

UNDERSTANDING PERCEPTIONS TO IMPROVE THE SUCCESS AND ACCEPTANCE
OF INSECT POLLINATOR HABITAT IN PUBLIC SPACES.

by

GREGORY HUBER

(Under the Direction of Jon Calabria)

ABSTRACT

A better understanding of perceptions of insect pollinator habitat may promote their acceptance and success in public spaces. This study examines preferences for design treatments and identify impacts on perceptions. A sample frame of Master Gardener Extension Volunteers and green-industry practitioners in Georgia, USA responded to an online survey regarding pollinator sites (N=424). Preferences for pollinator landscapes were ascertained through conjoint analysis of image-based discrete choice experiments and revealed significant differences in utility scores for site preference ($p < 0.001$). The findings suggest that certain design treatments with a modest balance between human elements (e.g. benches, mowed borders) and naturalness may appeal to a larger audience while improving year-round appeal. Further research exploring perceptions and design treatments is needed to build a knowledge base for increasing the acceptance and success of pollinator habitats in the Southeast.

KEYWORDS: Discrete Choice Experiment, Ecological Aesthetics, Georgia Pollinator Habitat, Landscape Architecture, Landscape Perception, and Visual Preference Survey.

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A Thesis Submitted to the Graduate Faculty of the University of Georgia in Partial Fulfillment of
the Requirements for the Degree

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DEDICATION

I dedicate this thesis to my loving family and friends who provided the encouragement and support I needed when the road was rough and the climb was steep. Thank you for your love and encouragement Dad, Mom, Jeff, April, Davis, Brooks, and Eliza.

I also dedicate this thesis to those who made the ultimate sacrifice for the freedom and liberties that we enjoy in the United States of America; that we may worship freely without persecution, that we may have the opportunity to pursue an education, exercise the right to vote, use our skills to earn a living, and joyfully raise a family. May we be reminded of the great blessings that we too often take for granted and stand united as one nation under God.

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TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	v
LIST OF TABLES	ix
LIST OF FIGURES	x
CHAPTER	
1 INTRODUCTION	1
Statement of the Problem.....	1
Background.....	1
Focus of Study	2
Research Questions.....	5
Significance of the Research.....	6
Delimitations.....	6
2 LITERATURE REVIEW	8
Overview.....	8
Urbanization and Landscape Aesthetics	8
Visual Preference Studies	9
3 METHODOLOGY	13
Overview of Research Design	13
Selection of Study Sites	13

Photo Sampling.....	18
Insect Density.....	19
Richness of Plant Species	21
Human Elements.....	21
Survey Instrument.....	22
Gardening Experience.....	22
Demographics	23
Choice-based conjoint exercise.....	23
Keyword analysis.....	28
Acceptability	29
Value ranking.....	30
Statistical Analysis.....	31
4 RESULTS	33
Survey Results	33
Demographics	33
Gardening Knowledge and Experience	35
Professional Experience, Licensing, Certification.....	37
Acceptability.....	39
Plant Species Richness.....	44
Insect Density.....	42
Plant Species Richness.....	43
Summary	46

5	DISCUSSION.....	47
	Site Preferences.....	48
	Seasonality and Site Preference.....	50
	Human Elements and Site Preference.....	51
	Complexity of Perceptions.....	53
	Discussion on Gardening Knowledge, Education.....	55
	Discussion on the use of Conjoint Analysis.....	56
6	CONCLUSIONS.....	57
	Research Questions and Conclusions.....	57
	The Impacts of Gardening Knowledge and Experience.....	57
	The Impacts of Seasonality on Perceptions.....	58
	The Impacts of Human Elements on Perceptions.....	59
	Understand Perceptions Using Conjoint Analysis.....	59
	Implications.....	60
	Recommendations and Future Research.....	60
	REFERENCES.....	62
	APPENDICES	
	A Human Subjects Institutional Review Board Approval Letter.....	66
	B Web Survey.....	67
	C Survey results (graphics).....	123
	D Site data.....	141
	E Statistical Analysis.....	147

LIST OF TABLES

	Page
Table 3.1: List of Pollinator Study Sites.....	14
Table 3.2: Summary of human elements occurring on each study site	21
Table 3.3: Example of Choice-based Conjoint Exercise	25
Table 3.4: Comparing Landscape Attributes in Table Format	26
Table 3.5: Discrete choice experiment attributes and levels.....	27
Table 3.6: Reciprocal comparison of seasonality on preference	29
Table 3.7: Keyword analysis.....	30
Table 4.1: Summary of demographic responses.	35
Table 4.2: Summary of gardening knowledge and experience.....	35
Table 4.3: Summary of professional experience, licensing, certification.....	38
Table 4.4: Summary of site acceptability ratings.....	39
Table 4.5: Summary of negative and positive keyword counts.....	41
Table 4.6: Keyword frequency.	42
Table 4.7: Summary of insect counts and mean density per site.....	43
Table 4.8: Inventory of plant species and bloom time.....	44
Table 5.1: Tukey’s HSD pairwise differences connecting letters report	49
Table 5.2: Reciprocal choice comparisons of seasonality.	50
Table 5.3: Keyword comparison of sites PSS1 and PSS5.	55

LIST OF FIGURES

	Page
Figure 1.1: Conceptual framework for improving habitat success	4
Figure 2.1: Examples of elements and characteristics of intentional care	10
Figure 3.1: Map of pollinator study sites	15
Figure 3.2: Aerial photographs of pollinator study sites.....	16
Figure 3.3: Site photos	17
Figure 3.4: Winter and summer photo alignment	18
Figure 3.5: Image corrections to improve color and tonal consistency	19
Figure 3.6: Example of transect layout for bee abundance monitoring procedures.	20
Figure 3.7: Sample question – site preferences (discrete choice experiment).....	28
Figure 3.8: Sample question – acceptability of site PSS3.	31
Figure 3.9: Sample question – park space priority ranking.	32
Figure 4.1: Respondent demographics histogram of age (years).....	35
Figure 4.2: Respondent demographics – age of first gardening experience.	37
Figure 5.1: Analysis – Box Plot – Utility Scores for Winter and Summer Preference.....	48
Figure 5.2: Analysis – Acceptability comparison with human elements (Site PSS3).....	52
Figure 5.3: Analysis – Acceptability comparison with human elements (Site PSS5).....	53
Figure 5.4: Analysis – Acceptability comparison sites PSS1 and PSS5.....	54

CHAPTER 1

INTRODUCTION

Statement of the Problem

Research to better understand the human preferences for pollinator spaces may inform landscape architects and communities on design decisions that will enhance the success and acceptance of pollinator habitats in public spaces. In recent years, pollinator decline has been identified as a key issue of national and global concern. Research has grappled with gaining a better understanding of the decline and formulate responses to improve pollinator habitat. An emerging strategy is to increase the quantity, improve the quality of pollinator habitats, and create forage opportunities in urban and rural environments. However, pollinator habitats are sometimes perceived by the public as undesirable in contrast to conventional landscapes of manicured lawns and sheared hedges.

Background

Scientists are concerned that pollinator health worldwide is trending downwards and there is no simple explanation. Pollinators include certain beneficial bees, butterflies, bats, birds, moths, flies, wasps, and beetles. It is estimated that one out of every three bites of food rely on the free services of pollinators including apples, peaches, blackberries, blueberries, squash, and almonds (USDA 2016). The United States EPA and USDA are working with researchers to find answers, and scientists attribute the decline to many complex interrelated factors including

pollinator pests and diseases, poor nutrition, pesticide exposure, bee management practices, lack of genetic diversity (US EPA 2015).

In 2015, the Environmental Protection Agency (EPA) asked each state to develop a customized pollinator protection plan with recommendations on improving pollinator health in response to national concerns over pollinator populations. In addition, the EPA is now requiring a “Protection of Pollinators” advisory box on certain pesticides labels and has issued a new bee hazard icon and instructions for protecting bees and other pollinators. In Georgia, a plan titled “Protecting Georgia’s Pollinators” was developed as a joint effort between the Georgia Department of Agriculture and the University of Georgia Department of Entomology (Berry et al. 2016). Part of this plan is to protect and provide quality forage and habitat throughout the state.

Focus of Study

While interest in the creation and improvement of pollinator habitat is on the rise, the aesthetic characteristics of pollinator habitats are sometimes a barrier to success. “One of the biggest problems with (ecological) rehabilitation projects has been public perception” (Hands and Brown 2002, 58). Humans are linked to their environment through what they see and experience, those experiences are connected to emotions, and those emotions influence our attitudes and values (Gobster 2007). Decision-making in regard to pollinator spaces can be influenced by the way humans see, interact, and experience those spaces. The scale of human experience is a potential barrier in the aesthetic-ecological relationship (Gobster 2007). It is important to gain a better understanding of perceptions and attitudes towards pollinator spaces to enhance their success. In a study addressing key challenges to the management of urban green

spaces, Aronson suggests, "although the environmental consequences of management activities to enhance urban biodiversity are now beginning to be addressed, additional research and practical management strategies must be developed to balance human needs and perceptions while maintaining ecological processes (2017).

In residential subdivisions, projects are often met with resistance by neighborhood associations or local residents who perceive them as “weedy” unkept landscapes. In urban areas, the task becomes even more challenging with limited open space and competing values and interests. With concerns of pollinator decline at the forefront, a timely opportunity exists to build a defensible understanding of perceptions and attitudes regarding ecological landscapes (Dietz and Stern 1998).

This study examined the perceptions of Master Gardener Extension Volunteers and landscape practitioners’ perceptions regarding various design treatments of insect pollinator habitat. A survey instrument collected data on human perceptions and field data measured the density of insect pollinators on six pollinator study sites (PSS). The experiment revealed positive and negative perceptions of quality habitat for insect pollinators (Figure 1.1).

Understanding Human Perceptions to Improve Pollinator Habitat Success

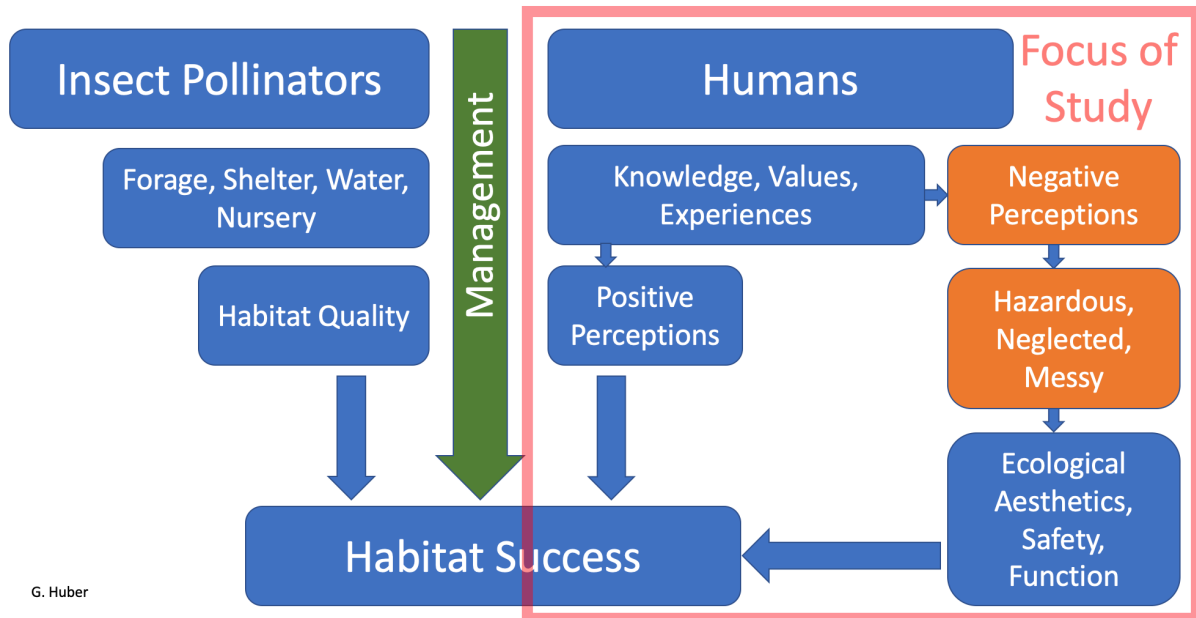


Figure 1.1: Conceptual framework for improving habitat success through a better understanding of human perceptions. (Diagram created using Microsoft PowerPoint Ver. 16.41 © 2020 Microsoft.)

If the adoption of ecological landscape design, such as pollinator spaces are to be successfully woven into the fabric of urban and suburban landscapes, then a better understanding of the visual preferences of these spaces must be explored to strengthen and inform design strategies. Pollinator habitats in public urban spaces are especially at risk, where open lands are in high demand with many competing interests. In private spaces, pollinator gardens can be nurtured, enhanced, and protected by gardeners and land managers who share a common concern for pollinators, and who exercise a working knowledge of forage species and other habitat requirements to inform decisions. However, in public spaces, pollinator habitat must satisfy competing interests, values, and perceptions. Additionally, public pollinator spaces are often managed by departments and individuals who may not have the necessary time, resources, or

training to manage complex and dynamic ecosystems. As a result, pollinator habitats in public places may be perceived as messy, neglected, or unsafe (Nassauer 1995). Aesthetically appealing solutions for pollinator spaces can help to change the way they are perceived and cared for and answers from the following research questions can inform successful stewardship models.

Research Questions

This study addressed the following research questions:

1. Can a better understanding of human perceptions of pollinator spaces inform design decisions and enhance the public acceptance of success of pollinator habitats?
 - a. Does gardening knowledge, years of experience, training, and certification influence human perceptions of pollinator habitat?
 - i. Hypothesis: Respondents with the highest level of gardening knowledge, Extension trainings, and certification will have more favorable perceptions of the more natural pollinator sites compared to respondents having less gardening knowledge.
 - b. How does winter and summer seasonality impact perceptions?
 - i. Hypothesis: Summer images of study sites are more favored than winter images of the same sites.
 - c. Do human elements, such as the presence or absence of site furnishings, signage, walkways, and defined borders, impact human perceptions and acceptability of pollinator spaces?

- i. Hypothesis: A balance of human care and functionality with pollinator habitat will be more widely accepted across the survey sample than treatments that skew in either direction.
- d. Can a conjoint analysis survey instrument be used as an effective tool in landscape architecture for the study of complex human preferences for the design of space?
 - i. Hypothesis: Conjoint analysis has potential in landscape architecture applications for identifying the most preferable attributes of complex landscapes using a relatively small sample size, similar to consumer product research.

Significance of the Research

New urban green spaces can be designed, and existing landscapes enhanced to help curb pollinator decline. This study examined the human perceptions of designed pollinator habitats and the physical and aesthetic attributes that may serve as indicators of public acceptance or rejection of pollinator spaces.

Delimitations

This study should be interpreted with delimitations. The study does not address the habitats of ALL pollinators such as Aves (birds), Chiropteran (bats), and Coleoptera (beetles), etc. The sample frame represents the perceptions of Georgia Master Gardener Extension Volunteers and green industry practitioners; therefore, the perceptions of respondents are not necessarily representative of the general population. The experiment is based on site conditions

at the time of the study and does not address long-term maintenance strategies or temporal implications for habitat success.

The time frame for the study required that study sites be selected during winter, making site selection difficult without a full glimpse of summer plant variety. All pollinator study sites used in the study are accessible to the public without fees with the exception of the privately-owned site at the Callaway Gardens Butterfly Center, who allowed courtesy access for the field study. In addition, this study was conducted during the COVID-19 global pandemic and a time of social unrest, protesting, and riots. These circumstances resulted in shelter-in-place ordinances, safety concerns, and impacted the frequency and scheduling of field research. Despite these limitations, one visit per site was achieved to collect insect and plant data in late August.

The subsequent chapter will highlight the theoretical framework underpinning this work.

CHAPTER 2

LITERATURE REVIEW

Overview

A large body of work addresses the challenges of incorporating ecological landscapes in an appealing way (Parsons 2002). In addition, a significant body of work addresses pollinator habitat quality, species richness, density, and forage preferences. However, the literature review did not reveal a large body of work addressing ecological aesthetics specific to insect pollinator habitat in Georgia. Building a scientifically defensible understanding of what drives ecologically responsible behaviors and attitudes can similarly inform environmental policy makers (Dietz and Stern 1998). Scenic landscapes may play an important role in shaping environmental attitudes and behaviors (Palmer 1998). Timely studies on current human preferences and the specific ecological aesthetics of pollinator spaces are needed to address growing concerns regarding pollinator health and habitat success.

Urbanization and Landscape Aesthetics

Studies attribute urbanization and habitat loss as key contributors to pollinator decline. Land use changes alter vegetation and impact natural ecosystems, “Neighborhoods have developed in areas that were once forests and other natural habitats.” (Benton and Griffin 2017, 2). The richness and variety of plant species intertwines with pollinator success, “A decline in pollinator abundance and diversity may result in pollen limitation and reduced reproductive

success in plants. At the same time, low plant diversity may sustain fewer pollinator species.” (Hennig and Ghazoul 2012, 150). In addition to the loss of habitat in urban areas and a decline in biodiversity, habitat success is impacted by human perceptions and the rejection of pollinator habitats based on aesthetics. “Natural landscapes have both the floral and nesting resources needed for native bees, but in most conventional landscapes, the grass is mowed short, flowering “weeds” are killed with herbicides, many landscape bushes do not bloom, and debris is quickly removed to maintain a neat and manicured appearance.” (Benton and Griffin 2017, 2).

