changes.

The local officials were requested to indicate their awareness of the existence of a tree agencies or programs, which include Tree Board, Tree Commission, City Forester, Municipal tree program, Privately funded tree program, publicly funded tree program, Citizen Advocacy Group, Tree inventory, Street tree ordinance, Landscape ordinance, Tree protection ordinance, Nuisance tree ordinance, Park/public tree ordinance, View ordinance, Urban Forestry Department and Ordinance governing trees on private properties lots of choices. The respondents were also inquired about their familiarity with a service/agency or program of urban trees at the state level. For example, U.S. Department of Agriculture (USDA) Forest Service,

National Arbor Day Foundation, American Forest, International Society of Arboriculture, Alabama Forestry Commission, Tree for Alabama, and Alabama Urban Forestry Association.

To assess the perception and support of local officials to urban forestry development in Alabama, this paper summarizes how municipal officials perceive the role of urban trees, how the funding of urban tree programs is distributed, how local officials are getting and sharing forestry service information, and what information is demanded.

We are particularly interested in what might affect the amount of money the respondent's community spent on the trees in the following four categories: urban tree planting, urban tree maintenance, urban tree debris removal, and urban tree removal. It is hypothesized that the amount of money spent on each tree management category is a function of a city/community's characteristics and the attitude of municipal officials toward trees. The amount of funding cities can provide is highly related to the social economic status, such as household income, poverty rate, race composition, and education level. Also, the municipal officials' attitudes toward urban trees, and their knowledge of urban tree programs cannot be ignored. The OLS regression models are presented below:

$$Log\ (Y_1^j) = \beta_0 + \beta_i x_i + \varepsilon \qquad (5\text{-}1)$$

The explanation of dependent variables Y and independent variables X_i are shown in Table 5-1. The values of X1 to X5 are obtained from U.S census survey data in 2000 through a zip code inquiry. The values of X6 to X11 are constructed from our survey questions. The descriptive statistics are also showed in Table 5-1.

Table 5-1 Description of explanatory variables

Var	Description	Freq / Means (Std) N=797
Y_1^1	Funding spend on urban tree planting ($)	9,437 (10096)
Y_1^2	Funding spend on urban tree maintenance ($)	12,829 (13500)
Y_1^3	Funding spend on urban tree debris removal ($)	17,293 (16371)
Y_1^4	Funding spend on urban tree removal ($)	13,984 (13175)
X1	Population of the city (persons)	14,359 (25652)
X2	The percentage of whites in the city	75.48% (20.10%)
X3	Residents holding high school or higher degree (%)	71.54% (8.10%)
X4	The median of city household income	32552 (8730)
X5	Poverty percentage in the city	13.77% (7.71%)
X6	Number of tree agencies in the city	2.02 (2.69)
X7	Awareness of AL forestry services (counting # known agency/service)	2.68 (1.73)
X8	Appreciation of urban tree in citizens' life (scale from 1-5)	3.64 (0.54)
X9	Plan to plant urban tree for next 5 years (1=Yes; 0 =No)	27.98%

Results

Perceptions

The attitudes and perceptions of officials can be expected to influence their actions toward starting or improving city tree programs. The role of urban forestry is recognized by municipal officials in Alabama (See Table 5-2). A four-point Likert scale measured the importance level of these elements, extending from 4 = very important or 3 = somewhat important to 1= not at all important. The overall average rating for the importance of trees in the community and trees to citizens are 3.88 and 3.64, respectively. A further ANOVA test suggests that there is no significant difference between any of two groups for mayor, council member, and administrator. Thus, in general, the important role of trees for residents and the community is highly recognized by municipal officials.

Table 5-2 Perception of public officials to the role of urban trees and tree management

	Mayor	Council member	Administrator	Overall rating
		Mean (Std. dev)		
		The presence of urban trees		
Trees to community	3.89 (0.36)	3.91 (0.31)	3.83 (0.42)	3.88 (0.36)
Trees to the citizens	3.68 (0.52)	3.63 (0.54)	3.61 (0.53)	3.64 (0.53)
		Tree management practice		
Tree topping**	2.45 (1.00)	2.71 (0.98)	2.51 (0.98)	2.59 (0.99)
Tree pruning	3.53(0.73)	3.60 (0.69)	3.53 (0.76)	3.56 (0.72)
Tree preservation**	3.45 (0.68)	3.50 (0.65)	3.60 (0.59)	3.51 (0.64)
Tree ordinances**	3.07 (0.90)	3.23 (0.87)	3.14 (0.84)	3.16 (0.87)
Choice regulation	1.85 (0.95)	1.94 (0.96)	1.83 (0.88)	1.88 (0.94)
Use of tax for tree program	2.83 (0.94)	2.81 (0.90)	2.73 (0.95)	2.79 (0.92)

The most favored tree benefits recognized by local officials are shown in Table 5-3. In general, the top three favorite benefits are: an increase in community pride (40%-46%), increase in property value (35%-45%) and increase in recreational opportunities (39%-41%). It seems that the three types of officials have a similar preference for the benefits which are most favored. The only differences that appear among the three types of officials are in regard to the ecological benefits and health issues, such as “decrease in soil erosion”, “improvement in water quality”, “creation of buffer zones”. The difference in the perceptions of the benefits trees provide is an indication that knowledge about their tree programs may be incomplete or not fully understood.

Table 5-3 Perceptions to the benefits & problems of urban trees for mayor, council member and administrator

	Mayor N=204	Council Member N=359	Administrator N=220
		Benefits %	
Increase in property values**	45%	45%	35%
Decrease in energy costs	25%	24%	19%
Improvement in air quality	31%	29%	33%
Reduction of noise levels	18%	13%	11%
Decrease in soil erosion**	23%	34%	25%
Improvement in water quality**	26%	24%	32%
Creation of wildlife habitat	28%	34%	35%
Increase in community pride	46%	40%	41%
Reduction in storm water runoff	15%	17%	20%
Increase in recreational opportunities	39%	41%	40%
Improvement in health and well-being**	9%	4%	3%
Positive impact on consumer behavior	15%	16%	11%
Creation of buffer zones**	9%	6%	3%
		Problems and Costs %	
Planting costs**	44%	27%	22%
Pruning costs**	22%	21%	13%
Irrigation costs**	61%	66%	58%
Recycling pruned tree limbs**	24%	29%	32%
Removing hazardous trees	31%	30%	28%
Insect & disease control**	57%	47%	55%
Root damage to sidewalks, curbs & utility lines	7%	9%	8%
Medical costs associated with allergies	7%	10%	7%
Administering a local urban tree program**	14%	25%	30%
Damage to property or personal safety	29%	35%	37%

Regarding the attitudes toward municipal tree management practices, the results in Table 5-2 suggest that tree pruning, tree preservation, and tree ordinance are the most popular services in urban tree management. Considering the cost, local officials choose the top two costs/disadvantages as: irrigation costs (58%-66%), insect & disease control (47%-57%) (See Table 5-3). Three types of officials seem to have different concerns regarding these costs/disadvantages. Mayors pay relatively more attention to the cost of tree maintenance (e.g. planting, pruning) and pay relatively less attention to the cost of administering a local urban tree

program. Contrarily, local administrators are more concerned about administration costs rather than tree maintenance costs.