Visual Preference Studies

Visual preference research in landscape architecture has roots in the late 1970’s, when urban planner Anton Nelessen and James Constantine developed visual preference survey (VPS) techniques to obtain public feedback on physical design (Constantine 1993). Evidence of “human care” in the landscape has a powerful normative effect on human perceptions and behavior to change landscapes (Nassauer 1995). Nassauer addressed ecological design for vacant urban neighborhoods and studied correlations between human preferences and the acceptance of ecological design. Nassauer found that “Ecological quality tends to look messy, and this poses problems for those who imagine and construct new landscapes to enhance ecological quality; what is good may not look good, and what looks good may not be good” (Nassauer 1995, 161). Nassauer found that rather than confronting people with their ecologically destructive behavior, incorporating familiar evidences of intentional human care and orderly frames improved the perception of “messy” ecological landscapes (Nassauer 1995).

Cues to Care

Neatness		Stewardship		Naturalness	
<u>Attractive</u>	<u>Unattractive</u>	<u>Attractive</u>	<u>Unattractive</u>	<u>Attractive</u>	<u>Unattractive</u>
<i>Apparent Yard Care</i>	<i>Dead or Rotten</i>	<i>Good conservation</i>	<i>Poor conservation</i>	<i>Apparent naturalness</i>	<i>Too formal</i>
<i>Fences</i>	<i>Lack of yard care</i>	<i>Contour plowing</i>	<i>All planted in corn</i>	<i>Development blends in</i>	<i>Too much concrete</i>
<i>Flowers or shrubs</i>	<i>No flowers</i>	<i>No erosion</i>	<i>Poor water quality</i>	<i>Natural habitat</i>	<i>Too open</i>
<i>Landscaped</i>	<i>No shade</i>	<i>Pasture</i>	<i>Erodible land</i>	<i>Native vegetation</i>	<i>Bare</i>
<i>Lawn ornaments or architectural details</i>	<i>Not landscaped</i>	<i>Strip-cropping</i>	<i>No conservation practices</i>	<i>Natural</i>	<i>Flat</i>
<i>Trees in rows</i>	<i>Not mown</i>	<i>Terraces</i>	<i>Overgrazed</i>	<i>Trees</i>	<i>Monotonous</i>
<i>Big yard</i>	<i>Messy</i>	<i>Windbreak</i>	<i>Plowing up the hills</i>	<i>Wildlife</i>	<i>No trees</i>
<i>Clean and neat</i>	<i>Cluttered</i>		<i>Runoff</i>		
<i>Clean</i>	<i>Construction going on</i>		<i>Slimy looking water</i>		
<i>Neat</i>	<i>Junk</i>				
<i>No Junk</i>	<i>Poor care</i>				
<i>Put Away</i>	<i>Abandoned</i>				
<i>Good care</i>	<i>Neglected</i>				
<i>Cared for</i>	<i>No house on a farmstead site</i>				
<i>Maintained</i>	<i>Weedy</i>				
<i>Well-kept</i>					
<i>Mown</i>					
<i>New</i>					
<i>No weeds</i>					

Figure 2.1: Examples of elements and characteristics of intentional care. (Source: “Content Analysis of Descriptive Terms Organized Under the Concept of Landscape Care.” (Nassauer 1995, 165. Messy Ecosystems, Orderly Frames.))

In 2002, preferences for ecological rehabilitation sites investigated the visual preferences of employees working adjacent to the ecological restoration of brownfield industrial sites, setting out to identify which design elements had the potential to ameliorate negative perceptions (Hands and Brown 2002). The main findings were that employees perceived ecological rehabilitation at the factory site to be messy and problematic (Hands and Brown 2002). The research concluded that the addition of designed interventions to ecological projects on factory sites could significantly improve employee perceptions, without significantly affecting ecological functionality. Several suggestions to improve perceptions were determined, including planting rapidly growing ground cover or nurse crops during establishment phases, maximizing the use of color during this stage, and using highly visible, strategically placed plantings to create

the impression that the rehabilitation process is a planned procedure, rather than neglect of a site due to carelessness.

Gobster et al. found that for ecologically important but “un-scenic” wildland areas such as wetlands or prairies, mown borders, gateway plantings, and carefully placed boardwalks can convey care and foster more positive aesthetic experiences (2007). In addition, enhancing knowledge and engagement of ecological landscapes through signage and activity brings aesthetic and ecological goals into closer alignment. A study by Gobster suggests that recognizing habitats could influence people’s intentions for landscape change and that “enhanced knowledge might establish desirable relationships between aesthetics and ecology (2007).

Evidence from these and similar studies suggest that orderly frames and signs of human care (Nassauer 1995); the use of color and highly visible strategic plantings (Hands and Brown 2002); and mown borders, gateway plantings, and signage can help to align ecological goals and aesthetic preferences (Gobster 2007). However, studies on the human perceptions of designed pollinator habitats in the context of urban and suburban Georgia are lacking. This provides a timely niche to contribute visual preference data on Georgia’s urban ecosystems, specific to pollinator habitats, to advance the state goal of protecting and providing quality pollinator forage and habitat.

The methodology and framework for the assessing visual preferences is described in the following chapter. While the design of the experiment was informed by previous visual preference studies, this methodology explored the use of an image-based discrete choice experiment/choice-based conjoint experiment in combination with a survey instrument to better understand aesthetic preferences. The methodology combines multiple strategies for assessing

visual preferences including a keyword analysis, acceptability ratings, and a discrete choice experiment.

CHAPTER 3

METHODOLOGY

Overview of Research Design

A visual preference survey using a choice-based conjoint experiment (discrete choice experiment) examined the perceptions of landscape professionals and Master Gardener Extension Volunteers regarding pollinator habitat in public spaces. A survey instrument gathered data on gardening knowledge, experience, certification, and demographics. Study sites representing pollinator habitat were identified and photographed from multiple viewpoints. Transect data was collected on each study site to validate the presence of insect pollinators and inventory plant species.

Selection of Study Sites

Pollinator landscapes representing landscapes that would be commonly encountered in public spaces were selected for the project. In January 2019, Agriculture and Natural Resource agents and specialists employed by the University of Georgia Cooperative Extension, having a working knowledge of pollinators, were contacted by email to compile a list of publicly accessible pollinator landscapes to consider for the study. Pollinator landscapes were defined as spaces designed with the intent of providing pollinator habitat in public spaces. Twelve pollinator study sites were shortlisted for the project and photographed on February 15, 2020. In reviewing the sites, several criteria emerged that were used to narrow the number of study sites

to six: proximity/travel distance, context (rural to urban gradient), population density, the presence of human elements (constructed or applied care), and design treatment that would provide variety and contrast in the study. Six sites representing a diverse range of design approaches were selected for the study, two each from the urban, suburban, and rural context. Population density for each site was gathered using zipcode data (US Census Bureau 2018). All sites were located within 90 minutes travel time from Griffin, GA, and the maximum distance between sites was approximately two hours driving time.

Table 3.1: List of Pollinator Study Sites

Pollinator Study Site (PSS)	Description	Context
PSS1	Atlanta Beltline Eastside	Urban
PSS2	Atlanta Beltline Ponce Market	Urban
PSS3	East Park Meadow	Suburban
PSS4	Big Creek Greenway Trailhead	Suburban
PSS5	The Ray GDOT Visitors Center	Rural
PSS6	Callaway Gardens Butterfly Center Landscape	Rural

Sites ranged in size from 1,000 to 100,000 square feet of gentle terrain having less than a 5% slope with the exception of PSS4 having steep terrain with >20% slope (Table 3.1).

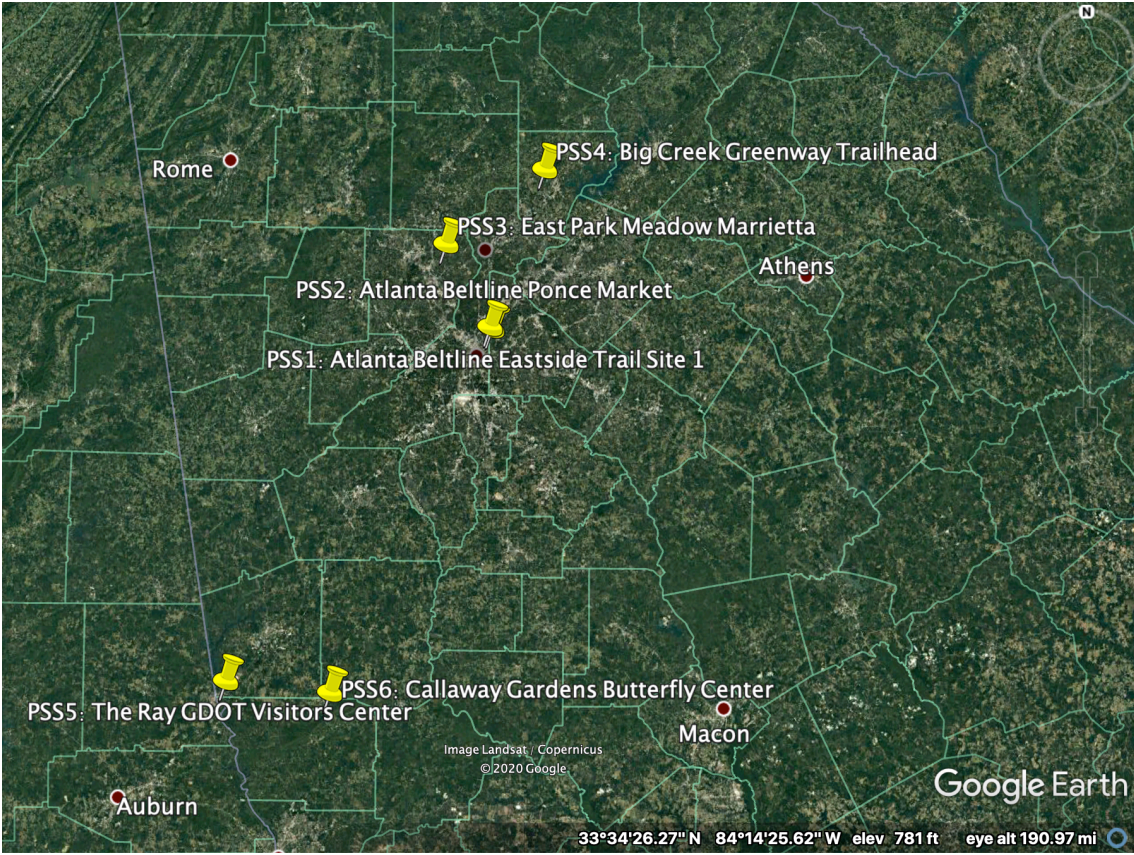


Figure 3.1: Map of pollinator study sites. (Retrieved from: Source: Image retrieved from Google Earth. September 18, 2020. https://earth.google.com/web/@33.7662053,-84.19043476,335786.3545576a,0d,35y,6.3866h,0t,0r?utm_source=earth7&utm_campaign=vine&hl=en)



PSS1 - Atlanta Beltline Eastside Trail (urban)



PSS2 - Atlanta Beltline Ponce Market (urban)



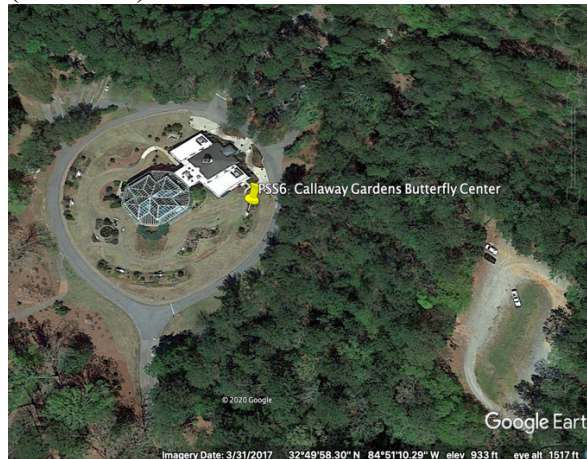
PSS3 - East Park Meadow (suburban)



PSS4 - Big Creek Greenway Trailhead (suburban)



PSS5 - The Ray GDOT Visitors Center (rural)



PSS6 - Callaway Gardens Butterfly Center (rural)

Figure 3.2: Aerial photographs of pollinator study sites. (Source: Images retrieved from Google Earth. September 19, 2020. <https://earth.google.com/web>.)



PSS1 - Atlanta Beltline Eastside Trail (urban)



PSS2 - Atlanta Beltline Ponce Market (urban)



PSS3 - East Park Meadow (suburban)



PSS4 - Big Creek Greenway Trailhead (suburban)



PSS5 - The Ray GDOT Visitors Center (rural)

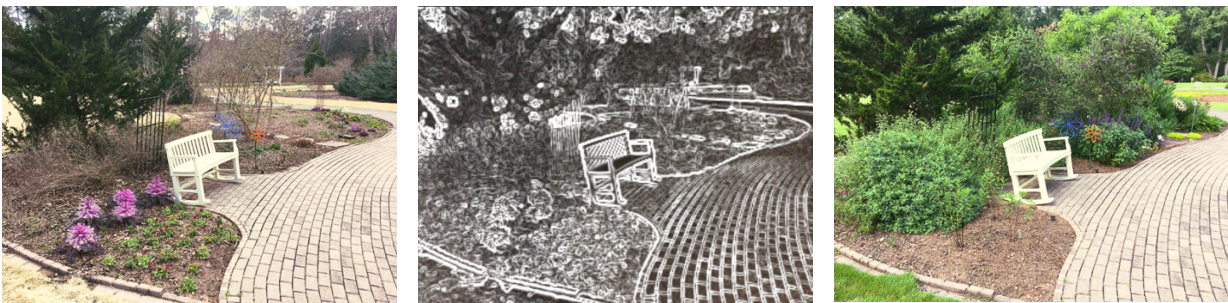


PSS6 - Callaway Gardens Butterfly Center (rural)

Figure 3.3: Site photos. (Photos by G. Huber, August 2020.)

Photo Sampling

Each site was photographed from three vantage points, replicated in winter and summer. The summer photographs were taken before solar noon during the hours of 10am and noon for relative light and shadow consistency. Winter photos were taken during the hours of 2:00 PM and 5:30 PM EST. The camera positions and vantage points for the summer photographs were closely matched with winter photographs using the Timeshutter © 2017 Pixnbit Inc. software application, overlaying ghost images for positioning.



Winter Photo

"Timeshutter" Ghost Image

Summer Photo

Figure 3.4: Winter and summer photo alignment using software application. (Photo alignments created using Timeshutter © 2017 Pixnbit Inc. software application on iPhone 6.)

To minimize bias caused by image vibrance or color intensity, summer and winter photos were corrected using Adobe Lightroom © 2020 Adobe to improve color and tonal consistency (Broich 2019) (Figure 3.5).

Image specific corrections to improve color and tonal consistency using Adobe Lightroom

- Raw Images



- Photos after edits



Figure 3.5: Image corrections to improve color and tonal consistency. (Image corrections created using Adobe Lightroom © 2020 Adobe.)

Insect Density

To validate insect presence on the chosen pollinator study sites (PSS), visual assessment of insect activities was performed as follows. Insect counts of the orders *Hymenoptera*, *Diptera*, and *Lepidoptera* were performed along four transects per site. Observations were recorded between the hours of 10:00 a.m. and 4:00 p.m. EST on August 15, 2020 (PSS1, PSS2, PSS3, PSS4) and August 21 (PSS5, PSS6).

Observational field data was collected on insect density and plant richness with an adapted version (Figure 3.6) of the bee abundance monitoring procedures along transects outlined in the U.S. Department of Transportation Federal Highway Administration technical report titled “Roadside Revegetation; An Integrated Approach to Establishing Native Plants and Pollinator Habitat” (Armstrong, et al., 2017). Four perpendicular transect layouts were equally spaced along the greatest length of each study site. Transect lengths varied slightly across the

sampling area according to site dimensions and constraints, and observation times were adjusted according to length based on a 1 minute per 10 feet of transect calculation. For example, a 30 foot transect was observed for 3 minutes. Only species in bloom at the time of observation were included in counts.

A visual survey to assess insect presence was conducted across four transects on each of six study sites, totaling twenty-four transects (six study sites x four transects = twenty-four (24)). Four equally spaced transects were established at perpendicular angles along the longest margin of each site using a tape measure.