Supporting Urban Tree Programs

Financial support is the most effective way to promote urban tree and urban forest programs. Planting and maintaining trees in city require input of money and labor (Kielbaso, 1990). Lack of funding is also the most important barrier to starting or improving tree programs (Grado et al., 2006; Stevenson et al., 2008). Regarding the budget on urban forestry, most Alabama cities are spend less than $20,000/year for each category of tree management (Table 5-1). On average, funding for tree debris removal is the most ($17293). The regression results on what might affect the spending are reported in Table 5-4. The log form is used for the dependent variable of amount of funding on each model as well as the independent variables of population (X1) and household income (X4). In this way, the estimates of coefficient represent elasticity. Four models are all significant at a 0.01 level. The R-square ranges from 0.15-0.26.

Population of the city (X1) is statistically significant in four models at a 0.05 level, suggesting population as an important predicator for funding allocation of the city. When population of the city increases by 1%, the funding used for tree planting will increase by 0.74%. The population-funding elasticity is less than 1 for all of the four categories, suggesting an inelastic effect to the amount of funding.

Table 5-4 OLS Regression results of recent year funding in urban tree program

N=610	Planting Y_1^1 Est. (Std.err)	Maintenance Y_1^2 Est. (Std.err)	Debris removal Y_1^3 Est.(Std.err)	Tree removal Y_1^4 Est. (Std.err)
Intercept	-46.51 ***	-25.47	-9.96	-5.57
	(16.89)	(16.52)	(15.43)	(16.12)
X1	0.74***	0.64***	0.66***	0.41**
	(0.19)	(0.19)	(0.18)	(0.18)
X2	0.03*	0.01	0.02	0.03*
	(0.01)	(0.01)	(0.01)	(0.01)
X3	-0.04	-0.02	0.02	0.02
	(0.03)	(0.03)	(0.03)	(0.03)
X4	3.73 **	2.10	0.38	0.12
	(1.64)	(1.61)	(1.51)	(1.57)
X5	-0.21***	-0.11*	-0.13**	-0.12**
	(0.06)	(0.06)	(0.05)	(0.05)
X6	0.39***	0.43***	0.26***	0.32***
	(0.08)	(0.08)	(0.07)	(0.07)
X7	0.21**	0.28***	0.24**	0.26**
	(0.11)	(0.10)	(0.10)	0.11
X8	0.68**	0.43	0.33	0.33
	(0.32)	(0.31)	(0.30)	(0.32)
X9	2.19***	2.04***	0.88**	1.26***
	(0.43)	(0.42)	(0.39)	(0.42)
F-value	19.14	17.00	9.37	9.64
R^2	0.26	0.23	0.15	0.15

The percentage of whites in the city (X2) is significant at a 0.01 statistic level in the first and fourth model. That means the percentage of whites in a city or community has a positive effect on the funding of tree planting and tree removal, although the effect is slight. Every 1% increase in white population will increase the funding by \$1 ($\exp^{0.03}$). X3 is not statistically significant in any of our models, suggesting the percentage of high school graduates in the city has no significant impact on tree program funding allocation.

Income (X4) is significant and positively related to funding for tree planting. The elasticity is 3.74 which imply the income effect is very elastic. Even for Alabama cities usually have a relatively low input in urban trees, we still see a large potential for tree planting plan in

the future for many cities. With a better economic situation, the funding allocated toward tree planting would be increased. Specifically, when household income increases by 1%, the funding for tree planting will increase by 3.73%.

Poverty rate (X5) has significant negative effect on funding for tree programs. A high poverty rate in the city or community will reduce the funding of urban tree programs. So in a relatively poor city, financing for tree planting will mostly be cut in urban tree programs.

The number of tree agencies in cities (X6) and the awareness of Alabama forestry service (X7) both have a positive contribution to tree program financing. The magnitude of the effect of X6 on tree maintenance is the largest compared to the other three categories (0.43). That is to say, the funding for tree maintenance will benefit from the increased awareness of tree agencies. Also, the awareness of forestry services will help tree maintenance by a large amount (0.28). Other urban tree services financing such as debris and tree removal also get benefits from the promotion of tree agencies and services.

Whether a city has plans to plant more trees within the next 5 years (X9) can significantly influence the financing of an urban tree program. Cities with tree planting plans will increase the tree planting funding by exp (2.19); tree maintenance funding by exp (2.04), debris removal funding by exp (0.88), and tree removal funding by exp (1.26). This is reasonable because if the city would plant more trees in the future, the spending on tree planting will definitely be increased. More funding will be needed to manage and maintain the newly planted trees as well. Local officials' preference toward trees is not statistically significant in most of the models. The municipal officials' appreciation of urban trees in citizen's life (X8) is only significantly related to tree planting funding. How much they love trees or consider trees important in citizens' life seems unrelated to the real spending on tree programs.

The opportunity for citizens to support urban trees in either voluntary or donation forms is also a very important part for supporting urban tree programs. The survey results found that almost half of the cities offer opportunities for its citizens to volunteer to plant trees (Figure 5-1). For maintenance of urban trees and removal of debris from dispose of urban trees, the percentages are 39% and 43% respectively. As for the opportunity for citizens to donate money to support urban tree programs, the percentages are relatively low. For planting trees, 43% of the Alabama cities provide ways for their citizens to donate. For maintenance of urban trees and removal of debris from disposal of urban trees, the percentages are only 33% and 28% respectively. Thus, less than half of cities provide their citizens with ways to donate. More efforts can be made.