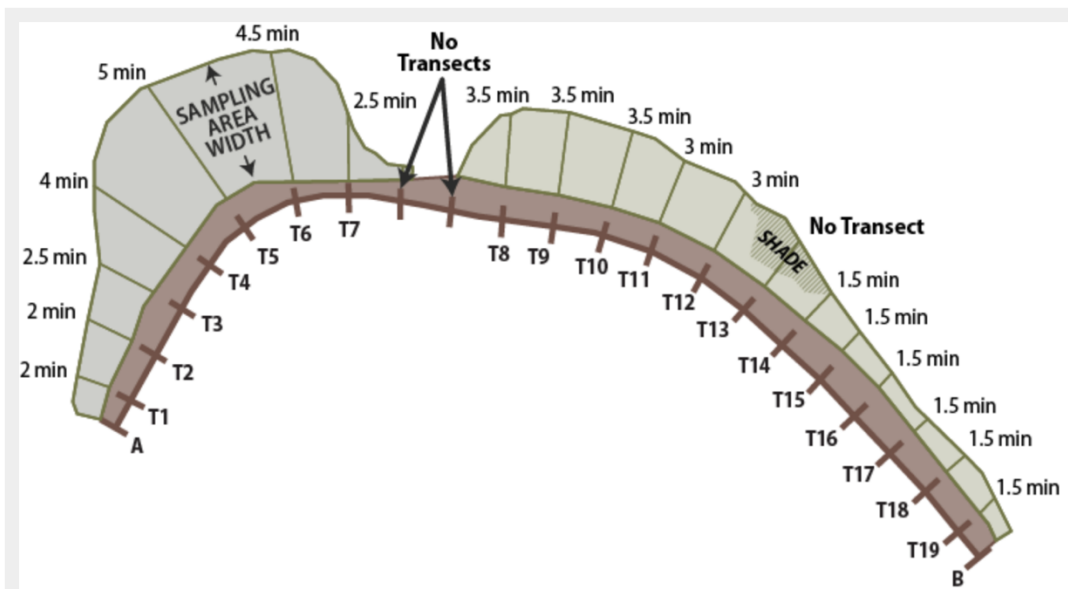


Figure 6-18 | Transect layout on roadsides for Bee Abundance monitoring procedures

Multiple transects for pollinator surveys are laid out similarly to those described in [Section 6.3.6](#) for each roadside sampling area. In this example, survey times are based on 1 minute per 10 feet of transect. Transects that are shaded from the sun are not sampled, nor are transects that are less than 10 feet.

Figure 3.6: Example of transect layout for Bee Abundance monitoring procedures. (Transect layout for pollinator surveys “Roadside Revegetation: An Integrated Approach to Establishing Native Plants and Pollinator Habitat.” U.S. Department of Transportation Federal Highway Administration, 2017.)

Richness of Plant Species

In addition to the visual survey of insect orders, a list of plant species within 3 feet of each side of the transect line was recorded and photographed. The presence or absence of flowers was recorded for each species at the time of observation, and a list of anticipated bloom time was included in Table 4.8.

Human Elements

Site photos were keyed for the presence of up to seven human elements: bench, lamp post, pedestrian walk, signage, sculpture/art, constructed perimeters (post and chain, railing, or fencing), and mowed perimeter. Site photos were taken from different perspectives capturing different combinations of human elements to evaluate their influence on same-site perceptions. Photos A, B, C for summer and winter presented different combinations of human elements. The number of human elements in photos A, B, C for summer and winter were keyed, then averaged for each site (Table 3.2).

Table 3.2: Summary of human elements occurring on each study site.

Site	Human Elements Presented in Photos							Avg. # of human elements featured across site photos summer/winter/6.
	bench	lamp post	ped. walk	signage	sculpture /artwork	constructed perimeter	mowed perimeter	
PSS1			Y		Y	Y	Y	3.33
PSS2	Y	Y	Y	Y		Y	Y	3.33
PSS3	Y		Y	Y	Y		Y	2.66
PSS4			Y	Y		Y		1.33
PSS5	Y		Y	Y		Y	Y	3.00
PSS6	Y		Y	Y	Y	Y	Y	3.66

Survey Instrument

A survey instrument was developed based on the protocols and methods for online survey research (Dillman et al. 2014). The materials for data collection, consent form, and recruitment materials were submitted and received exemption approval from the University of Georgia Institutional Review Board (IRB ID: PROJECT00002699) approved on August 26, 2020 (Appendix A). The survey instrument was created and hosted using Lighthouse Studio © 2020 Sawtooth Software made available through an academic grant award (Appendix B). Due to the challenges of using the internet to effectively reach all segments of the general population (Dillman, et al. p.69), surveys were distributed by list-serve to a convenience sample frame of green-industry practitioners on September 12, 2020, and Master Gardener Extension Volunteers on September 18, 2020. The sample frame selected for the study represents individuals whom I have an interest in better understanding for training purposes in my role as a University of Georgia Cooperative Extension employee. An added benefit of using the convenience sample frame was that individuals had a reasonable expectation to receive a survey invitation from the surveyor and therefore was likely to increase the trust factor and response rate (Dillman 2014).

A pilot study was distributed electronically on September 3, 2020 at 9:24 AM EST to collect responses and input from UGA Extension agents and specialists (n=34) and comments and input informed survey adjustments.

Gardening Experience

The survey instrument gathered information on gardening knowledge and experience to assess potential correlations with choice preferences. The questions addressed included:

- Average weekly gardening time during the growing season.
- Years of gardening experience.

- Pollinator plant identification (1 question).
- Pollinator insect identification (1 question).
- Trainings attended in the last 12 months.
- University affiliation.
- Years of professional experience in a green industry related career.
- Professional niche (skip logic).
- Industry-related licenses and certifications (skip logic).

Demographics

The survey instrument gathered general demographic information to assess potential correlations with choice preferences. Demographic questions included:

- Zip code
- Age
- Sex
- Race
- Highest level of formal educational

Choice-Based Conjoint Exercise

While the physical features of the landscape can be studied somewhat quantitatively, the study of human preferences is more subjective (Gobster 2019). This study employed a discrete choice experiment using conjoint analysis, traditionally used in assessing consumer preferences in product marketing, to the realm of landscape architecture. The design of the questionnaire was informed by the theoretical frameworks for ecological aesthetics discussed in the literature review in Chapter 2. Study sites used in the study represent various “cues to care” such as mowed perimeters (Nassauer 1995), presence or absence of bare areas (Hands and Brown 2002), and signage and walkways (Gobster 2007).

Human emotions, preferences, and decisions are complex, and choices are typically not based solely on isolated elements in the landscape, but on the sum of parts. Conjoint analysis studies are used to identify the relative importance of key attributes and predict the preferences for consumer choices (Sawtooth 2013). The aim of this study is to better understand public preferences for pollinator spaces using a photo-based discrete choice experiment, a form of conjoint analysis. Participants were presented with randomized designs for six parks having different attribute combinations. The theory and protocols of survey design by Dillman and others will underpin the structure of the survey instrument for collecting demographic information, gardening knowledge, and perceptions of the target sample (Dillman 2014). Pollinator study sites will be selected across a rural to urban gradient representing a variety of design approaches. Data on plant species and insect density will be collected using adapted methodologies of the Federal Highway Administration (Armstrong, et al., 2017).

Conjoint analysis is used to effectively predict consumer choices and preferences for products by presenting choice exercises and determining which attributes carry the most weight. Proponents of this methodology contend that choice-based decisions more closely mimic product buying decisions than max-diff experiments that require respondents to use a rating scale for independent attributes. Consumer products can be broken down into a few key attributes and concepts can easily be compared in a word table. This allows attributes to be scrambled into variations and presented to respondents in choice exercises. This methodology provides an efficient means for researchers to determine utility weights for different attributes and predict product designs that are likely to succeed. For example, credit card products might be easily compared using the attributes of brand, annual fee, and interest rate (Table 5.5).

Table 3.3: Example of choice-based conjoint exercise.

OPTION A	OPTION B	OPTION C
VISA	MASTERCARD	AMERICAN EXPRESS
No Annual Fee	\$50 Annual Fee	\$100 Annual Fee
15.0 % interest rate	10.0 % interest rate	9.0 % interest rate

However, in contrast to consumer products, landscapes are not easily compared in written format. For example, Table 5.5 illustrates the complexity of comparing a relatively simple landscape concept in table format. Complex tables describing landscapes would likely cause respondent fatigue and diminish response rates.

Table 3.4: Comparing landscape attributes in table format.

OPTION A	OPTION B	OPTION C
Red cedar bench	Cast iron bench	Cast concrete bench
Cast iron lamp post	Wooden lamp post	Aluminum lamp post
Asphalt walkway	Concrete paver walkway	Brick walkway
Canadian Hemlock	Southern Magnolia	Cryptomeria
Dogwood	Redbud	Fringe Tree
George Taber Azalea	Forsythia	Indian Hawthorne
Pachysandra	Vinca	Ajuga

To address the issue of respondent fatigue, concepts were presented in visual format rather than having participants compare complex word tables. This required special programming in the background, where a table of all possible concepts (36 possible concepts: six sites by three views by two seasons) was created and assigned an image to conditionally display anytime the concept was used in the choice-based conjoint exercise. This allowed the comparison of randomly generated concepts using conditionally displayed images rather than word tables.

The choice-based conjoint/discrete choice exercise was created using Lighthouse Studio © 2020 Sawtooth Software, whereby respondents were presented with thirty-two (32) site iterations, two per screen by sixteen (16) screens and asked to select the image they most preferred. Respondents were also offered a “None: I wouldn’t choose either of these” option. Each screen randomly presented iterations of differing combinations of site attributes and attribute levels. Images were discretely tagged in the background with attributes and levels so that respondents were unaware that each iteration represented a particular combination of attributes, such as “site PSS1 x photo B” (Table 3.3).

Table 3.5: Discrete choice experiment attributes and levels.

ATTRIBUTE 1: SITE

Levels:

- Site – PSS1
- Site – PSS2
- Site – PSS3
- Site – PSS4
- Site – PSS5
- Site – PSS6

ATTRIBUTE 2: PHOTO

Levels:

- Photo – A
- Photo – B
- Photo – C

The exercise was repeated for winter and summer seasons using the photos A, B, and C for winter/summer photos. This resulted in six sites x three possible vantage points = eighteen (18) unique summer and eighteen (18) unique winter concepts. (total of thirty-six (36) possible concepts). Conditional display was coded in the Lighthouse Studio © 2020 Sawtooth Software tool to substitute a photo/image for each possible set of attribute combinations (eighteen (18) winter/ eighteen (18) summer). Respondents were presented with six exercises comparing two summer concepts per screen and asked to select the most appealing concept in each comparison (Figure 3.7). The same was repeated for winter concepts.

Imagine you are standing in each of these park spaces, which of these is more appealing to you?



NEITHER: I wouldn't choose either of these.

Select

Figure 3.7: Sample question – site preferences (discrete choice experiment). (Lighthouse Studio, Version 9.8.1. © 2020 Sawtooth Software, Provo UT 84604-6508.)

Two independent choice-based conjoint (CBC) exercises compare winter to winter and summer to summer concepts. A third, mock CBC exercise, presents four fixed concepts comparing winter to summer images (excluded from the CBC analysis to prevent skewing the winter-winter and summer-summer comparisons). The goal of this particular exercise was to study the effects of summer and winter seasonality on preferences, similar to a study by Broich (2019). For example, an image of site PSS2-summer was compared with an image of PSS6-winter, then the reciprocal (using different images) presents PSS2-winter with PSS6-summer. The goal of this experiment was to determine if respondent choices were based on site or seasonality, for example if a respondent preferred site PSS2 summer over site PSS6 winter, then later preferred site PSS6 summer over site PSS2 winter, this might suggest that the respondent is choosing summer seasonality over winter seasonality regardless of site design.

Table 3.6: Contrast experiment/reciprocal comparison of seasonality on preference.

Summer and winter reciprocal concept comparison exercise to study the effects of seasonality on preferences

Concept 1	Site PSS2, photo C (Summer)	Site 6, photo C (Winter)
Concept 2	Site PSS6, photo B (Summer)	Site 2, photo B (Winter)
Concept 3	Site PSS3, photo C (Summer)	Site 5, photo C (Winter)
Concept 4	Site PSS5, photo A (Summer)	Site 3, photo A (Winter)

Keyword Analysis

To gain a deeper understanding of human perceptions of pollinator habitats, respondents were asked to rate each site using a scale ranging from “extremely acceptable” to “extremely

unacceptable.” This provided additional preference data to supplement the discrete choice experiment.

A multiple select keyword analysis included positive, negative, and neutral options relative to all study sites to gather perception data from respondents relative to study sites. Six summer images were presented, one of each pollinator study site (PSS). Winter images were excluded from the keyword analysis to minimize respondent fatigue.

Table 3.7: Keyword analysis.

Positive Keywords

Orderly
Clean
Safe
Nurtured
Attractive
Useful
Vibrant
Eco-Friendly

Negative Keywords

Disorderly
Messy
Unsafe
Neglected
Unattractive
Useless
Dull
Untamed

Neutral

Neither Attractive nor Unattractive
Other _____

Acceptability

Respondents were asked if different park spaces would be acceptable or unacceptable in their local area of primary residence (Figure 3.8). Visual midpoints and balanced scales were used for answers (Dillman 2014, 157).

Would this park space be acceptable or unacceptable in your local area of primary residence?



- Extremely acceptable
- Somewhat acceptable
- Neither acceptable nor unacceptable
- Somewhat unacceptable
- Extremely unacceptable

Figure 3.8: Sample question – acceptability of site PSS3. (Lighthouse Studio, Version 9.8.1. © 2020 Sawtooth Software, Provo UT 84604-6508.)

Value Ranking

A drag and drop ranking method question measured respondent priorities for the hypothetical use of park space (Dillman 2014, 145). This data may help to explore how values and priorities may correlate with design preferences (Figure 3.9).

Suppose you have been asked to prioritize the use of limited public park space in your local area. According to your personal values, rank in order from the highest priority to the lowest priority for the general use of public park space in your local area. (drag and drop to ranking table).

Items to Rank	Highest Priority
Community vegetable gardens	
Ornamental gardens	
Recreation	
Social interaction	
Wildlife habitat	
	Lowest Priority

Figure 3.9: Sample question – park space priority ranking. (Lighthouse Studio, Version 9.8.1. © 2020 Sawtooth Software, Provo UT 84604-6508.)

Statistical Analysis

Data collected in the choice-based conjoint exercise was analyzed for preference. The relative impact of each attribute and level (A1: Site, L: 1-6; A2: Photo, L: A, B, C) was examined in Lighthouse Studio © 2020 Sawtooth Software using Hierarchical Bayesian (HB) estimation to produce a set of utility scores for the attribute list for each respondent. The utility scores for each CBC exercise summer and winter were generated for site and image for each respondent. These utility scores were compiled in an Excel spreadsheet and exported to JMP®, Version 15.0. SAS Institute Inc. statistical software for further analysis. Data was subjected to a two-way analysis of variance (ANOVA) for site and season, and a means separation was performed Tukey’s HSD. This multiple/pairwise letters comparison identified statistically significant pairs and differences in a letters report, with same letters representing similar means and differing letters indicating dissimilar means. The study assumed a statistical significance probability value

of $P < 0.05$ (5% probability). A test of homogeneity of variance was done using the Bartlett test. The assumption of homogeneity of variance was met for the factor of season (F-Ratio=4.4121, DF=1, $P=0.0357$) but showed unequal variance for the factor of site (F-Ratio=140.3237, DF=5, $P < .0001$). This may be attributed to outliers in the data. However, given the normal distribution of data and the large sample size ($N=331$), the study proceeded with the analysis of the data using a two-factor ANOVA for site and season.

Demographics, knowledge, and experience collected in the survey instrument was studied for correlation with preference data from the CBC. Additionally, data from the acceptability ratings was compared with the CBC experiment to assess consistency and/or contrast.

CHAPTER 4

RESULTS

Survey Results

The survey instrument was distributed to a non-random convenience sample using a listserv of 1,140 landscape practitioners on September 12, 2020 at 6:30 AM EST and a list serve of 2,500 Master Gardener Extension Volunteers on September 18, 2020 at 10:27 AM EST. Respondent results (n=424) and a response rate of 12% was retrieved at 2:00 PM EST on September 18th for this study report.

Demographics

Respondents were 69% female, 28% male with 70% of respondents reported an age range of 59 to 78, with 5% age 18-38, 6% age 39-48, 17% age 49-58, 36% age 59-68, 34% age 69-78, and 2% age 79 and older (n=355, Figure 4.1). Ninety-six percent 96% of respondents had some level of college credit, with 82% earning a college degree (7% associate's, 36% bachelor's, 28% master's, 6% professional, 5% doctorate).

What is your age in years?