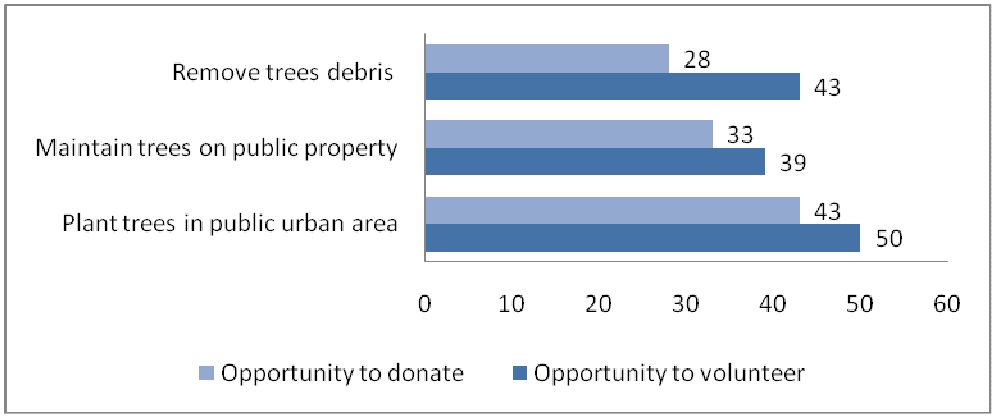

Figure 5-1 Information of citizens' opportunity to serve urban tree

Governing and Information Sharing

Tree governing and serving agencies are important in urban tree management. A high awareness of forest service can help municipal officials better understand the benefits of urban trees and promote community tree programs. Our findings in Figure 5-2 suggest that the most popular tree governing agencies in cities among the municipal officials are "municipal tree program", "tree board", and "citizen advocacy group". Around 24% of the cities have a

municipal tree program. Moreover, findings indicate that the percentage of cities having a privately funded tree program (16%) is higher than publicly funded tree program (10%).

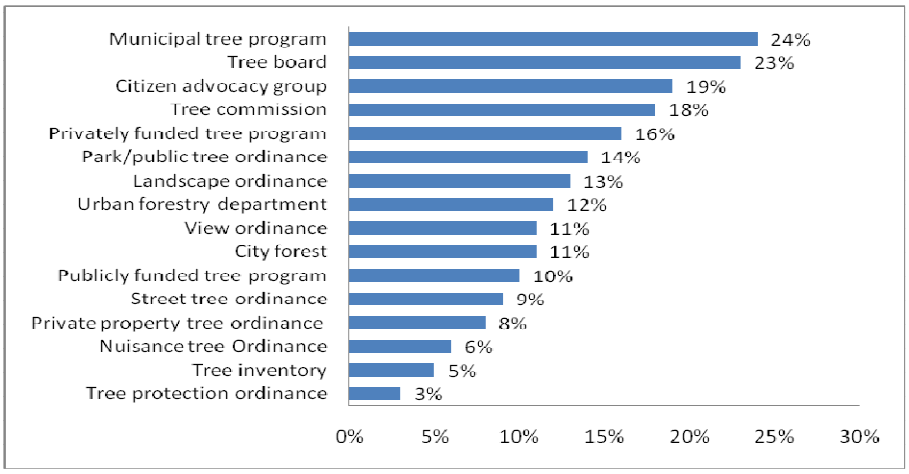

Figure 5-2 Presence of urban tree governing agencies in city

In Table 5-5, the most well know Alabama forest service organization is American Forest (72%-82%). Auburn university school of forestry and wildlife science is also one of the main information sources for local municipal offices. However, other agencies such as Tree for Alabama, International Society of Arboriculture, and Alabama Forestry Commission are also important but receive a low recognition. Comparing the three types of officials, it seems that mayors are better informed about these Alabama forest services, followed by council members. The percentage of local administrators who are familiar with those agencies is the lowest.

Table 5-5 Awareness of Alabama forest service for mayor, council member and administrator

	Mayor N=204	Council Member N=359	Administrator N=220
		Information known	
USDA Forest Service**	**60%**	52%	40%
Tree for Alabama**	10%	6%	5%
American Forest**	**82%**	**72%**	**74%**
International Society of Arboriculture**	13%	8%	5%
Alabama Urban Forestry Association**	34%	24%	25%
A.U Sch. of Forestry and Wildlife Sci.	**73%**	**66%**	**67%**
Alabama Forestry Commission	5%	3%	3%
National Arbor Day Foundation**	27%	32%	17%
		Information want to know	
Urban tree benefits**	42%	43%	30%
Urban forestry costs**	**70%**	**76%**	**65%**
Tree selection	49%	58%	54%
Tree planting	28%	28%	22%
Young tree care	43%	50%	46%
Mature tree care**	41%	40%	32%
Tree pest management**	**69%**	**73%**	**60%**
Volunteer training	48%	50%	45%

A full understanding of urban tree programs can help municipal officials to better manage and allocate the government sources for their citizens. There is a demand for urban tree information by municipal officials, not only about the biophysical maintenance and management, but also the social-economic concerns. The information most desired by local officials is the cost of urban forestry (65%-76%), followed by the tree pest management (60%-73%). Tree selection and volunteer training information is also needed. Municipal officials care more about the economic cost of urban trees and how to better manage and maintain the existing trees. Less concern has been put to tree planting (22%-28%) (See Table 5-5).

Timely news and update information regarding urban trees and urban forestry are very important for municipal officials' decision making, especially the funding availability. Findings in Figure 5-3 suggest that mail is the most favorite way to receive urban forestry information (79%), compared to 49% for e-mail. Paper mail seems more official and reliable for municipal

officials. Internet provides a large amount of information and it is easy accessed. Around 67% of the local officials prefer receiving information via internet. Having classes or seminars offered on topics related to urban tree care is recognized as an effective way to learn knowledge about urban trees (63%). Meeting with forestry professionals directly is also a good choice.

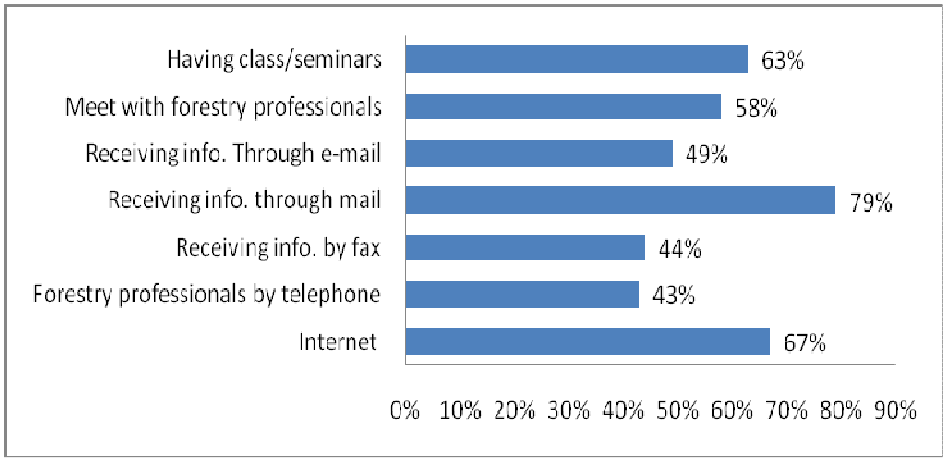

Figure 5-3 Effective ways to provide urban tree information

Conclusions and Discussions

Our findings indicate that the important role of urban forestry has been widely recognized by Alabama local officials. Most local officials consider urban trees in the community to be very important. In contrast, Zhang et al. (2007) found that 77% of citizens consider trees to be important in selecting a residence. So both citizens and local officials like trees in general. However, municipal officials are responsible for allocating funding and managing public trees, so their concerns about trees are different from residents. As for the benefits of trees, it seems that municipal officials pay more attention to the social-economic benefit of trees (such as increased property value and an increase in community pride). Residents in communities usually favor the aesthetical and health value (Thompson et al., 1999; Lewis, 1992), and the residents' awareness of economic benefits was very low (Jim & Chen, 2006). Municipal officials want to

know more information about urban forestry cost, while residents usually want to know more about how to take care of trees in their yard (Zhang et al., 2007).

More importantly, the ecological benefits are considered less significant for municipal officials. The benefit of improvement of health and well-being is least valued. The difference in tree benefit perception among the three types of officials is an indication that knowledge about their tree programs may be incomplete or not fully understood. This incomplete understanding of the benefits of trees and tree care practices may lead to low public support, insufficient funding, and inadequate personnel and equipment. Meanwhile, it seems that local municipal officials do not know the financial situation of their community's urban forest program very well. Our finding indicates that around 20%-30% of the municipal officials did not know how much money was spent in their community urban tree programs. In Stevenson et al.'s (2008) study, they found that only 20% to 42% regard a well-funded tree program to be as important as other municipal responsibilities. Many are unaware of available grants or technical assistance. Thus, more education opportunity should be provided. Officials may be persuaded to start or improve tree programs by explaining benefits more fully and how public safety can be improved by proper pruning, inventories that locate dangerous trees, and management plans that arrange to remove them.

When compared to the importance of planting trees, local municipal officials are more concerned about how to manage and maintain existing trees. More money has been spent on tree maintenance (e.g. tree debris removal) rather than tree planting. In an Illinois community, support for spending municipal funds was strongest for the removal of hazardous trees (Schroeder et al., 2003). Research has shown that adequate funding for tree programs can be achieved where officials perceive that residents are supportive (Robeson, 1984; Elmendorf et al.,

2003). In this study, municipal officials express high appreciations to trees. However, the actual spending on tree programs will be highly influenced by the economic situation facing a community. Our findings indicate that the appreciation of trees has no significant impact on the financing of urban tree programs. The fact that demand for urban trees is high does not mean the local officials will spend more on urban tree programs. The cost of urban trees and their affordability are primary concerns for the municipal officials. Our findings suggest that social economic factors such as percentage of whites, household income level, and poverty rate are significant predictors. To promote urban forest programs, the development state of the local economy is still the critical issue. Efforts should be made to promote development within the local economy, increase household income, and reduce the poverty rate. The positive impacts of economic development on urban trees have been investigated in Zhu and Zhang (1997, 2009).

Furthermore, providing citizens the opportunity to be active in promoting community trees is an important part of management. Funding might also be alleviated by using volunteers, grants, and available technical advice. Voluntary activities and personal donations provide important support for urban tree programs, especially when funding is limited. About half of the cities offer opportunities for their citizens to volunteer to in order to provide support for urban trees in their community, but less than half of cities provide the opportunity for donation. Based on our findings, the percentage of privately funded urban tree programs is higher than publicly funded ones. Individual donation is a very important source to finance urban tree programs. More efforts can be made.

Large cities usually provide more opportunities for citizens to support tree programs. Community involvement in management is prevalent (Stenhouse, 2004). Large cities usually have more tree agencies and accessible forest services, which can provide more opportunities for

citizens to be involved in urban forestry, not only as a volunteer but also with a monetary donation. Tree agency also plays an important role in getting funding from government, business or personal donation. Alabama forestry services provide reliable source of information and technical support for urban trees. Together they provide the public with comprehensive information and service about trees. The better understanding and effective use of tree agency and forestry services will also help to finance urban tree programs including tree planting, maintenance, and debris and tree removal.

Mayors have relatively more knowledge about these Alabama forest service. They are slightly more likely to be concerned about tree planting and maintenance costs than are council members and administrators. However, relatively minor differences are found among the three types of officials in regards to their preferences of trees' benefits and disadvantages. This result is consistent with findings from Ricard (1994) and Stevenson et al. (2008).

A good understanding of the benefits that urban trees provide, and an awareness of the forestry services available, help to promote urban tree programs. Municipal officials should be provided more chances to get specific training or education opportunities in their work. Mail and internet are important ways to get information. Having classes or seminars offered on topics related to urban tree care is also an effective way to gain knowledge about urban trees. Support from forestry professionals in the Alabama forestry service is also recommended as a good option.

Conclusions

Urban forests are increasingly being seen as an important infrastructure that can help cities and communities improve their environment and provide residents amenities. Preference study provides positive tool for understanding individual's behavior and social well-being. This dissertation assessed individual's preference to urban trees and urban forest management. The preferences to biophysical presence of trees as well as ecological benefits have been addressed. To account for preference, individual's socio-economic and demographic background has been analyzed. The financial sources and tree ordinance as a management tool have also been discussed. Five chapters addressed the preference issue from different perspectives but as a whole contributing to a full map of understating of public attitudes and behaviors in urban tree management activities.

Chapter I highlights the aesthetic preference to the biophysical presence of trees. As important design factors in residential landscapes, it has been revealed that people in general prefer to live in houses with more trees. Large trees with wide round canopy seem also favored. Different tastes between senior and fresh students are noticed. Findings also suggest that students majoring in wildlife science prefer more trees than students majoring in forestry.

Chapter II explores students' preferences toward natural and wild versus clean and neat residential landscape. Results suggest that students in agricultural economics, horticulture, and social sciences are more inclined to choose a neat, well-kept environment. In contrast, wildlife science students prefer more natural landscapes. Students who are members of an environmental

group and those whose parents have a better education, are more likely to choose a more natural landscape. Those findings reveal the diversity of tree preferences as regard to different family background and personal experience.

Chapter III focuses on the development of tree ordinances in Alabama and the role such ordinances have on urban trees. Among the 100 municipalities that have some type of tree ordinances in Alabama, based on our investigation, the major items of tree ordinances are: having a tree commission (board), defining tree planting, removal and replacement of trees on public land, public tree protection and care, tree species selection, and dead tree removal on public and private property. Those tree ordinances provide not only a legal framework, but also an effective tool to engage public participation and awareness of urban tees in the process of formulating, implementing, and amending of the tree ordinance.

Chapter IV investigates the attitudes of urban residents toward urban trees and how they would like to support urban tree programs. It is found, in general, that people prefer to have trees on their property and in their community for all gender, age, race, income, and other family background, but individuals with higher education tend to like more trees. The most desirable amenity of trees is the improved appearance. The negative impacts people are concerned with discourage them from having trees in their communities. Private donation is widely agreed upon as an important source of support. According to the respondents' statements, it is found that the willingness to donate individually is significantly less than the amount that should be contributed for every household (e.g., taxation). The awareness of the presence of a tree agency and service can significantly increase the amount of donation a person is willing to make.