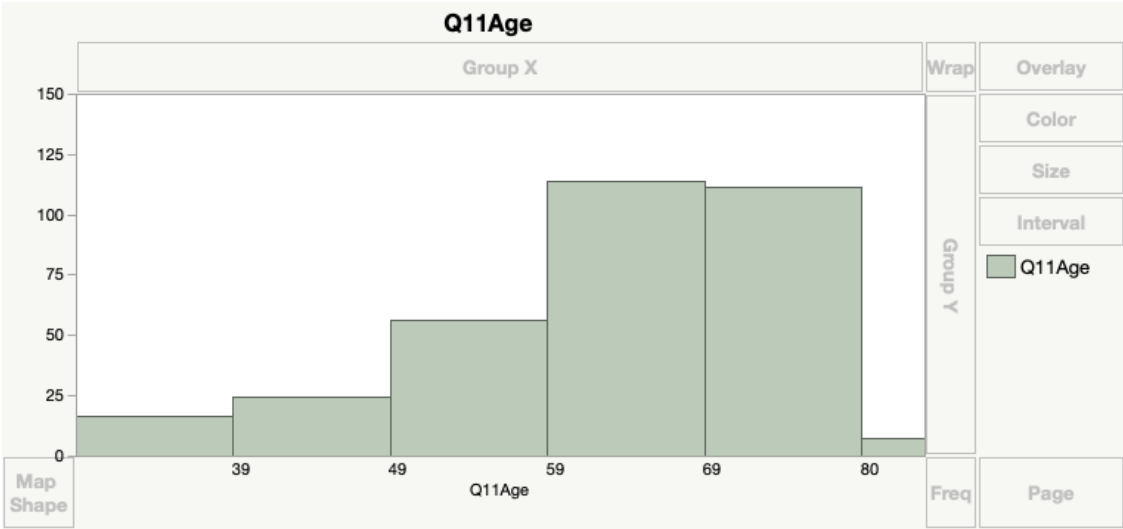


Figure 4.1: Respondent demographics histogram of age (years). (JMP®, Version 15.0. SAS Institute Inc., Cary, NC, 1989-2019.)

Table 4.1: Summary of demographic responses.

Q12: What is your sex?		(n=355)
Choices	#	%
Male	98	28%
Female	247	69%
Prefer not to answer	10	3%

Q13: How would you describe yourself?		(n=355)
Choices	#	%
White	317	89%
Black	6	2%
Asian	2	1%
American Indian	0	
Pacific Islander	0	
Two or more races	10	3%
Prefer not to share	20	6%

Q14: What is the highest degree or level of school you have completed? (n=354)

Table 4.1: Summary of demographic responses.

Choices	#	%
No schooling completed		
Nursery school		
Grades 1 through 11		
12th grade—no diploma	1	
Regular high school diploma	12	3%
GED or alternative credential		
Some college credit, but less than 1 year of college	16	5%
1 or more years of college credit, no degree	31	9%
Associates degree (for example: AA, AS)	25	7%
Bachelor’s degree (for example: BA, BS)	128	36%
Master’s degree (for example: MA, MS, MEng, MEd, MSW, MBA)	100	28%
Professional degree beyond bachelor’s degree (for example: MD, DDS, DVM, LLB, JD)	23	6%
Doctorate degree (for example, PhD, EdD)	18	5%

Gardening Knowledge and Experience

Ninety-six percent 96% of respondents spent at least one day per week engaged in vegetable or flower gardening during the growing season, and seventy-six percent 76% spent three or more days per week in the garden (Table 4.2). The majority of respondents first experienced gardening between the ages of five and ten years old (Figure 4.2).

Table 4.2: Summary of gardening knowledge and experience.

Q1: During an average week in the growing season, how often do you engage in vegetable or flower gardening? (n=367)		
Choices	#	%
None	13	4%
1-2 days per week	79	22%
3-4 days per week	105	29%
5-6 days per week	101	28%
Daily	69	19%

Table 4.2: Summary of gardening knowledge and experience.

Q3: What type of flower is pictured below? (n=362)		
Choices	#	%
Daylily	3	1%
Goldenrod	35	10%
Milkweed (correct answer)	304	84%
Marigold	20	6%

Q4: What type of insect is pictured below? (n=358)		
Choices	#	%
Yellow jacket	22	6%
Wasp	2	1%
Honeybee (correct answer)	312	87%
Carpenter bee	22	6%

Q5: How many UGA Cooperative Extension gardening or landscape trainings did you attend in last 12 months? (n=362)		
Choices	#	%
0	136	38%
1	44	12%
2	52	14%
3	36	10%
4	24	7%
5	14	4%
6	14	4%
7	4	1%
8	8	2%
9	3	1%
10	10	3%
12	9	2%
More than 12	8	2%

At what age did you first experience gardening?

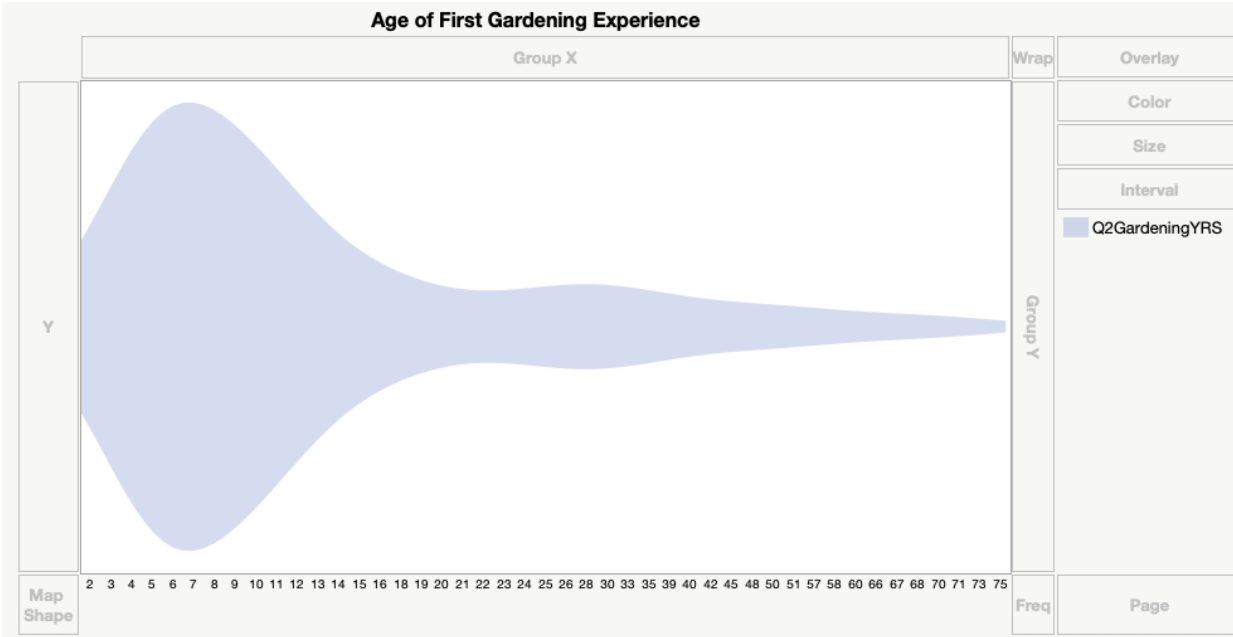


Figure 4.2: Respondent demographics – age of first gardening experience (years). (JMP®, Version 15.0. SAS Institute Inc., Cary, NC, 1989-2019.)

Professional Experience, Licensing, Certification

Sixty-nine percent 69% of respondents had no professional experience in a landscape, arboriculture, or horticulture-related career. Of the remaining thirty-one percent 31%, approximately one quarter had 1-5 years of experience, with one in five respondents having teaching experience (Table 4.3).

Approximately one-half of respondents (n=176) had some type of certification or license, 34% pesticide applicators license, 34% certified Master Gardener Extension Volunteer, 14% Georgia Certified Plant Professional, and 10% Georgia Certified Landscape Professional.

Table 4.3: Summary of professional experience, licensing, certification.

Q7: How many years of professional experience do you have in a landscape, arboriculture, or horticulture-related career? (n=361)

Choices	#	%
None	249	69%
1-5 years	29	8%
6-10 years	13	4%
11-20 years	22	6%
21-30 years	22	6%
31-40 years	18	5%
41-50 years	7	2%
More than 50 years	1	<1%

Q8: (Conditional, if non-zero response to Q7) What segment of the industry best describes your professional experience? (n=111)

Choices	#	%
Educator	21	19%
Garden Center Retailer	8	7%
Greenhouse or Nursery Grower	7	6%
Irrigation Contractor	1	1%
Landscape Architect	2	2%
Landscape Contractor	14	13%
Landscape Manager	9	8%
Other (please specify)	49	44%




Q9: What professional licenses or certifications related to landscaping, horticulture, or arboriculture do you have (select all that apply)? (n=176)

Choices	#	%
Georgia Certified Landscape Professional	11	10%
Georgia Certified Plant Professional	16	14%
Georgia Pesticide Applicators License	38	34%
International Society of Arboriculture	9	8%
Master Gardener Extension Volunteer	38	34%
National Association of Landscape Professionals	1	1%
Native Plant-Related Certificate	6	5%
Parks and Recreation-Related Certification	0	0%
Pollinator-Related Certification	10	9%
Registered Landscape Architect	2	2%
Turfgrass-Related Certification	8	7%
None of the Above	21	19%
Other (please type)	16	14%

Acceptability

In the acceptability exercise, site PSS1 was rated the least acceptable overall, with 64% of responses indicating “somewhat acceptable or extremely unacceptable.” Site PSS6 was rated as the most acceptable overall with 96% of responses indicating “Somewhat acceptable or extremely acceptable.” Sites PSS3 and PSS5 were presented with and without human elements at different points in the acceptability exercise (Table 4.4). The acceptability rating increased for sites PSS3 and PSS5 with the presence of human elements; site PSS3 increased from 61% to 81% “somewhat acceptable or extremely unacceptable” and site PSS5 increased from 65% to 96%.

Table 4.4: Summary of site acceptability ratings.

	Site	% Somewhat acceptable or extremely acceptable	% Neither acceptable or unacceptable	% Somewhat unacceptable or extremely unacceptable
	PSS1	27%	9%	64%
	PSS2	93%	3%	4%
	PSS3 (without human elements)	61%	13%	27%

	PSS3 (with human elements)	81%	6%	9%
	PSS4	84%	7%	9%
	PSS5 (without human elements)	65%	13%	22%
	PSS5 (with human elements)	96%	2%	2%
	PSS6	96%	2%	2%

Keyword analysis

Respondents (n=325) selected keywords describing each site using a multiple select question format. Options were presented in a balanced table of eight positive and eight negative keywords. Overall, study site PSS1 received the lowest count of positive keywords (165, 20% positive) and the highest count of negative keywords (652, 80% negative). In contrast, site PSS6 received the overall highest count of positive keywords (1,647, 98% positive) and the lowest

overall count of negative keywords (26, 2% negative). Overall, positive keyword counts for sites PSS2-PSS6 outweighed negative keyword counts with the top three being PSS6, PSS5, and PSS2 (Table 4.5).

Table 4.5: Summary of negative and positive keyword counts.

Study site:	Negative keyword count:	Positive keyword count:
PSS1	652	165
PSS2	54	1,328
PSS3	59	1,082
PSS4	110	829
PSS5	42	1,328
PSS6	26	1,647

The distribution of positive keywords selection was somewhat balanced across choice options, the two most frequently selected keywords were: “clean” 16.7% and “orderly” 16.4%. The most frequently selected negative keywords were: “untamed” 19.8% and “disorderly” 17.6%. The least selected positive keywords were “eco-friendly” 11.8% and “safe” 11.7%. The least selected negative keywords were “useless” 3.7% and “ugly” 4.8%. Table 4.6 provides an overall summary of keyword frequency.

Table 4.6: Keyword frequency.

Positive keyword	Total count	% of positive count
Clean	1,211	16.7%
Orderly	1,187	16.4%
Attractive	966	13.3%
Useful	932	12.9%
Nurtured	871	12.0%
Eco-friendly	853	11.8%
Safe	844	11.7%
Negative keyword	Total count	% of negative count
Untamed	233	19.8%
Disorderly	207	17.6%
Dull	194	16.5%
Messy	190	16.1%
Neglected	176	14.9%
Unsafe	75	6.4%
Ugly	57	4.8%
Useless	44	3.7%

Insect Density

Pollinating insects were observed on species in bloom by a one-time visual assessment using transect walks. The presence of plants in bloom and full sun were key factors in insect counts. On all sites, insect activity was noticeably greater on flowering plants as the sun emerged from cloud cover. Species lacking bloom had only occasional insect visitors while flowering plants were host to a variety of activity.

The scheduling of site visits was impacted by the COVID-19 shelter in place ordinance in early summer followed by safety concerns resulting from riots and social unrest in close proximity to the study sites. Scheduled visits were cancelled on several occasions in response to these circumstances. Sites PSS1-PSS4 were observed on August 15, 2020 and sites PSS5-PSS6 were observed on August 20, 2020. Partly cloudy conditions and approaching storms may have

influenced insect counts on sites PSS1 & PSS2. Additional site visits across the season would provide more comprehensive data.

Despite less than ideal conditions and insufficient data to determine conclusive insect densities, the presence of insect pollinators was confirmed on all study sites (Table 3.6, see also Appendix C). While the study focused on insect pollinators, the presence of other arthropods including spiders (*Araneae*) and beetles (*Coleoptera*) were also observed (Appendix C).

Table 4.7: Summary of insect counts and *mean density per site. (*Note: Insufficient data to determine conclusive densities (single sampling date under unfavorable conditions).

<i>Order</i>	<i>Hymenoptera</i>			<i>Diptera</i>	<i>Lepidoptera</i>	<i>*Mean density (#/ft.) x 10</i>
<i>Site</i>	<i>Small Bees</i>	<i>Honeybees</i>	<i>Wasps</i>	<i>Flies</i>	<i>Butterflies</i>	
PSS1	0	6	3	7	1	1.42
PSS2	7	0	0	4	2	1.09
PSS3	9	1	12	6	8	3.08
PSS4	3	3	34	4	8	5.99
PSS5	8	1	23	7	5	4.08
PSS6	10	0	5	16	4	6.17

Plant Species Richness

A plant species inventory was conducted across all study sites (Table 4.8). A sum of 77 plant species was found across the six study sites. Most inventories were significantly different across the study sites. No particular plant species were present across all sites, and only 14 plant species occurred on multiple study sites.

Table 4.8: Inventory of plant species and bloom time (study sites PSS1-PSS6). (The data analysis relied on spreadsheets using Microsoft Excel Ver. 16.41 © 2020 Microsoft.)

Scientific Name	Common Name	Habit	Bloom Times by Month	Bloom Observed	PSS1	PSS2	PSS3	PSS4	PSS5	PSS6
<i>Acer rubrum</i>	Red Maple	Tree	March-April	N			Y			
<i>Allium tuberosum</i>	Chives	Forb	April-May	N						Y
<i>Alternanthera philoxeroides</i>	Alligator Weed	Forb	July-Aug.	Y				Y		
<i>Ampelopsis brevipedunculata</i>	Porcelainberry Vine	Vine	July-Aug.	N			Y			
<i>Amsonia hubrichtii</i>	Amsonia	Forb	April-May	N						Y
<i>Andropogon gerardii</i>	Big Bluestem	Grass	Aug.-Sept.	Y			Y			
<i>Andropogon virginicus</i>	Broomsedge	Grass	Sept.-Oct.	N				Y	Y	
<i>Asclepias curassavica</i>	Tropical Milkweed	Forb	June-Oct.	Y						Y
<i>Asclepias syriaca</i>	Common Milkweed	Forb	July-Aug.	N				Y		
<i>Asclepias tuberosa</i>	Butterfly Weed	Forb	July-Aug.	N				Y	Y	
<i>Asimina triloba</i>	Paw Paw	Tree	April-May	N						Y
<i>Baptisia megacarpa</i>	Wild Indigo	Shrub	April-June	N				Y		
<i>Baptisia spp.</i>	Indigo	Forb	June-July	N					Y	
<i>Buddlei davidii</i>	Butterfly Bush	Shrub	June-Sept.	Y						Y
<i>Callicarpa americana</i>	Beautyberry	Shrub	June-July	N			Y	Y		
<i>Centaurea cyanus</i>	Bachelor's Button	Forb	May-June	N		Y				
<i>Cercis canadensis</i>	Redbud	Tree	March-May	N	Y					
<i>Chamaecrista fasciculata</i>	Partridge Pea	Forb	Aug.-Sept.	Y			Y	Y		
<i>Clematis virginiana</i>	(Native)	Vine	Aug.-Sept.	Y			Y			
<i>Coreopsis auriculata</i>	Lobed Tickseed	Forb	May-July	N				Y		
<i>Coreopsis major</i>	Forest Tickseed	Forb	May-July	Y				Y		
<i>Coreopsis verticillata</i>	Tickseed	Forb	July-Aug.	Y		Y				Y
<i>Cuphea ignea</i>	Cuphea	Forb	June-Sept.	Y						Y
<i>Cynodon dactylon</i>	Bermuda grass	Grass	July-Aug.	N			Y			
<i>Desmodium</i>	Tick Trefoil	Forb	June-Aug.	N	Y					
<i>Echinacea purpurea</i>	Purple Coneflower	Forb	June-July	Y		Y			Y	
<i>Eupatorium hyssopifolium</i>	Thoroughwort	Forb	Aug.-Sept.	Y			Y	Y		
<i>Eupatorium perfoliatum</i>	Boneset	Forb	Aug.-Sept.	Y			Y			
<i>Eupatorium purpureum</i>	Boneset	Forb	Aug.-Sept.	Y			Y			
<i>Eupatorium rigidum</i>	Joe Pye Weed	Forb	July-Aug.	Y				Y		
<i>Eupatorium serotinum</i>	Boneset	Forb	Sept.-Oct.	Y	Y					
<i>Euthamia graminifolia</i>	Goldentop	Forb	Aug.-Sept.	N				Y		
<i>Gaillardia aristata</i>	Blanket Flower	Forb	June-Aug.	Y				Y		
<i>Hedychium coronarium</i>	Butterfly Ginger	Forb	July-Aug.	Y						Y

Table 4.8: Inventory of plant species and bloom time (study sites PSS1-PSS6). (The data analysis relied on spreadsheets using Microsoft Excel Ver. 16.41 © 2020 Microsoft.)