Chapter V explores the municipal officials' perception of urban trees, financing, governing and information sharing regarding urban forest management in Alabama. The main

findings suggest that the important role of urban trees has been widely recognized by local officials. The socio-economic benefits of trees to increase property value and community pride are highly recognized by local officials. In contrast, the ecological benefits are less valued. Most Alabama cities spend less than $60,000 a year on tree planting, tree maintenance, debris removal and tree removal. Although cities with a large population usually spend more on urban trees, higher household incomes and lower poverty rates would significantly increase the input on urban tree programs. Relatively minor differences are found among the three types of officials: mayors, council members, and administrators. It seems many municipal officials are not aware of, or informed about, related agencies providing urban tree management services.

Urban forest plays a special role in building a livable community, which should not only be environmentally friendly, but aesthetically as well as cultural and socially appealing. Findings of this study indicate that greening is important in residential landscapes. This study also provides helpful information for policy making and city development. Findings highlight the important role of "knowledge" in shaping public's preference. Biased information or limited information might result in a biased preference. Thus, it is important for policy maker to provide all kinds of sources of information to help both public and managers better understand the important role of trees and forestry management.

To better manage urban forest and residential landscape, it is necessary to expand knowledge and innovation about tree and urban forest resource management to promote ecosystem health and sustainability. Logically, people with a greater knowledge of nature should prefer more ecologically-sustainable landscape. The affiliation with environmental groups positively influenced the favor of nature landscape. A more proactive way to coordinate aesthetical landscape and ecological landscape is to use education and information to shape

people's preferences toward designing ecologically-sound landscape. Education and public media provide a potential way to change public preference through awareness and ecological education. An increasing of the number of tree agencies and a well understanding of urban tree benefits and awareness of forestry services available also help to promote urban tree program. It is also important to provide diverse education programs to meet the different needs of general public and managers.

Planting and maintaining trees in many U.S. cities involves multiple partners and multiple agencies. To promote the urban tree management, it is important to get support from different stakeholders, include property owner, nonprofits and local agencies. Considering the different concerns among those stakeholders and the local institutional and historic differences, one of the important collaborative approaches is to build a common goal which led to an inter-organizational coincidence of interests. More negotiation and compromise can be done to improve the understanding and collaboration of government with private individuals, business, and nonprofit organizations.

Tree ordinances also play an important role in promoting collaboration between government and citizens. Tree ordinances are successful when they include public participation and citizen leadership. For example, city tree commissions have usually been established through public involvement taking responsibility to develop and amend tree ordinances in the U.S., and especially in the Alabama. Developing tree ordinances is a great opportunity to engage public participation, solve local issues through negotiation and compromise, and create policy that works for the community.

Trees are living entities requiring care on a regular basis throughout the year. Tree management needs the input of money, time and labor. Findings in this study suggest ways to

gain the support from residents and officials. Individual donation and tax are important sources to finance urban forest program. Findings suggest that understanding the functions of urban tree programs is an important way of gaining public support, especially for small communities. Thus, residents could be organized and educated to demonstrate strong support for a tree program. Funding might be also alleviated by using volunteers, grants, and available technical advice. Voluntary activities and personal donations provide important support for urban tree program especially when funding is limited.

This study mainly used data from survey data. The visual preference survey targeted on college students for two reasons. First, college students behave as adults. They are representative in individual's behavior. In addition, current college students will be future buyer and producer. What they have learned today will influence their future decision. The sample from Alabama citizen survey has its limitation in sampling size and response rate, but the results shed some light on our perception of financing urban trees program. Another limitation in our study is that the sample could be potentially biased due to the relatively high income and high education level families as compared to the average level in Alabama. However, since the purpose of this study is not to value but just reveal the preference difference, findings are still helpful for policy making. Moreover, the results also have to be interpreted cautiously. As the study is based on a survey in Alabama, the outcomes will be a general frame work on this region. An extensive study based on the similar approach may offer more site specific results and explanation.

Self-selection might be another problem in this study. For example, students who chose forestry as a major may initially prefer natural environment. Thus, if an individual an academic major based on the initial perceptions he or she possesses, the effect of training or education might be less influential in this study, and more attention should be put on family background

and past experience. Future research is needed to better understand the individual's level of concern and initial interests. The causality relation between academic major and individual belief should be examined more cautiously.

In all, trees play an important role in our life. A thoughtful landscape design is critical for a good-looking, functional, ecological and economical housing. The preference and supporting from citizens and local officials are important to promote urban tree and management. The results of this study provide information for resource managers, land-use planners, developers, environmental policy makers, and private land owners on a variety of topics regarding residential land development.

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Appendixes

Appendix I

Human Subject Protocol

AUBURN
UNIVERSITY

Institutional Review Board
Office of Human Subjects Research
307 Samford Hall
Auburn University, AL 36849

Telephone: 334-844-5966
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May 13, 2009

MEMO To: Dr. Yaoqi Zhang
Professor, School of Forestry and Wildlife Sciences

From: Dr. Kathy Jo Ellison, IRB Chair

Cc: Dr. Richard Brinker, Dean

Re: Compliance Issue for Protocols #07-058 EX 0703 and #07-059 EX 0703 "Assessing Preferences for and Attitudes towards Urban Forests in Suburban Communities (1 and 2)".

Thank you for meeting with Dr. Weathers, Dr. Vazsonyi, Dr. McCormick and me yesterday to review the circumstances surrounding your use of un-approved data collection methods for your studies noted above.

Your responses to the IRB's concerns were forthright and clear. Based on the information you shared as to your intent in collecting data through un-approved procedures, the IRB has the following recommendations:

1. Please note in the future that <u>any</u> changes to your protocol procedures, including recruitment and data collection, must be approved by the IRB before you make the changes.

2. Please provide a formal response (memo or letter) to the IRB that you understand that any change in recruitment methods or data collection procedures must be reported to and approved by the IRB.

3. You will be allowed the continued use of data previously collected. (Note that the IRB did have the option of having you destroy the data that was collected inappropriately.)

4. It appears that all of your research activities were covered by the scope of work described in your funding proposal, as provided to the IRB from the Office of Sponsored Programs. None of the activities that you described that occurred appear to have increased any risk to participants and would have been approved by the IRB had you requested modifications to your protocol. The IRB has no reason to report these non-compliance events to your funding agency.

Please submit the memo to the IRB by May 22, 2009.

Appendix II

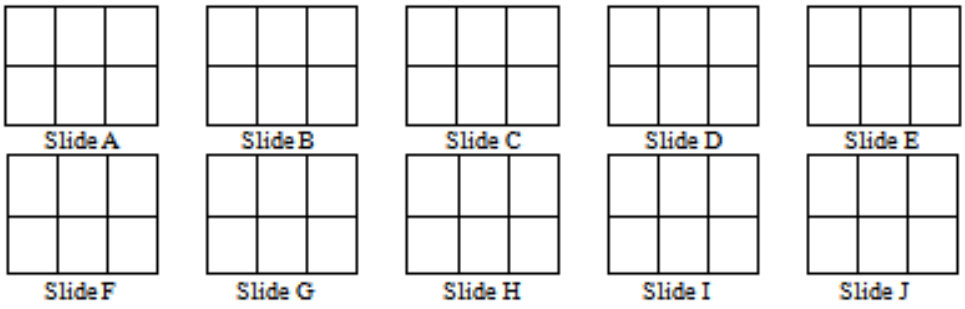
Preferences Survey for Students

Preferences & Attitudes:
Trees & Greening in Single Home Communities

Part I Visual Preference Survey

Please assign a **Likert scale** from 1 to 5 **(1= least preferred; 5= most preferred)** when we show the landscape slide by slide.

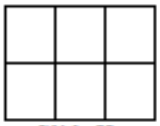
1) Single house landscape



Slide A | Slide B | Slide C | Slide D | Slide E

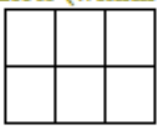
Slide F | Slide G | Slide H | Slide I | Slide J

2) Streetscape (within your subdivision)



Slide K

3) Woodlots (within and nearby your subdivision)



Slide L

4) When you have completed rating the scenes for visual quality, we would like to find out which factors in the scenes influenced your ratings. Please put a check ☑ beside each influential factor, check as many as apply:

	Which is preferred?	
☐ The size of the trees.....	☐ Bigger trees	☐ Small trees
☐ The species of the trees.....	☐ Native species	☐ exotic species
☐ The presence of trees	☐ a lot of trees	☐ few trees
☐ The open space.....	☐ More open space	☐ Less open space
☐ The configuration.....	☐ close to home	☐ away from home
☐ The wildness/nature.....	☐ More Nature	☐ More Artificial

☐ Others_____

Part II: Verbal Questions

1. **Within same size of subdivision and same construction area and number of single house, which one you like?**
   a) Compact development (leave an integrated open green space or wood lot)
   b) Dispersed Development (evenly dispersed settings of the homes)

2. **Woodlot near or within your subdivision, which one you would like?**
   a) More natural and wild status (mixed species) with some dead wood and grass on the ground
   b) Clean ground and well managed with most of the trees are planted with similar size.

3) The following kinds of urban trees and landscaping (or activities) you would agree?

	Strongly Disagree	←----------		----------→	Strongly Agree
A) To increase tree canopy by planting more trees	1	2	3	4	5
B) To keep trees pruned and well maintained	1	2	3	4	5
C) To plant flowering shrubs, perennials, annuals	1	2	3	4	5
D) To keep more naturalized landscape	1	2	3	4	5
E) To use more created and artificial landscape	1	2	3	4	5
F) To have a good mix of conifers & deciduous trees	1	2	3	4	5

Ranking the Top 3 factor from A-F of the above items by order of the importance you think: (1st is most important, 3rd is less important):

1st._____

2nd._____

3rd._____

4) The following characteristics of trees are important for me.

A) Seasonal color	1	2	3	4	5
B) Shape of trees	1	2	3	4	5
C) Growing rate	1	2	3	4	5

Part III: Demographic Information

1. Including yourself, how many brothers and sisters?

2. How many children under 18 years of age currently live in your household?

3. What is your major?

4. What is your grade? ☐ freshmen ☐Junior ☐ Sophomore ☐ Senior ☐ graduate

5. What race do you identify with? ☐ African-American ☐White/Caucasian ☐ Hispanic ☐Other (e.g., Asian)

6. Gender ☐Male ☐Female

7. In which age group would you belong to? ☐less than 20 ☐ more than 20

8. In what areas you have most recently lived before you came to Auburn?

☐ Rural area (population less than 2000); ☐ small city (2000- 50,000); ☐ large city (lager than 50, 000)

9. Do you belong to any environmental groups ☐Yes ☐ No

10. Which category best describes your annual household income?

☐ Less than $20,000 ☐ $20,000-$39,999 ☐ $40,000-$74,999 ☐ $75,000-$99,0999 ☐ $100,000+

11. What is your parents' education (the higher one)

☐ Less than 12th grade ☐ High school completed ☐ Some College or technical degree ☐ Bachelor's degree ☐ Graduate degree

12. What is your parents' occupation (the higher one) ☐ Professional ☐ Technical ☐ Skilled worker

Thanks!

Part III: Demographic Information

1. Including yourself and your children, how many people live in your household?
2. How many children under 18 years of age currently live in your household?
3. Current Employment Status: ☐ Full-time ☐ Part-time Homemaker ☐Retired ☐Unemployed ☐ Other (e.g. student, etc.)
4. What is your highest level of education? ☐ Less than high school ☐ High school diploma/GED ☐ Some college ☐Bachelor's or higher
5. Which category best describes your annual household income? ☐ Less than $20,000 ☐ $20,000-$39,999 ☐ $40,000-$74,999 ☐ $75,000-$99,0999 ☐ $100,000+
6. What race do you identify with? ☐ African-American ☐White/Caucasian ☐ Hispanic ☐Other (e.g., Asian)
7. **Do you belong to any environmental groups** ☐Yes ☐ No
8. Gender ☐Male ☐Female
9. How would you classify the house in which you live? ☐ Apartment ☐House (less than $100,000)* ☐ House ($100,000 –150,000) ☐House (150,000-200,000) ☐ House (more than $200,000) * Estimated current market value
Other Comments and Information (particularly on how to support community tree programs):

Thanks!

Appendix IV

Urban Forestry Citizen Survey in Alabama

Urban Forestry Citizen Survey in Alabama 2005

Instruction: Use any pen or pencil to mark one answer to each item. Simply complete the form, fold and drop it in the mail box. You do not need a stamp and envelope.