<i>Hemerocallis</i> spp.	Daylily	Forb	July-Aug.	Y			Y		
<i>Ipomoea indica</i>	Morning Glory	Vine	Aug.-Sept.	N		Y			
<i>Itea virginica</i>	Virginia Sweetspire	Shrub	June	N			Y		
<i>Lespedeza cuneata</i>	Sericea	Forb	Aug.-Sept.	Y			Y		
	Lespedeza								
<i>Leucanthemum</i>	Oxeye Daisy	Forb	June-July	Y		Y			
<i>Ligustrum chinensis</i>	Chinese Privet	Shrub	June-July	N					Y
<i>Liquidambar styraciflua</i>	Sweetgum	Tree	April-May	N			Y		Y
<i>Liriodendron tulipifera</i>	Tulip Poplar	Tree	April-May	N			Y		
<i>Liriope muscari</i>	Liriope	Groundcover	Aug.-Sept.	N					Y
<i>Lonicera japonica</i>	Honeysuckle	Vine	June-July	N			Y		Y
<i>Ludwegia</i> spp.	Seedbox	Forb	June-Aug.	N			Y		
<i>Muhlenbergia capillaris</i>	Muhly Grass	Grass	July-Aug.	N				Y	
<i>Nepeta</i> spp.	Catnip	Forb	June-July	Y		Y			Y
<i>Panicum virgatum</i>	Switchgrass	Grass	Aug.-Sept.	N		Y			
<i>Passiflora incarnata</i>	Passion Flower	Vine	May-Aug.	N				Y	
<i>Penstemon smallii</i>	Beardtongue	Forb	May-June	N				Y	
<i>Pentas lanceolata</i>	Pentas	Forb	June-Aug.	Y					Y
<i>Petroselinum crispum</i>	Parsley	Forb	June-Aug.	Y					Y
<i>Phlox subulata</i>	Phlox	Groundcover	March-	N		Y			
			April						
<i>Phyllanthus urinaria</i>	Chamberbitter	Forb	June-Sept.	N					Y Y
<i>Pinus virginiana</i>	Virginia pine	Tree	-	N			Y		
<i>Pseudognaphalium obtusifolium</i>	Rabbit Tobacco	Forb	Aug.-Sept.	Y			Y		
<i>Pycnanthemum muticum</i>	Mountain Mint	Forb	July-Sept.	N				Y	
<i>Pycnanthemum virginianum</i>	Mountain Mint	Forb	July-Sept.	Y				Y	Y
<i>Quercus acutissima</i>	Sawtooth Oak	Tree	March-	N					Y
			April						
<i>Quercus falcata</i>	Southern Red Oak	Tree	March-	N		Y			
			April						
<i>Rhododendron</i> spp.	Azalea	Shrub	April-May	N					Y
<i>Rhus glabra</i>	sumac	Woody shrub	May-July	N		Y			Y
<i>Rubus</i> sp.	Blackberry	Shrub	May-June	N				Y	
<i>Rudbeckia fulgida</i>	Blackeyed Susan	Forb	July-Aug.	Y		Y		Y	
<i>Rudbeckia triloba</i>	Three lobed	Forb	June-Sept.	Y					Y
	Blackeyed Susan								
<i>Salidago rogusa</i>	Goldenrod	Forb	Aug.-Sept.	Y			Y		
'Fireworks'	'Fireworks'								
<i>Salidago speciosa</i>	Goldenrod	Forb	Aug.-Sept.	Y			Y	Y	
<i>Salidago</i> spp.	Goldenrod	Forb	Aug.-Sept.	N		Y			

Table 4.8: Inventory of plant species and bloom time (study sites PSS1-PSS6). (The data analysis relied on spreadsheets using Microsoft Excel Ver. 16.41 © 2020 Microsoft.)

<i>Salidago spp.</i>	Goldenrod	Forb	Aug.-Sept.	N				Y
<i>Salvia spp.</i>	Salvia	Forb	June-July	N				Y
<i>Sambucus canadensis</i>	Elderberry	Tree	June-July	N				Y
<i>Schizachyrium scoparium</i>	Little Bluestem	Grass	Aug.-Sept.	Y		Y		
<i>Scutellaria lateriflora</i>	Skullcap	Forb	Aug-Oct.	N			Y	
<i>Sedum mexicanum</i>	Lemon Coral Sedum	Forb	June-Aug.	N				Y
<i>Spiraea alba var. latifolia</i>	Meadowsweet	Forb	June-Aug.	Y			Y	
<i>Stokesia laevis</i>	Stokes Aster	Forb	May-July	N				Y
<i>Verbena bonariensis</i>	S. American Verbena	Forb	July-Sept.	N	Y			

Summary

The survey data collected may be useful to study other correlations and analyze the sample frame. Additional diagrams and survey results are provided at the end of this study (Appendix D). The next section provides results, discussions, and conclusions.

CHAPTER 5

RESULTS AND DISCUSSION

Site Preferences

As opposed to surveys using rating scales to generate a preference score for each site, choice-based conjoint analysis (CBC) generates a “utility score” based on a series of respondent preferences in a choice exercise (respondents are presented with randomly generated comparisons and asked to select the most preferred option). The Hierarchical Bayes (HB) estimates of utility scores for the discrete choice experiments for summer and winter revealed the attribute of “site” to be more important in predicting choice than the attribute of “photo” (site 84.98, photo 15.02 (CBC1 summer utilities)), (site 68.77, photo 31.23 (CBC2 winter utilities)). In other words, respondent choice was more dependent on the site being presented (PSS1 through PSS6), than by the photo vantage point (A,B, or C) being presented. Furthermore, the analysis of variance (ANOVA) for site preference utilities revealed significant differences in means across sites PSS1, PSS2, PSS4, and PSS6 (DF=5, F Ratio=502.9835, $p < 0.0001$, $n=424$). Site PSS6 was the most preferred in winter and summer, with a standard deviation skew towards the negative. Site PSS1 was the least preferred site in summer, and in the lower 50% of site preference for winter, although the data showed a somewhat positive skew. (Figure 5.1). A box plot of preference data illustrates the broad range of utility scores for sites PSS1 and PSS6, in contrast to tightly grouped utility scores for sites PSS3 and PSS5 (Figure 5.1). This suggests that

the characteristics of sites PSS1 and PSS6 solicit more scattered opinions while the characteristics of sites PSS3 and PSS5 generate more consensus.

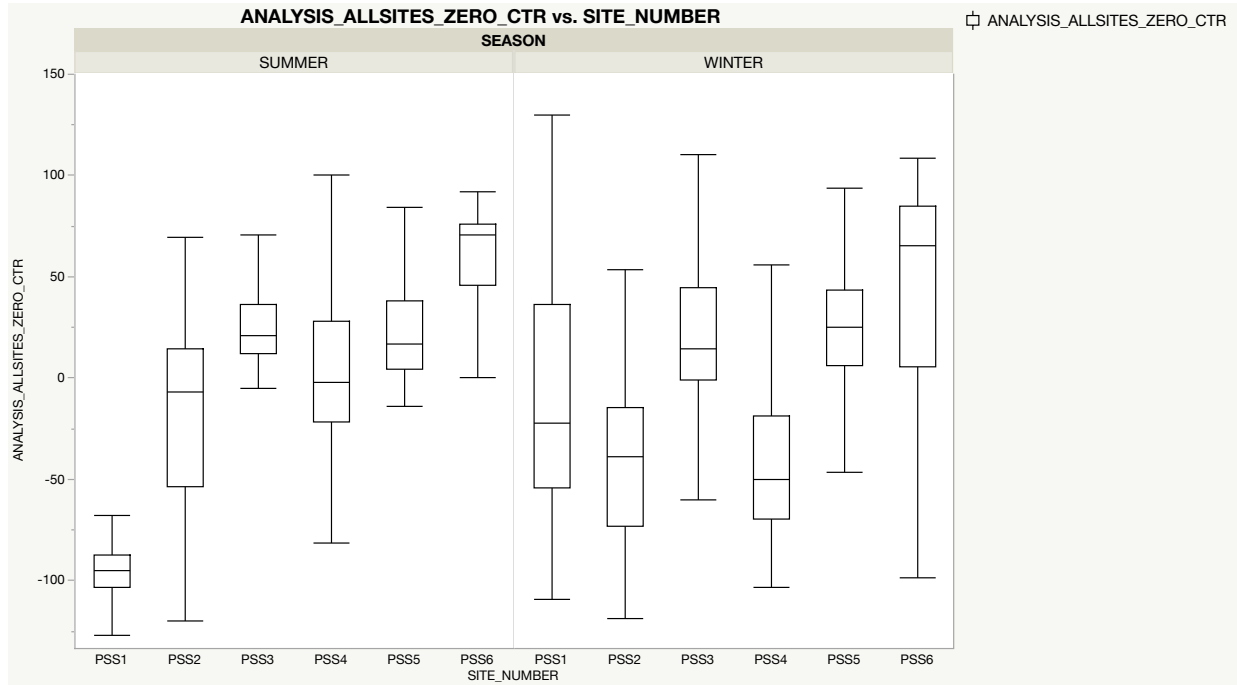


Figure 5.1 – Box Plot – Utility Scores for Winter and Summer Preference by Site (JMP®, Version 15.0. SAS Institute Inc., Cary, NC, 1989-2019.)

A Tukey’s HSD letters comparison found significant pairwise differences among site utility scores for PSS1, PSS2, PSS4, and PSS6, while PSS3 and PSS5 were similar (Table 5.1). Sites PSS3 and PSS5 share pairwise similarities in the Tukey’s HSD as well as receiving a moderate-high utility score for preference in the acceptability exercise. This suggests that the design of these sites may appeal more universally to respondents as compared to sites PSS1 and PSS6.

Table 5.1: Statistical analysis of pollinator site utility scores for preference in two seasons (summer and winter). Pairwise comparisons of means and means separation performed by Tukey’s post hoc test. (JMP®, Version 15.0. SAS Institute Inc., Cary, NC, 1989-2019.)

SITE_NUMBER	SEASON	Letter	Column	Least Squares Mean
PSS6	SUMMER	A		54.6465
PSS6	WINTER	B		40.27964
PSS3	SUMMER	C		25.68687
PSS5	WINTER	C		24.08083
PSS5	SUMMER	C		22.63506
PSS3	WINTER	C		22.3326
PSS4	SUMMER	D		6.576789
PSS1	WINTER	E		-7.69401
PSS2	SUMMER	F		-19.4022
PSS4	WINTER	G		-38.1838
PSS2	WINTER	G		-40.8153
PSS1	SUMMER	H		-90.1431

Seasonality and Site Preference

A Tukey’s pairwise letters comparisons of summer to winter utility scores suggests that some sites exhibit more seasonal balance. An analysis of sites PSS1, PSS2, PSS4, and PSS6 reveals significant differences between winter and summer preferences while sites PSS3 and PSS5 do not exhibit no significant differences across the seasons (DF=5, $p < 0.001$). Sites PSS2, PSS4, and PSS6 were more preferable in summer and site PSS1 was more preferable in winter. Sites PSS3 and PSS5 showed consistently moderate preference across summer and winter, suggesting that the designs of these sites may be more seasonally balanced relative to the other sites.

While a Tukey’s HSD letters comparison demonstrates significant differences in site preference for many of the study sites across the seasons, the HB estimates for attribute importance place more importance on site than season. Secondly, a choice comparison in the

survey instrument comparing same sites using reciprocal seasons reinforces the utility estimates of importance for site over season. A comparison of site PSS2-winter to PSS6-summer resulted in site PSS6-summer being the more favorable choice by 84% of respondents (n=296). A reciprocal comparison PSS2-summer to PSS6-winter had the same result, with a respondent preference for site PSS6-winter of 62%, suggesting that site PSS6 was preferred regardless of seasonality. The same was true in a comparison of sites PSS3 and PSS5, where site PSS5 was more preferable (n=170), regardless of season (Table 5.2).

Table 5.2: Reciprocal choice comparisons of seasonality.

Value	Count	Percent %
CBC3SUMRWTR_Fixed1		
PSS2C_SUMMER	111	31%
PSS6C_WINTER	219	62%
NONE	25	7%
CBC3SUMRWTR_Fixed2		
PSS6B_SUMMER	296	84%
PSS2B_WINTER	41	12%
NONE	16	5%
CBC3SUMRWTR_Fixed3		
PSS3C_SUMMER	110	31%
PSS5C_WINTER	207	59%
NONE	34	10%
CBC3SUMRWTR_Fixed4		
PSS5A_SUMMER	170	49%
PSS3A_WINTER	78	22%
NONE	100	29%

Human Elements and Site Preference

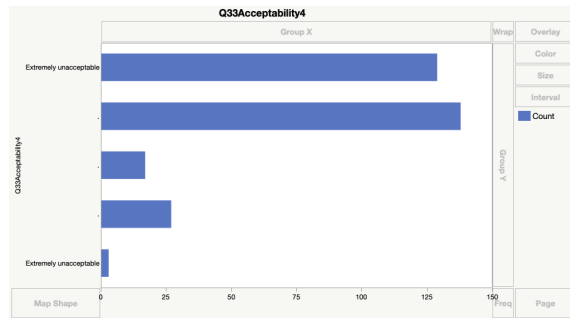
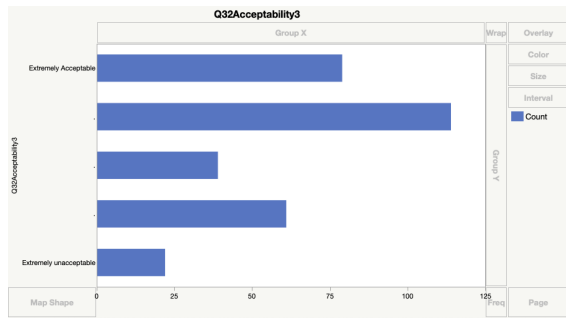
The data suggests some correlation between site preferences and human elements. Respondents were asked “Would this park space be acceptable or unacceptable in your local area of primary residence?” and presented with an acceptability scale ranging from “extremely acceptable” to “extremely unacceptable.” Sites PSS3 and PSS5 were presented with and without human elements at different points in the exercise. The acceptability rating increased for sites PSS3 and PSS5 with the presence of human elements; site PSS3 increased from 61% “somewhat acceptable or extremely unacceptable” to 81% (Figure 5.3) and site PSS5 increased from 65% to 96% (Figure 5.4).

These comparisons suggest that the introduction of a bench and signage may increase acceptability among sites from a moderate range of acceptance to a higher range of acceptance. However, the acceptability increase does not appear to be a linear trend, more human elements does not necessarily equate to a higher preference across all sites. For example, in the discrete choice experiment, site PSS6 had the highest presence of human elements and the highest mean preference utility across all sites. However, the standard deviation and range of preferences for site PSS6 skewed towards the negative. This suggests that high levels of human presence may decrease site preference for certain segments of the sample frame. Additionally, the absence of human elements in site PSS1 did not universally reduce preferences for this site, as the range of preference data skewed towards the positive for some of the survey sample. The comparison suggests that a balance of human elements with nature may result in the most widely accepted treatment.

Would this park space be acceptable or unacceptable in your local area of primary residence?



Would this park space be acceptable or unacceptable in your local area of primary residence?



Acceptability of PSS3 (photo A, summer)

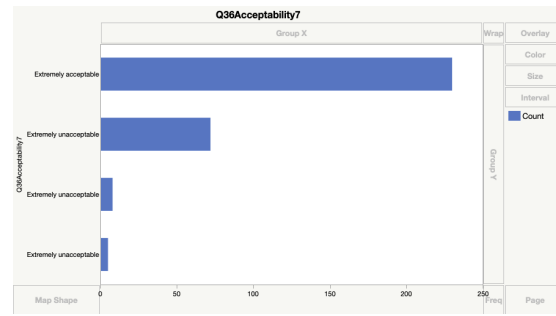
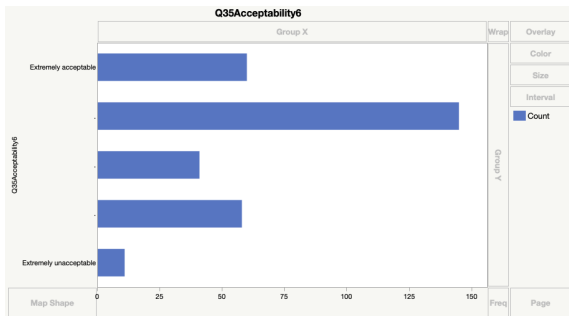
Acceptability of PSS3 (photo B, summer)

Figure 5.2: Analysis – Acceptability comparison with human elements (Site PSS3). (JMP®, Version 15.0. SAS Institute Inc., Cary, NC, 1989-2019.)