1. General Attitude to the importance of urban trees

	Very important … Not important 1 2 3 4 5 6 7
1. If you were looking for a residence in which to live (such as a house or apartment), how important would you rate having trees on the property?	O O O O O O O
2. If you were choosing a neighborhood, town, or city in which to live, how important would you rate having trees in the community?	O O O O O O O
3. Ranking Importance of urban forestry benefits:	
• Increase in property values	O O O O O O O
• Decrease in energy costs	O O O O O O O
• Improvement in air quality	O O O O O O O
• Reduction in storm water runoff, soil erosion, water quality	O O O O O O O
• Creation of wildlife habitat	O O O O O O O
• Increase in community pride	O O O O O O O
• Appearance of the community (beauty, aesthetics)	O O O O O O O
• Increase in recreational opportunities	O O O O O O O
• Improvement in health and well-being	O O O O O O O
• Reduction of noise levels	O O O O O O O
• Creation of buffer zones	O O O O O O O
• None of above	O O O O O O O
4. Ranking the negative impacts of urban forestry	
• Safety (e.g., by branch falling down, hurricane)	O O O O O O O
• Property damage (e.g., by hurricane)	O O O O O O O
• Costs of planting and maintenance (topping, clearing leaves)	O O O O O O O
5. Below is a list of forms of promoting and educating urban forestry, how useful do you think?	
• TV programs	O O O O O O O
• Newspapers	O O O O O O O
• Internet	O O O O O O O
• City activities and festivals	O O O O O O O
• Forestry extension professional and urban foresters	O O O O O O O
• Private consultants	O O O O O O O
• Distributing brochure and other materials	O O O O O O O

2. General Attitudes to Governing and Financing Community Trees Program

	Strongly agree ……Not agree 1 2 3 4 5 6 7
6. To what extent do you agree that **governments** should adopt tree ordinances requiring builders and developers to follow guidelines to preserve and protect trees?	
• New construction site	O O O O O O O
• Public property	O O O O O O O
• Individually-owned yard	O O O O O O O
7. How important is it for following governments to provide funds to help **individual communities plant and maintain trees**?	
	Strongly important ….Not important 1 2 3 4 5 6 7
• Federal government	O O O O O O O
• Alabama state government	O O O O O O O
• local government	O O O O O O O
8. How important to you are the following ways to finance community trees programs?	
• State sales tax	O O O O O O O
• Local property tax	O O O O O O O
• Estate tax	O O O O O O O
• Alcohol and tobacco tax	O O O O O O O
• State income tax	O O O O O O O
• Corporate income tax	O O O O O O O
• Private donations	O O O O O O O
• Others (please specify:)	O O O O O O O
9. How much should an average family support urban tree program annually by the above ways? 0 ☐ less than $ 30 ☐ $31-80 ☐ $81-150 ☐ $151--$250 ☐ more than $250 ☐	
10. In the future, how likely would you donate your money to support urban tree activities in your area?	Very likely ……..Not likely 1 2 3 4 5 6 7 O O O O O O O
How much would you like to donate annually? 0 ☐ less than $ 30 ☐ $31-80 ☐ $81-150 ☐ $151--$250 ☐ more than $250 ☐	
11. In the future, how likely would you volunteer your time to support urban tree activities in your area?	Very likely ……..Not likely 1 2 3 4 5 6 7 O O O O O O O
12. An urban tree activity in which you would be willing to become involved, if requested:	Very likely ……..Not likely 1 2 3 4 5 6 7
• Help plant trees on public property	O O O O O O O
• Help with local public education activities	O O O O O O O
• Help recruit and mobilize other citizens to plant and care for urban trees	O O O O O O O
• Serve on your community's Tree Board/Commission	O O O O O O O

3. Other Information

13. Have you personally performed any of the following urban tree activities in the past 10 years		
• Planted a tree	☐ Yes	☐ No
• Mulched around a tree	☐ Yes	☐ No
• Staked a tree	☐ Yes	☐ No
• Pruned a tree	☐ Yes	☐ No
• Removed a tree	☐ Yes	☐ No
• Others	☐ Yes	☐ No
14. Are you aware of following forestry programs		
• USDA Forest Service	☐ Yes	☐ No
• the National Arbor Day Foundation	☐ Yes	☐ No
• the International Society of Arboriculture	☐ Yes	☐ No
• the Alabama Cooperative Extension System	☐ Yes	☐ No
• the Alabama Forestry Commission	☐ Yes	☐ No
• Aware of the Auburn University School of Forestry & Wildlife Sciences	☐ Yes	☐ No
15. Including yourself and your children, how many people live in your household? ----------	**16. How many children under 18 years of age currently live in your household?** ----------	

17. Current Employment Status:
☐ Full-time ☐ Part-time Homemaker ☐Retired ☐Unemployed ☐ Other (e.g. student, disabled, etc.)

18. What is your highest level of education?
☐ Less than high school ☐ High school diploma/GED ☐ Some college ☐Bachelor's or higher

19. Which category best describes your annual household income?
☐ Less than $20,000 ☐ $20,000-$39,999 ☐ $40,000-$74,999 ☐ $75,000-$99,0999 ☐ $100,000+

20. What race do you identify with?
☐ African-American ☐White/Caucasian ☐ Hispanic ☐Other (e.g., Asian)

21. Gender
☐Male ☐Female

22. In which age group would you include yourself?
☐18-30 ☐31-45 ☐46-60 ☐60 +

23. How would you classify the house in which you live?
☐ Apartment
☐House (less than $100,000)* ☐ House ($100,000 –150,000)
☐House (150,000-200,000) ☐ House (more than $200, 000)
* Estimated current market value

Other Comments and Information (particularly on how to support community tree programs):

Thank you for participating in this Survey!
Please fold, staple (or tab) and drop the forms into a mailbox. You do not need a stamp and envelope.

#:

Appendix V

Urban Forestry in Alabama: Survey of Public Officials

Urban Forestry in Alabama: Survey of Public Officials

You may use either pen or pencil. Please fill in circles completely & neatly so that your answers will be recorded accurately.

Right	Wrong			
●	⊘	⊗	⊖	◯

Please answer each of the following questions about community trees by filling in the circles that correspond to your response choices.

		Very Important	*Somewhat Important*	*Not Very Important*	*Not At All Important*	*Don't Know*
1.	In **your personal opinion**, how important is it to have trees in the urban areas of your community?	○	○	○	○	○
2.	How important do think urban trees are to the **citizens** of your community?	○	○	○	○	○

3. Please consider each issue listed below, and rate whether each is very problematic, somewhat problematic, not very problematic, or not at all problematic for your community.

		Very Problematic	*Somewhat Problematic*	*Not Very Problematic*	*Not At All Problematic*	*Don't Know*
a.	Urban tree debris removal?	○	○	○	○	○
b.	Urban tree debris disposal?	○	○	○	○	○
c.	Property damage?	○	○	○	○	○
d.	Interruption of services from urban tree maintenance or upkeep?	○	○	○	○	○
e.	Public safety issues surrounding urban trees?	○	○	○	○	○
f.	Physical maintenance of urban trees?	○	○	○	○	○
g.	Financial burden of urban forestry program?	○	○	○	○	○

4. Please indicate whether each of the following urban forestry services should be provided by Local Government, State Government, and/or the Federal Government. For each service, you may select as many levels of government as you feel are appropriate.

		Local Government	*State Government*	*Federal Government*	*None*	*Don't Know*
a.	Provide public education about urban forestry?	○	○	○	○	○
b.	Provide urban forestry technical services to citizens?	○	○	○	○	○
c.	Plant trees in public urban areas?	○	○	○	○	○
d.	Maintain, remove, and dispose of urban trees on public property?	○	○	○	○	○

5. To what extent do you favor each of the practices listed below? For each, please rate whether you personally feel very favorable, somewhat favorable, not very favorable, or not at all favorable about the practice.

		Very Favorable	*Somewhat Favorable*	*Not Very Favorable*	*Not At All Favorable*	*Don't Know*
a.	The practice of tree topping	○	○	○	○	○
b.	Pruning trees away from utility wires	○	○	○	○	○
c.	The preservation of trees in construction areas	○	○	○	○	○
d.	Tree ordinances	○	○	○	○	○
e.	Government regulation of homeowner choice regarding tree type and maintenance	○	○	○	○	○
f.	Local government use of tax dollars to fund community tree programs	○	○	○	○	○

6. Please select the ***three*** **benefits or advantages** of urban forestry that you consider to be most significant:

Increase in property values	○	Decrease in energy costs	○	Improvement in air quality	○
Reduction of noise levels	○	Decrease in soil erosion	○	Improvement in water quality	○
Creation of wildlife habitat	○	Increase in community pride	○	Reduction in storm water runoff	○
Increase in recreational opportunities	○	Improvement in health and well-being	○	Positive impact on consumer behavior	○
Creation of buffer zones	○				

7. Please select the ***three*** **costs or disadvantages** of urban forestry that you consider to be most significant:

Planting costs	○	Pruning costs	○	Irrigation costs	○
Recycling pruned tree limbs	○	Removal of hazardous trees	○	Insect and disease control	○
Repairing root damage to sidewalks, curbs, and utility lines	○	Medical costs associated with allergies	○	The cost of administering a local urban tree program	○
Damage caused to property or personal safety	○				

8. Does your community currently provide opportunities for citizens to volunteer to . . .

		Yes	*No*
a.	Plant trees in public urban areas?	○	○
b.	Maintain urban trees on public property?	○	○
c.	Remove debris from dispose of urban trees?	○	○

9. Does your community currently provide opportunities for citizens to donate money to . . .

		Yes	*No*
a.	Plant trees in public urban areas?	○	○
b.	Maintain urban trees on public property?	○	○
c.	Remove debris from urban trees or dispose of urban trees?	○	○

10. Please check if your community has the following:

Tree Board	○	Tree Commission	○	City Forester or equivalent	○
Municipal tree program	○	Privately funded tree program	○	Publicly funded tree program	○
Citizen Advocacy Group	○	Tree inventory	○	Street tree ordinance	○
Landscape ordinance	○	Tree protection ordinance	○	Nuisance tree ordinance	○
Park/public tree ordinance	○	View ordinance	○		
Urban Forestry Department or equivalent	○	Ordinance governing trees on private property	○		

11. If your community has a municipal tree program, in what year was it initiated? _____

	Very Satisfied	*Somewhat Satisfied*	*Somewhat Dissatisfied*	*Very Dissatisfied*	*Don't Know*
12. If your community has a municipal tree program, how satisfied are you with this program?	○	○	○	○	○

	Developer	*Property Owner*	*Municipal Organization*	*Other*	*Don't Know*
13. In new commercial developments, who is responsible for tree planting and maintenance?	○	○	○	○	○
14. In new residential developments, who is responsible for tree planting and maintenance?	○	○	○	○	○

Five years ago, approximately how much money would you estimate your community spent on each of the following initiatives for one year:	*None*	*$1 - $20,000*	*$20,001- $40,000*	*$40,001- $60,000*	*Over $60,000*	*Don't Know*
a. Urban tree planting	○	○	○	○	○	○
b. Urban tree maintenance[1]	○	○	○	○	○	○
c. Urban tree debris removal	○	○	○	○	○	○
d. Urban tree removal	○	○	○	○	○	○

16. Approximately how much money will your community spend this year on the following initiatives?	*None*	*$1 - $20,000*	*$20,001- $40,000*	*$40,001- $60,000*	*Over $60,000*	*Don't Know*
a. Urban tree planting	○	○	○	○	○	○
b. Urban tree maintenance	○	○	○	○	○	○
c. Urban tree debris removal	○	○	○	○	○	○
d. Urban tree removal	○	○	○	○	○	○

17. ***Five years from now***, approximately how much money do you expect your community will spend on each of the following initiatives in one year?	*None*	*$1 - $20,000*	*$20,001- $40,000*	*$40,001- $60,000*	*Over $60,000*	*Don't Know*
a. Urban tree planting	○	○	○	○	○	○
b. Urban tree maintenance	○	○	○	○	○	○
c. Urban tree debris removal	○	○	○	○	○	○
d. Urban tree removal	○	○	○	○	○	○

[1] Maintenance would include activities such as pruning, pest and disease control, mulching, etc.

	More	Less	About the Same	Don't Know
18. Within the next five years, does your community plan to plant more, less, or about the same amount of trees as are currently planted (per annum)?	○	○	○	○
19. Within the next five years, does your community plan to remove more, less, or about the same amount of trees as are currently removed (per annum)?	○	○	○	○
20. Within the next five years, does your community plan to retain more, less, or about the same amount of land area to urban forests as is currently devoted?	○	○	○	○

21. How often does your community inspect city-owned urban trees? _____ times a year.

22. Please check each of the following services or programs with which you are familiar:

USDA Forest Service	○	Trees for Alabama	○	American Forest	○
International Society of Arboriculture	○	Alabama Urban Forestry Association	○	A.U. School of Forestry and Wildlife Sciences	○
Alabama Forestry Commission	○	National Arbor Day Foundation	○		

	Yes	No
23. Have you ever used publications, courses, or assistance of any kind from the above organizations to help your community plant or care for trees?	○	○
24. Would you consider research updates about the planting and maintenance of urban trees to be helpful to your community?	○	○
25. If available, do you think your community's citizens would take community courses about how to plant or care for urban trees?	○	○
26. If your community's citizens were aware of whom to contact, do you think they would contact the Alabama Cooperative Extension Service to receive information about urban tree planting and growth?	○	○

27. Please check the types of urban forestry information that you would find useful:

Urban forestry benefits	○	Urban forestry costs	○	Tree selection	○
Tree planting	○	Young tree care	○	Mature tree care	○
Tree pest management	○	Volunteer training	○		

28. Is there any other information you think your community needs regarding urban forestry?

_____

_____

29. What forms of communication providing information about urban forestry would you find beneficial?

		Yes	No
a.	Communication available on the internet	○	○
b.	Communication with urban forestry professionals by telephone	○	○
c.	Receiving information by fax	○	○
d.	Receiving publications through the mail	○	○
e.	Receiving publications through e-mail	○	○
f.	Being able to meet with forestry professionals to discuss urban tree care	○	○
g.	Having classes or seminars offered on topics related to urban tree care	○	○