Would this park space be acceptable or unacceptable in your local area of primary residence?



Would this park space be acceptable or unacceptable in your local area of primary residence?



Acceptability of PSS5 (photo A, summer)

Acceptability of PSS5 (photo B, summer)

Figure 5.3: Analysis – Acceptability comparison with human elements (Site PSS5). (JMP®, Version 15.0. SAS Institute Inc., Cary, NC, 1989-2019.)

Complexity of Perceptions

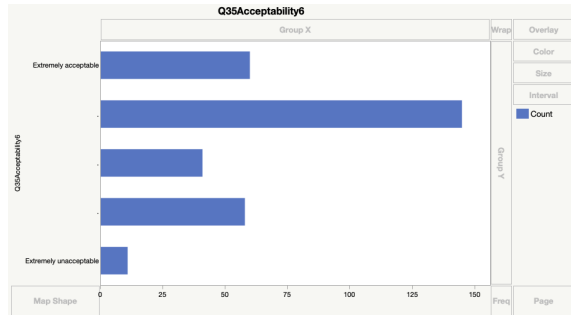
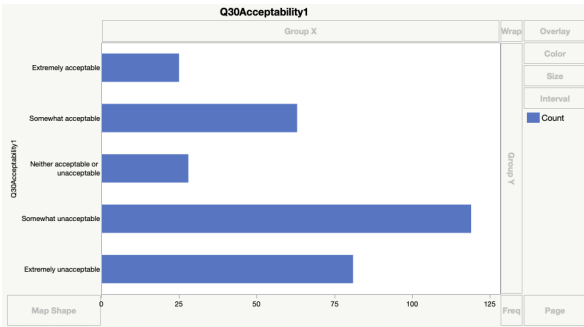
Despite many visual similarities, the acceptability ratings for site PSS1 are much lower than the acceptability ratings of site PSS5 (Figure 5.5). Both images feature: post and chain perimeters, varying amounts of bare soil, hints of buildings in the background, and the presence of trees. Site PSS1 features a paved walkway, and site PSS5 features a mowed perimeter. Despite similarities and the relatively balanced number of human elements, the acceptability ratings are nearly opposite. Additionally, the words used to describe each of these sites in the keyword study reveals opposing attitudes and perceptions (Table 5.3). This comparison perhaps illustrates the subtle nature of acceptance or rejection. Perhaps the visibility of the post and

chains, tree placement, tree color (dark green), and presence of bare soil is enough to drastically influence acceptability.

Would this park space be acceptable or unacceptable in your local area of primary residence?



Would this park space be acceptable or unacceptable in your local area of primary residence?



Acceptability of PSS1 (photo B, summer)

Acceptability of PSS5 (photo A, summer)

Figure 5.4: Analysis – Acceptability comparison sites PSS1 and PSS5. (JMP®, Version 15.0. SAS Institute Inc., Cary, NC, 1989-2019.)

Table 5.3: Keyword comparison of sites PSS1 and PSS5.

<i>Keywords</i>	<i>Total count (PSS1)</i>	<i>Total count (PSS5)</i>
Orderly	2	226
Clean	21	259
Safe	13	184
Nurtured	13	170
Attractive	24	196
Useful	57	230
Vibrant	35	63
Eco-friendly	150	180
Neither Attractive or Unattractive	74	28
Disorderly	164	6
Messy	148	6
Unsafe	62	2
Neglected	152	3
Ugly	43	3
Useless	24	2
Dull	59	20
Untamed	168	8
Other	35	40

Discussion on Gardening Knowledge, Education, and Preferences

The education and gardening knowledge across the sample frame was somewhat homogenous and didn't provide significant contrast to correlate knowledge, experience, and certification with preferences. Eighty-four percent 84% of respondents correctly identified milkweed, an important pollinator plant species (n=362), and 87% of respondents correctly identified a honeybee (n=358) while 96% of respondents reported weekly vegetable or flower gardening at least once per week, with many engaging multiple days per week. The sample frame reported a high level of formal education with 82% of respondents holding a college degree, and 96% of respondents having earned at least some college credit. While the sample frame did not capture enough contrast to correlate gardening knowledge, experience, and certification with preferences, it did provide insights to the preferences of a well-educated

sample frame. The highest mean preference score was site PSS6, one of the more intensely managed sites, and least preferred site was PSS1, perhaps the most least managed site. This suggests that a high level of gardening knowledge and education may not gravitate towards the more natural sites as hypothesized.

Discussion on the use of Conjoint Analysis in Perception Studies

In theory, choice-based conjoint analysis lends itself to the visual analysis of complex landscapes, where hundreds of combinations of attributes could be presented in choice combinations rather than max-diff rating scales for each individual attribute. However, presenting attributes in a completely visual format versus text descriptions presents unique challenges. While consumer products can be broken down into a few key attributes and compared in a word table, landscapes are not easily compared in written format. This requires that concepts be presented in visual format to avoid respondent fatigue and diminish response rates, making the task impractical. (e.g. seven attributes, with five levels for each attribute would require 2,520 unique visual representations (calculated using the combination permutation calculator of $C_r = \frac{n!}{r!(n-r)!}$). A possible solution to visually representing the large number of possibilities generated in a CBC experiment would be the development of a software package with the ability to generate virtual representations from a given list of attributes and levels. This would allow designers to plug in key attributes and levels, generate CBC exercises, and distribute the exercise for client input.

CHAPTER 6

CONCLUSIONS

Research Questions and Conclusions

This chapter will address the sub questions and summarize the key conclusions and hypotheses pertaining to the overarching research question “can a better understanding of human perceptions of pollinator spaces inform design decisions and enhance the public acceptance of pollinator habitats?”

In summary, the study suggests that certain design treatments, such as the Ray (PSS5) and East Park Meadow (PSS3), may increase universal appeal and acceptance across the seasons. Achieving a modest balance of human elements (e.g. signage, pathways, site furnishings, mowed perimeters, planted hedges) and nature may be an important factor in determining habitat success and acceptance. In addition, design treatments reflecting the keywords “clean” and “orderly” versus “untamed” or “disorderly” may also improve pollinator success. Further research exploring the connection between aesthetic attributes and human perceptions is needed to build a knowledge base for increasing the acceptance of pollinator habitats, and ultimately enhancing pollinator success.

The Impacts of Gardening Knowledge and Experience, and Certification on Perceptions

Does gardening knowledge, years of experience, training, and certification impact human perceptions of pollinator habitat? The hypothesis is that respondents with the highest level of

gardening knowledge, Extension trainings, and certification will have more favorable perceptions of the more natural pollinator sites (PSS1, PSS3, PSS4, and PSS5) compared to respondents having less gardening knowledge. The findings in the study neither reject nor fail to reject this hypothesis. The sample frame (convenience sample) and sample size (n=424) used in this study did not provide enough contrast to support any strong conclusions regarding the influences of gardening knowledge, experience, and certification. However, the study did provide evidence that respondents having a high level of formal education (82% college degree) and a high level of gardening knowledge and experience (96% gardening on a weekly basis) had the highest mean preference for landscapes that were “clean” and “orderly” and the lowest acceptance of landscapes that were “untamed” and “disorderly.”

The Impacts of Seasonality on Perceptions

How does winter and summer seasonality impact perceptions? The hypothesis is that summer images of study sites are more favored than winter images of the same sites. The study rejects this hypothesis, finding that while seasonality does influence perceptions for some sites, summer was not consistently more favorable season on each study site (when comparing winter and summer images of the same site, some were more favorable in winter). Additionally, when comparing winter and summer images of different sites, some winter sites were preferred over summer sites regardless of seasonality, suggesting the importance of site over seasonality and rejecting the hypothesis that summer sites would be consistently more favorable than winter sites.

The Impacts of Human Elements on Perceptions

Do human elements, such as the presence or absence of site furnishings, signage, walkways, and defined borders, impact human perceptions and acceptability of pollinator spaces? The hypothesis is that a balance of human care and functionality with pollinator habitat will be more widely accepted across the survey sample than treatments that skew in either direction. The study fails to reject the hypothesis that sites having a modest balance of human elements with pollinator habitat may be more widely accepted as opposed to the lack of human elements or a heavy presence of human elements. While the data suggests a correlation of site preference to the presence or absence of human elements, the range of preference data became broader and more skewed with the strong presence or absence of human elements.

Understanding Perceptions Using Conjoint Analysis

Can a conjoint analysis survey instrument be used as an effective tool in landscape architecture for the study of complex human preferences for the design of space? The hypothesis is that conjoint analysis has potential in landscape architecture perception studies for identifying the most preferable attributes of complex landscapes using a relatively small sample size, similar to consumer product research. The study neither rejects nor fails to reject this hypothesis. While discrete choice experiments using choice-based conjoint (CBC) analysis show great promise for landscape architecture applications, current software frameworks are more conducive to word-based comparisons rather than image-based comparisons. While this can be overcome by generating all possible attribute combinations and assigning images for conditional display, this limitation creates a cumbersome and perhaps impractical approach for identifying preferences in complex landscapes.

Implications

While urbanization and habitat loss have contributed to the decline of pollinator health, new landscapes can be designed to help curb the decline. It is important to gain a better understanding the human perceptions and aesthetic preferences for pollinator spaces in order to improve pollinator success through designed spaces, revise policies, and change public perceptions and attitudes towards pollinator habitats.

The resulting data will be used to develop guidelines and recommendations to inform landscape architects on design strategies that will enhance the success and wider adoption of pollinator habitats in public spaces.

Recommendations and Future Research

This study explored various methodologies to gain a better understand human perceptions of pollinator landscapes in public spaces across Georgia to improve their acceptance and success. A convenience sample of Georgia Master Gardener Extension Volunteers and green industry practitioners was used for the survey instrument; therefore, respondent preferences are not necessarily representative of the general population. With funding, a follow up survey representing the general population would widen the scope of data. Additionally, future studies may explore a larger body of study sites regionally or nationally.

The user interface and presentation of visual choice exercises is user-friendly for respondents and simulates real-world decision making by presenting choices rather than asking respondents to rate dozens of landscapes. However, current software applications do not have the ability to automatically generate visualizations for every possible attribute combination in a

landscape. Therefore, for each possible attribute combination, a visualization must be manually prepared and coded for conditional display, making the process cumbersome and exponentially impractical for the surveyor when assessing complex landscapes with multiple attributes. With software advancements, conjoint analysis may have great potential in predicting choice preferences in complex landscapes.

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APPENDICES

- A Human Subjects Institutional Review Board Approval Letter
- B Web Survey
- C Survey Results
- D Site Data

APPENDIX A

Figure A.1 – IRB Exemption Letter



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IRB@uga.edu
<http://research.uga.edu/hso/irb/>

Human Research Protection Program

EXEMPT DETERMINATION

August 26, 2020

Dear [Jon Calabria](#):

On 8/26/2020, the Human Subjects Office reviewed the following submission:

Title of Study:	Understanding Human Perceptions of Public Park Spaces Using Conjoint Analysis
Investigator:	Jon Calabria
Co-Investigator:	Gregory Huber
IRB ID:	PROJECT00002699
Review Category:	Exempt 2ii

We have determined that the proposed research is Exempt. The research activities may begin 8/26/2020.

Since this study was determined to be exempt, please be aware that not all future modifications will require review by the IRB. For more information please see Appendix C of the Exempt Research Policy (<https://research.uga.edu/docs/policies/compliance/hso/IRB-Exempt-Review.pdf>). As noted in Section C.2., you can simply notify us of modifications that will not require review via the “Add Public Comment” activity.

A progress report will be requested prior to 8/26/2025. Before or within 30 days of the progress report due date, please submit a progress report or study closure request. Submit a progress report by navigating to the active study and selecting Progress Report. The study may be closed by selecting Create Version and choosing Close Study as the submission purpose.

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

APPENDIX B

SURVEY INSTRUMENT

Figure B.1 – Copy of Survey Instrument



College of Environment + Design
UNIVERSITY OF GEORGIA

Survey Consent Letter

Understanding Human Perceptions of Public Park Spaces

Dear Participant,

My name is Greg Huber and I am a student in the Master of Landscape Architecture program under the supervision of Dr. Jon Calabria at the University of Georgia. I invite you to participate in a fifteen minute research study that will provide valuable insight into the design of public spaces.

Participation in this study is voluntary. You must be over 18 years old to participate. You can refuse to take part or stop at any time without penalty. There are no incentives or direct benefits to participation. You may elect not to answer any questions you don't want to answer, and you can end the survey any time.

The study begins with a few gardening and general demographic questions, followed by a series of photo-based questions about public landscapes. Your responses will help us gain a better understanding of public parks and landscapes to improve the enjoyment and benefits they provide to our environment and society.

Survey responses will be kept confidential. Summary results of the research study may be published, but your name or any identifying information will not be used. This

Figure B.1 – Copy of Survey Instrument

research involves the transmission of data over the Internet. Every reasonable effort has been taken to ensure the effective use of available technology; however, confidentiality during online communication cannot be guaranteed.

If you have any questions about this study, please contact Greg Huber at 770-229-3251 or ghuber@uga.edu. If you have any complaints or questions about your rights as a research volunteer, contact the IRB at 706-542-3199 or by email at IRB@uga.edu.

Please feel free to keep a screenshot of this page for your documentation. Thank you for your time and consideration.

Sincerely,

Greg Huber
MLA Candidate
College of Environment and Design
University of Georgia

By selecting “Yes” at the bottom of the page you consent to voluntary participation in this research.

Would you like to continue?

Yes

Consent=1

No

Consent=2

Next

Page Break

SectionBreak1

Part 1 of 5
Gardening Experience
(9 Questions)

Please answer a few questions to help us better understand your gardening experience.

Click "Next" to begin this section.

Back

Figure B.1 – Copy of Survey Instrument

Next

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Page Break

Q1GardenTime

During an average week in the growing season, how often do you engage in vegetable or flower gardening?

None Q1GardenTime=1

1-2 days per week Q1GardenTime=2

3-4 days per week Q1GardenTime=3

5-6 days per week Q1GardenTime=4

Daily Q1GardenTime=5

Back

Next

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Page Break

Q2GardeningYRS

At what age did you first experience gardening?

Age in years

Back

Next

0% 100%

Page Break

Q3Flower

What type of flower is pictured below?



Daylily Q3Flower=1

Figure B.1 – Copy of Survey Instrument

	Q3Flower=2
Goldenrod	
	Q3Flower=3
Milkweed	
	Q3Flower=4
Marigold	
Back	
Next	
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Page Break	

Q4Insect

What type of insect is pictured below?



	Q4Insect=1
Yellow jacket	
	Q4Insect=2
Wasp	
	Q4Insect=3
Honey bee	
	Q4Insect=4
Carpenter bee	

Figure B.1 – Copy of Survey Instrument

Back
Next

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Page Break

Q5Trainings1

How many UGA Cooperative Extension gardening or landscape trainings did you attend in last 12 months?

Number of trainings

Back
Next

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Page Break

Q6UniversityAffil

Are you affiliated with the University? If yes, check all that apply.

Q6UniversityAffil_1

No, I am not affiliated with the University.

Q6UniversityAffil_2

Student

Q6UniversityAffil_3

Employee

Q6UniversityAffil_4

Master Gardener Extension Volunteer

Q6UniversityAffil_5

UGA sports fan

Q6UniversityAffil_6

Q6UniversityAffil_6_other

Other

Back
Next

0% 100%

Page Break

Q7Profession

How many years of professional experience do you have in a landscape, arboriculture, or horticulture-related career?

Q7Profession=1

None

Q7Profession=2

1-5 years

Q7Profession=3

6-10 years

Figure B.1 – Copy of Survey Instrument

	<input type="checkbox"/> Q7Profession=4
11-20 years	
	<input type="checkbox"/> Q7Profession=5
21-30 years	
	<input type="checkbox"/> Q7Profession=6
31-40 years	
	<input type="checkbox"/> Q7Profession=7
41-50 years	
	<input type="checkbox"/> Q7Profession=8
More than 50 years	
Back	
Next	
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	<input type="checkbox"/> Q8ProfessionNiche
What segment of the industry best describes your professional experience?	
	<input type="checkbox"/> Q8ProfessionNiche=1
Educator	
	<input type="checkbox"/> Q8ProfessionNiche=2
Garden Center Retailer	
	<input type="checkbox"/> Q8ProfessionNiche=3
Greenhouse or Nursery Grower	
	<input type="checkbox"/> Q8ProfessionNiche=4
Irrigation Contractor	
	<input type="checkbox"/> Q8ProfessionNiche=5
Landscape Architect	
	<input type="checkbox"/> Q8ProfessionNiche=6
Landscape Contractor	
	<input type="checkbox"/> Q8ProfessionNiche=7
Landscape Manager	
	<input type="checkbox"/> Q8ProfessionNiche=8
	<input type="checkbox"/> Q8ProfessionNiche_8_other
Other (please specify)	<input type="text"/>
Back	
Next	
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	<input type="checkbox"/> Q9LicCert

Figure B.1 – Copy of Survey Instrument

What professional licenses or certifications related to landscaping, horticulture, or arboriculture do you have? (select all that apply)

- Q9LicCert_1
Georgia Certified Landscape Professional
- Q9LicCert_2
Georgia Certified Plant Professional
- Q9LicCert_3
Georgia Pesticide Applicators License
- Q9LicCert_4
International Society of Arboriculture Certification
- Q9LicCert_5
Master Gardener Extension Volunteer
- Q9LicCert_6
National Association of Landscape Professionals Certification
- Q9LicCert_7
Native Plant-Related Certificate
- Q9LicCert_8
Parks and Recreation-Related Certification
- Q9LicCert_9
Pollinator-Related Certification
- Q9LicCert_10
Registered Landscape Architect
- Q9LicCert_11
Turfgrass-Related Certification
- Q9LicCert_12
None of the Above
- Q9LicCert_13

Q9LicCert_13_other
Other (please type)

[Back](#)
[Next](#)

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Page Break

SectionBreak2

Part 2 of 5
Demographics
(5 Questions)

Figure B.1 – Copy of Survey Instrument

The next section presents five (5) general demographic questions to help us better understand how perceptions of park spaces may vary across the survey sample.

Click "Next" to begin this section.

Back
Next

0% 100%

Page Break

Q10ZipCode

What is your Zip Code?

Zip Code

Back
Next

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Page Break

Q11Age

What is your age in years?

Age in years

Back
Next

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Page Break

Q12Sex

What is your sex?

Male

Q12Sex=1

Female

Q12Sex=2

Prefer not to share

Q12Sex=3

Back
Next

0% 100%

Page Break

Q13Race

How would you describe yourself?

White

Q13Race=1

Black

Q13Race=2

Q13Race=3

Figure B.1 – Copy of Survey Instrument

Asian	<input type="text" value="Q13Race=4"/>
American Indian	<input type="text" value="Q13Race=5"/>
Pacific Islander	<input type="text" value="Q13Race=6"/>
Two or more races	<input type="text" value="Q13Race=7"/>
Prefer not to share	
Back	
Next	
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What is the highest degree or level of school you have completed?

No schooling completed	<input type="text" value="Q14FormalEducation=1"/>
Nursery school	<input type="text" value="Q14FormalEducation=2"/>
Grades 1 through 11	<input type="text" value="Q14FormalEducation=3"/>
12th grade—no diploma	<input type="text" value="Q14FormalEducation=4"/>
Regular high school diploma	<input type="text" value="Q14FormalEducation=5"/>
GED or alternative credential	<input type="text" value="Q14FormalEducation=6"/>
Some college credit, but less than 1 year of college	<input type="text" value="Q14FormalEducation=7"/>
1 or more years of college credit, no degree	<input type="text" value="Q14FormalEducation=8"/>
Associates degree (for example: AA, AS)	<input type="text" value="Q14FormalEducation=9"/>
Bachelor’s degree (for example: BA, BS)	<input type="text" value="Q14FormalEducation=10"/>
Master’s degree (for example: MA, MS, MEng, MEd, MSW, MBA)	<input type="text" value="Q14FormalEducation=11"/>
Professional degree beyond bachelor’s degree (for example: MD, DDS, DVM, LLB, JD)	<input type="text" value="Q14FormalEducation=12"/>

Figure B.1 – Copy of Survey Instrument

Q14FormalEducation=13

Doctorate degree (for example, PhD, EdD)

Back

Next

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Page Break

SectionBreak3

Part 3 of 5
Preferences
(16 Questions)

In the next series of questions, you will be presented with photos of two different park spaces. (Some photos may appear more than once.)

Imagine you are standing in the park spaces represented by each photo. Select which place is most appealing to you. You will also have the option of choosing "NEITHER."

Click "Next" to begin this section.

Back

Next

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Page Break

CBC1SUMMER_Random1

Imagine you are standing in each of these park spaces, which of these is more appealing to you?

Figure B.1 – Copy of Survey Instrument



CBC1SUMMER_Random1

Select



Figure B.1 – Copy of Survey Instrument

CBC1SUMMER_Random1

Select
NEITHER: I wouldn't choose either of these.

CBC1SUMMER_Random1

Select

Back

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Page Break

CBC1SUMMER_Random2

Imagine you are standing in each of these park spaces, which of these is more appealing to you?



CBC1SUMMER_Random2

Select

Figure B.1 – Copy of Survey Instrument



CBC1SUMMER_Random2

Select
NEITHER: I wouldn't choose either of these.

CBC1SUMMER_Random2

Select

Back

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Page Break

CBC1SUMMER_Random3

Imagine you are standing in each of these park spaces, which of these is more appealing to you?

Figure B.1 – Copy of Survey Instrument



CBC1SUMMER_Random3

Select



Figure B.1 – Copy of Survey Instrument

CBC1SUMMER_Random3

Select
NEITHER: I wouldn't choose either of these.

CBC1SUMMER_Random3

Select

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Page Break

CBC3SUMRWTR_Fixed1

Imagine you are standing in each of these park spaces, which of these is more appealing to you?



CBC3SUMRWTR_Fixed1

Select

Figure B.1 – Copy of Survey Instrument



CBC3SUMRWTR_Fixed1

Select

NONE: I wouldn't choose any of these.

CBC3SUMRWTR_Fixed1

Select

Back

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Page Break

CBC2WINTER_Random1

Imagine you are standing in each of these park spaces, which of these is more appealing to you?

Figure B.1 – Copy of Survey Instrument



CBC2WINTER_Random1

Select



Figure B.1 – Copy of Survey Instrument

CBC2WINTER_Random1

Select

NONE: I wouldn't choose any of these.

CBC2WINTER_Random1

Select

Back

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Page Break

CBC2WINTER_Random2

Imagine you are standing in each of these park spaces, which of these is more appealing to you?



CBC2WINTER_Random2

Select

Figure B.1 – Copy of Survey Instrument



CBC2WINTER_Random2

Select

NONE: I wouldn't choose any of these.

CBC2WINTER_Random2

Select

Back

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Page Break

CBC2WINTER_Random3

Imagine you are standing in each of these park spaces, which of these is more appealing to you?

Figure B.1 – Copy of Survey Instrument



CBC2WINTER_Random3

Select



Figure B.1 – Copy of Survey Instrument

CBC2WINTER_Random3

Select

NONE: I wouldn't choose any of these.

CBC2WINTER_Random3

Select

Back

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Page Break

CBC3SUMRWTR_Fixed2

Imagine you are standing in each of these park spaces, which of these is more appealing to you?



CBC3SUMRWTR_Fixed2

Select

Figure B.1 – Copy of Survey Instrument



CBC3SUMRWTR_Fixed2

Select

NONE: I wouldn't choose any of these.

CBC3SUMRWTR_Fixed2

Select

Back

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CBC1SUMMER_Random4

Imagine you are standing in each of these park spaces, which of these is more appealing to you?

Figure B.1 – Copy of Survey Instrument



CBC1SUMMER_Random4

Select



Figure B.1 – Copy of Survey Instrument

CBC1SUMMER_Random4

Select

NEITHER: I wouldn't choose either of these.

CBC1SUMMER_Random4

Select

Back

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CBC1SUMMER_Random5

Imagine you are standing in each of these park spaces, which of these is more appealing to you?



CBC1SUMMER_Random5

Select

Figure B.1 – Copy of Survey Instrument



CBC1SUMMER_Random5

Select
NEITHER: I wouldn't choose either of these.

CBC1SUMMER_Random5

Select
Back
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Page Break

CBC1SUMMER_Random6

Imagine you are standing in each of these park spaces, which of these is more appealing to you?

Figure B.1 – Copy of Survey Instrument



CBC1SUMMER_Random6

Select



Figure B.1 – Copy of Survey Instrument

CBC1SUMMER_Random6

Select
NEITHER: I wouldn't choose either of these.

CBC1SUMMER_Random6

Select
Back
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CBC3SUMRWTR_Fixed3

Imagine you are standing in each of these park spaces, which of these is more appealing to you?



CBC3SUMRWTR_Fixed3

Select

Figure B.1 – Copy of Survey Instrument



CBC3SUMRWTR_Fixed3

Select

NONE: I wouldn't choose any of these.

CBC3SUMRWTR_Fixed3

Select

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CBC2WINTER_Random4

Imagine you are standing in each of these park spaces, which of these is more appealing to you?

Figure B.1 – Copy of Survey Instrument



CBC2WINTER_Random4

Select



Figure B.1 – Copy of Survey Instrument

CBC2WINTER_Random4

Select

NONE: I wouldn't choose any of these.

CBC2WINTER_Random4

Select

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CBC2WINTER_Random5

Imagine you are standing in each of these park spaces, which of these is more appealing to you?



CBC2WINTER_Random5

Select

Figure B.1 – Copy of Survey Instrument



CBC2WINTER_Random5

Select

NONE: I wouldn't choose any of these.

CBC2WINTER_Random5

Select

Back

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Page Break

CBC2WINTER_Random6

Imagine you are standing in each of these park spaces, which of these is more appealing to you?

Figure B.1 – Copy of Survey Instrument



CBC2WINTER_Random6

Select



Figure B.1 – Copy of Survey Instrument

CBC2WINTER_Random6

Select

NONE: I wouldn't choose any of these.

CBC2WINTER_Random6

Select

Back

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CBC3SUMRWTR_Fixed4

Imagine you are standing in each of these park spaces, which of these is more appealing to you?



CBC3SUMRWTR_Fixed4

Select

Figure B.1 – Copy of Survey Instrument



CBC3SUMRWTR_Fixed4

Select

NONE: I wouldn't choose any of these.

CBC3SUMRWTR_Fixed4

Select

Back

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Section4

Part 4 of 5
Park Space Keywords
(6 Questions)

The next six (6) questions will help us to better understand your impressions of different park spaces. Please select all keywords that best describe your opinions of each landscape. You may also click "other" and type your own keywords.

Click "Next" to begin this section.

Figure B.1 – Copy of Survey Instrument

Back
Next

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Page Break

Q40Keywords1



What words best describe the landscape in the picture? (Check all that apply)

- Orderly Q40Keywords1_1
- Clean Q40Keywords1_2
- Safe Q40Keywords1_3
- Nurtured Q40Keywords1_4
- Attractive Q40Keywords1_5
- Useful Q40Keywords1_6
- Vibrant Q40Keywords1_7
- Q40Keywords1_8

Figure B.1 – Copy of Survey Instrument

- Eco-friendly Q40Keywords1_9
- Neither Attractive or Unattractive Q40Keywords1_10
- Disorderly Q40Keywords1_11
- Messy Q40Keywords1_12
- Unsafe Q40Keywords1_13
- Neglected Q40Keywords1_14
- Ugly Q40Keywords1_15
- Useless Q40Keywords1_16
- Dull Q40Keywords1_17
- Untamed Q40Keywords1_18

Q40Keywords1_18_other

Other

Back
Next

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Page Break

Q40Keywords2

Figure B.1 – Copy of Survey Instrument



What words best describe the landscape in the picture? (Check all that apply)

- Orderly Q40Keywords2_1
- Clean Q40Keywords2_2
- Safe Q40Keywords2_3
- Nurtured Q40Keywords2_4
- Attractive Q40Keywords2_5
- Useful Q40Keywords2_6
- Vibrant Q40Keywords2_7
- Eco-friendly Q40Keywords2_8
- Neither Attractive or Unattractive Q40Keywords2_9
- Disorderly Q40Keywords2_10

Figure B.1 – Copy of Survey Instrument

	Q40Keywords2_11
Messy	
	Q40Keywords2_12
Unsafe	
	Q40Keywords2_13
Neglected	
	Q40Keywords2_14
Ugly	
	Q40Keywords2_15
Useless	
	Q40Keywords2_16
Dull	
	Q40Keywords2_17
Untamed	
	Q40Keywords2_18
Q40Keywords2_18_other	
Other	<input type="text"/>
Back	
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Q40Keywords3	

Figure B.1 – Copy of Survey Instrument



What words best describe the landscape in the picture? (Check all that apply)

- Orderly Q40Keywords3_1
- Clean Q40Keywords3_2
- Safe Q40Keywords3_3
- Nurtured Q40Keywords3_4
- Attractive Q40Keywords3_5
- Useful Q40Keywords3_6
- Vibrant Q40Keywords3_7
- Eco-friendly Q40Keywords3_8
- Neither Attractive or Unattractive Q40Keywords3_9
- Disorderly Q40Keywords3_10

Figure B.1 – Copy of Survey Instrument

	Q40Keywords3_11
Messy	
	Q40Keywords3_12
Unsafe	
	Q40Keywords3_13
Neglected	
	Q40Keywords3_14
Ugly	
	Q40Keywords3_15
Useless	
	Q40Keywords3_16
Dull	
	Q40Keywords3_17
Untamed	
	Q40Keywords3_18
Q40Keywords3_18_other	
Other	<input type="text"/>
Back	
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Q40Keywords4	

Figure B.1 – Copy of Survey Instrument



What words best describe the landscape in the picture? (Check all that apply)

- Orderly Q40Keywords4_1
- Clean Q40Keywords4_2
- Safe Q40Keywords4_3
- Nurtured Q40Keywords4_4
- Attractive Q40Keywords4_5
- Useful Q40Keywords4_6
- Vibrant Q40Keywords4_7
- Eco-friendly Q40Keywords4_8
- Neither Attractive or Unattractive Q40Keywords4_9
- Disorderly Q40Keywords4_10

Figure B.1 – Copy of Survey Instrument

	Q40Keywords4_11
Messy	
	Q40Keywords4_12
Unsafe	
	Q40Keywords4_13
Neglected	
	Q40Keywords4_14
Ugly	
	Q40Keywords4_15
Useless	
	Q40Keywords4_16
Dull	
	Q40Keywords4_17
Untamed	
	Q40Keywords4_18
Q40Keywords4_18_other	
Other	<input type="text"/>
Back	
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Q40Keywords5	

Figure B.1 – Copy of Survey Instrument



What words best describe the landscape in the picture? (Check all that apply)

- Orderly Q40Keywords5_1
- Clean Q40Keywords5_2
- Safe Q40Keywords5_3
- Nurtured Q40Keywords5_4
- Attractive Q40Keywords5_5
- Useful Q40Keywords5_6
- Vibrant Q40Keywords5_7
- Eco-friendly Q40Keywords5_8
- Neither Attractive or Unattractive Q40Keywords5_9
- Disorderly Q40Keywords5_10

Figure B.1 – Copy of Survey Instrument

	Q40Keywords5_11
Messy	
	Q40Keywords5_12
Unsafe	
	Q40Keywords5_13
Neglected	
	Q40Keywords5_14
Ugly	
	Q40Keywords5_15
Useless	
	Q40Keywords5_16
Dull	
	Q40Keywords5_17
Untamed	
	Q40Keywords5_18
Q40Keywords5_18_other	
Other	<input type="text"/>
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Q40Keywords6	

Figure B.1 – Copy of Survey Instrument



What words best describe the landscape in the picture? (Check all that apply)

- Orderly Q40Keywords6_1
- Clean Q40Keywords6_2
- Safe Q40Keywords6_3
- Nurtured Q40Keywords6_4
- Attractive Q40Keywords6_5
- Useful Q40Keywords6_6
- Vibrant Q40Keywords6_7
- Eco-friendly Q40Keywords6_8
- Neither Attractive or Unattractive Q40Keywords6_9
- Disorderly Q40Keywords6_10

Figure B.1 – Copy of Survey Instrument

Messy	Q40Keywords6_11
Unsafe	Q40Keywords6_12
Neglected	Q40Keywords6_13
Ugly	Q40Keywords6_14
Useless	Q40Keywords6_15
Dull	Q40Keywords6_16
Untamed	Q40Keywords6_17
	Q40Keywords6_18
Other	Q40Keywords6_18_other
<input type="text"/>	

[Back](#)
[Next](#)

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Section5

Part 5 of 5
Rating of Park Spaces
(9 Questions)

This is the final section of the survey.

These questions will help us to gain a better understanding of how various park space designs might be "acceptable" or "unacceptable" in your local area of primary residence.

Click "Next" to begin this section.

[Back](#)
[Next](#)

0% 100%

Page Break

Figure B.1 – Copy of Survey Instrument

Q30Acceptability1

Would this park space be acceptable or unacceptable in your local area of primary residence?



Q30Acceptability1=1

Extremely acceptable

Q30Acceptability1=2

Somewhat acceptable

Q30Acceptability1=3

Neither acceptable nor unacceptable

Q30Acceptability1=4

Somewhat unacceptable

Q30Acceptability1=5

Extremely unacceptable

Back

Next

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Page Break

Q31Acceptability2

Would this park space be acceptable or unacceptable in your local area of primary residence?

Figure B.1 – Copy of Survey Instrument



Q31Acceptability2=1

Extremely acceptable

Q31Acceptability2=2

Somewhat acceptable

Q31Acceptability2=3

Neither acceptable nor unacceptable

Q31Acceptability2=4

Somewhat unacceptable

Q31Acceptability2=5

Extremely unacceptable

Back

Next

0%

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Page Break

Q32Acceptability3

Would this park space be acceptable or unacceptable in your local area of primary residence?

Figure B.1 – Copy of Survey Instrument



- Extremely acceptable Q32Acceptability3=1
- Somewhat acceptable Q32Acceptability3=2
- Neither acceptable nor unacceptable Q32Acceptability3=3
- Somewhat unacceptable Q32Acceptability3=4
- Extremely unacceptable Q32Acceptability3=5

[Back](#)

[Next](#)

0% 100%

Page Break

Q34Acceptability5

Would this park space be acceptable or unacceptable in your local area of primary residence?

Figure B.1 – Copy of Survey Instrument



Q34Acceptability5=1

Extremely acceptable

Q34Acceptability5=2

Somewhat acceptable

Q34Acceptability5=3

Neither acceptable nor unacceptable

Q34Acceptability5=4

Somewhat unacceptable

Q34Acceptability5=5

Extremely unacceptable

Back

Next

0%

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Q35Acceptability6

Would this park space be acceptable or unacceptable in your local area of primary residence?

Figure B.1 – Copy of Survey Instrument



- Extremely acceptable Q35Acceptability6=1
- Somewhat acceptable Q35Acceptability6=2
- Neither acceptable nor unacceptable Q35Acceptability6=3
- Somewhat unacceptable Q35Acceptability6=4
- Extremely unacceptable Q35Acceptability6=5

[Back](#)
[Next](#)

0% 100%

Page Break

Q33Acceptability4

Would this park space be acceptable or unacceptable in your local area of primary residence?

Figure B.1 – Copy of Survey Instrument



- Extremely acceptable Q33Acceptability4=1
- Somewhat acceptable Q33Acceptability4=2
- Neither acceptable nor unacceptable Q33Acceptability4=3
- Somewhat unacceptable Q33Acceptability4=4
- Extremely unacceptable Q33Acceptability4=5

Back

Next

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Page Break

Q36Acceptability7

Would this park space be acceptable or unacceptable in your local area of primary residence?

Figure B.1 – Copy of Survey Instrument



- Extremely acceptable Q36Acceptability7=1
- Somewhat acceptable Q36Acceptability7=2
- Neither acceptable nor unacceptable Q36Acceptability7=3
- Somewhat unacceptable Q36Acceptability7=4
- Extremely unacceptable Q36Acceptability7=5

Back

Next

0% 100%

Page Break

Q37Acceptability8

Would this park space be acceptable or unacceptable in your local area of primary residence?

Figure B.1 – Copy of Survey Instrument



Q37Acceptability8=1

Extremely acceptable

Q37Acceptability8=2

Somewhat acceptable

Q37Acceptability8=3

Neither acceptable nor unacceptable

Q37Acceptability8=4

Somewhat unacceptable

Q37Acceptability8=5

Extremely unacceptable

Back

Next

0%

100%

Page Break

Q38OpenSpaceRank

Suppose you have been asked to prioritize the use of limited public park space in your local area. According to your personal values, rank in order from the highest priority to the lowest priority for the general use of public park space in your local area. (drag and drop to ranking table).

Items to Rank

Q38OpenSpaceRank_1

Figure B.1 – Copy of Survey Instrument

Community vegetable gardens

Q38OpenSpaceRank_2

Ornamental gardens

Q38OpenSpaceRank_3

Recreation

Q38OpenSpaceRank_4

Social interaction

Q38OpenSpaceRank_5

Wildlife habitat

Highest Priority

Lowest Priority

Back

Next

0%

100%

Page Break

Q39Venting

Please share any thoughts, input, or closing comments you may have regarding this study in the box below. Thank you for your participation!

Back

Next

0%

100%

Page Break

PreTerminate

Thank you!

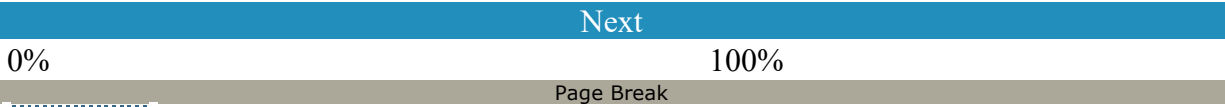
This concludes the survey!



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Back

Figure B.1 – Copy of Survey Instrument



Terminate

Note:

When respondents take the survey in regular mode this page will not be displayed. Respondents will be redirected to the link below:

<https://ced.uga.edu/>

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APPENDIX C

SURVEY RESPONSE SUMMARY

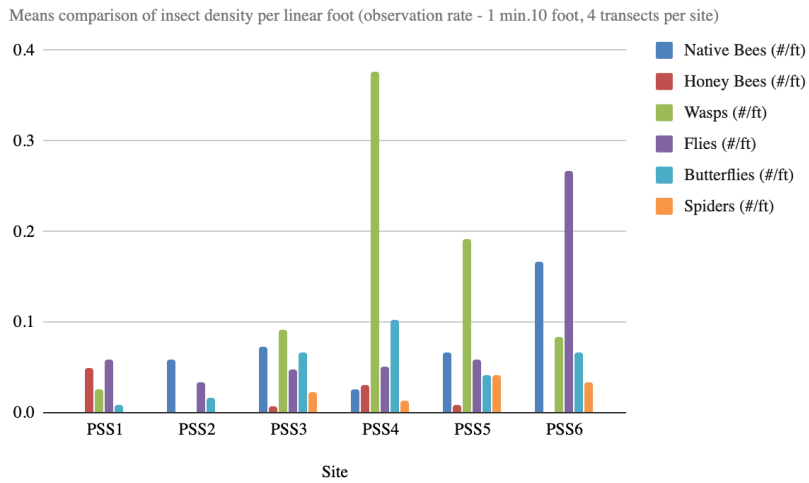


Figure C.1: Summary of insect counts and mean density per site. (The data analysis relied on spreadsheets using Microsoft Excel Ver. 16.41 © 2020 Microsoft.)

During an average week in the growing season, how often do you engage in vegetable or flower gardening?

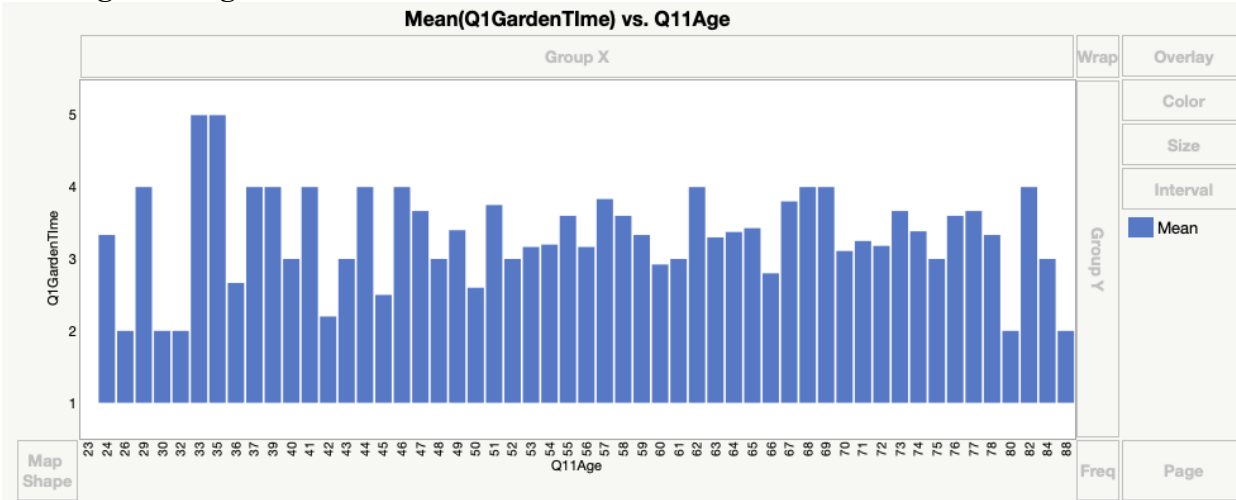


Figure C.2: Respondent demographics – weekly gardening time. (JMP®, Version 15.0. SAS Institute Inc., Cary, NC, 1989-2019.)

Table C.1: Summary of acceptability ratings (Q30-37).

Q30: (Image of PSS1) Would this park space be acceptable or unacceptable in your local area of primary residence?		(n=341)
Choices	#	%
Extremely acceptable	25	7
Somewhat acceptable	69	20
Neither acceptable nor unacceptable	30	9
Somewhat unacceptable	131	38
Extremely unacceptable	88	26
Q31: (Image of PSS2) Would this park space be acceptable or unacceptable in your local area of primary residence?		(n=343)
Label	Count	Percent
Extremely acceptable	228	66
Somewhat acceptable	92	27
Neither acceptable nor unacceptable	11	3
Somewhat unacceptable	11	3
Extremely unacceptable	1	
Q32: (Image of PSS3, Image A) Would this park space be acceptable or unacceptable in your local area of primary residence?		(n=343)
Label	Count	Percent
Extremely acceptable	86	25
Somewhat acceptable	123	36
Neither acceptable nor unacceptable	43	13
Somewhat unacceptable	67	20
Extremely unacceptable	24	7
Q33: (Image of PSS3, Image B) Would this park space be acceptable or unacceptable in your local area of primary residence?		(n=342)
Label	Count	Percent
Extremely acceptable	140	41
Somewhat acceptable	151	44
Neither acceptable nor unacceptable	19	6
Somewhat unacceptable	28	8
Extremely unacceptable	4	1
Q34: (Image of PSS4) Would this park space be acceptable or unacceptable in your local area of primary residence?		(n=343)
Label	Count	Percent
Extremely acceptable	158	46
Somewhat acceptable	130	38
Neither acceptable nor unacceptable	23	7

Somewhat unacceptable	28	8
Extremely unacceptable	4	1
Q35: (Image of PSS5, Image A) Would this park space be acceptable or unacceptable in your local area of primary residence?		(n=343)
Label	Count	Percent
Extremely acceptable	64	19
Somewhat acceptable	158	46
Neither acceptable nor unacceptable	46	13
Somewhat unacceptable	61	18
Extremely unacceptable	14	4
Q36: (Image of PSS5, Image B) Would this park space be acceptable or unacceptable in your local area of primary residence?		(n=343)
Label	Count	Percent
Extremely acceptable	249	73
Somewhat acceptable	80	23
Neither acceptable nor unacceptable	8	2
Somewhat unacceptable	6	2
Extremely unacceptable		
Q37: (Image of PSS6) Would this park space be acceptable or unacceptable in your local area of primary residence?		(n=342)
Label	Count	Percent
Extremely acceptable	281	82
Somewhat acceptable	48	14
Neither acceptable nor unacceptable	6	2
Somewhat unacceptable	7	2
Extremely unacceptable		

Table C.2: Summary of most frequent keywords per site.

PSS1

Total negative keywords: 652 (80%)

Total positive keywords: 165 (20%)

Most frequent:

Untamed - 168
Disorderly - 164
Neglected - 152
Messy - 148

Most frequent:

Eco-friendly - 150
Useful - 57
Vibrant - 35
Attractive - 24

PSS2

Total negative keywords: 54 (4%)

Total positive keywords: 1,328 (96%)

Most frequent:

Dull - 36
Useless - 10
Disorderly - 3
Ugly - 3

Most frequent:

Orderly - 317
Clean - 279
Attractive - 205
Nurtured - 190

PSS3

Total negative keywords: 59 (5%)

Total positive keywords: 1,082 (95%)

Most frequent:

Dull - 47
Untamed - 16
Neglected - 5
Messy - 2

Most frequent:

Orderly - 264
Clean - 251
Safe - 150
Attractive - 141

PSS4

Total negative keywords: 110 (12%)

Total positive keywords: 829 (88%)

Most frequent:

Untamed - 50
Disorderly - 34
Messy - 33
Neglected - 16

Most frequent:

Eco-friendly - 265
Useful - 216
Attractive - 134
Nurtured - 127

PSS5

Total negative keywords: 42 (3%)

Total positive keywords: 1,328 (97%)

Most frequent:

Dull - 20
Untamed - 8
Disorderly - 6
Messy - 6

Most frequent:

Clean - 259
Useful - 230
Orderly - 226
Attractive - 196

PSS6

Total negative keywords: 26 (2%)

Total positive keywords: 1,647 (98%)

Most frequent:

Dull - 19
Ugly - 3
Useless - 2
Messy - 1

Most frequent:

Orderly - 307
Clean - 301
Attractive - 266
Nurtured - 249

Table C.3: Summary of keyword responses.

Q40Keywords5-PSS1A-SU

Label	Count	Percent
Orderly	2	1
Clean	21	6
Safe	13	4
Nurtured	13	4
Attractive	24	7
Useful	57	17
Vibrant	35	10
Eco-friendly	150	44
Neither Attractive or Unattractive	74	22
Disorderly	164	48
Messy	148	43
Unsafe	62	18
Neglected	152	44
Ugly	43	13
Useless	24	7
Dull	59	17
Untamed	168	49
Other	35	10

Q40Keywords3-PSS2C-SU

Label	Count	Percent
Orderly	317	92
Clean	279	81
Safe	175	51
Nurtured	190	55
Attractive	205	60
Useful	112	33
Vibrant	50	15
Eco-friendly	73	21

Table C.3: Summary of keyword responses.

Neither Attractive or Unattractive	22	6
Disorderly	3	1
Messy		
Unsafe	2	1
Neglected		
Ugly	3	1
Useless	10	3
Dull	36	10
Untamed		
Other	27	8

Q40Keywords1-PSS3C-SU

Label	Count	Percent
Orderly	264	76
Clean	251	73
Safe	150	43
Nurtured	122	35
Attractive	141	41
Useful	124	36
Vibrant	30	9
Eco-friendly	103	30
Neither Attractive or Unattractive	53	15
Disorderly		
Messy	2	1
Unsafe	2	1
Neglected	5	1
Ugly	1	
Useless	2	1
Dull	47	14
Untamed	6	2
Other	33	10

Q40Keywords2-PSS4C-SU

Label	Count	Percent
Orderly	71	21
Clean	100	29
Safe	101	29
Nurtured	127	37
Attractive	134	39
Useful	216	63
Vibrant	80	23
Eco-friendly	265	77

Table C.3: Summary of keyword responses.

Neither Attractive or Unattractive	60	17
Disorderly	34	10
Messy	33	10
Unsafe	6	2
Neglected	16	5
Ugly	4	1
Useless	4	1
Dull	13	4
Untamed	50	14
Other	40	12

Q40Keywords4-PSS5C-SU

Label	Count	Percent
Orderly	226	66
Clean	259	75
Safe	184	53
Nurtured	170	49
Attractive	196	57
Useful	230	67
Vibrant	63	18
Eco-friendly	180	52
Neither Attractive or Unattractive	28	8
Disorderly	6	2
Messy	6	2
Unsafe	2	1
Neglected	3	1
Ugly	3	1
Useless	2	1
Dull	20	6
Untamed	8	2
Other	40	12

Q40Keywords6-PSS6B-SU

Label	Count	Percent
Orderly	307	89
Clean	301	88
Safe	221	64
Nurtured	249	72
Attractive	266	77
Useful	193	56
Vibrant	110	32
Eco-friendly	82	24

Table C.3: Summary of keyword responses.

Neither Attractive or Unattractive	14	4
Disorderly		
Messy	1	
Unsafe	1	
Neglected		
Ugly	3	1
Useless	2	1
Dull	19	6
Untamed	1	
Other	38	11

.....
Would this park space be acceptable or unacceptable in your local area of primary residence?

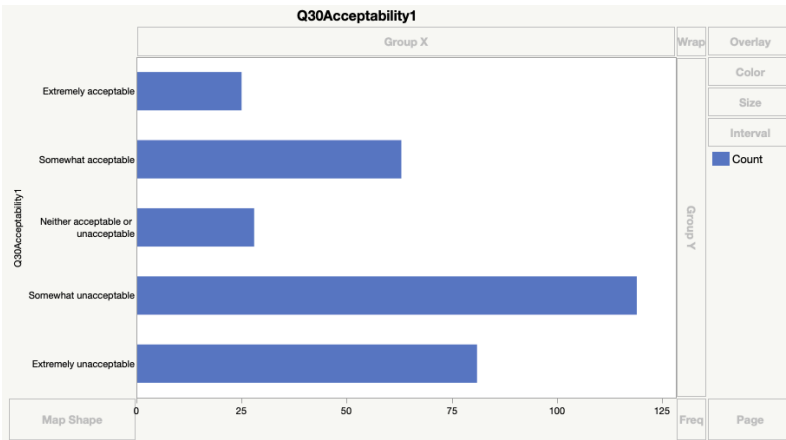


Figure C.3: Respondent acceptability PSS1. (JMP®, Version 15.0. SAS Institute Inc., Cary, NC, 1989-2019.)

Would this park space be acceptable or unacceptable in your local area of primary residence?

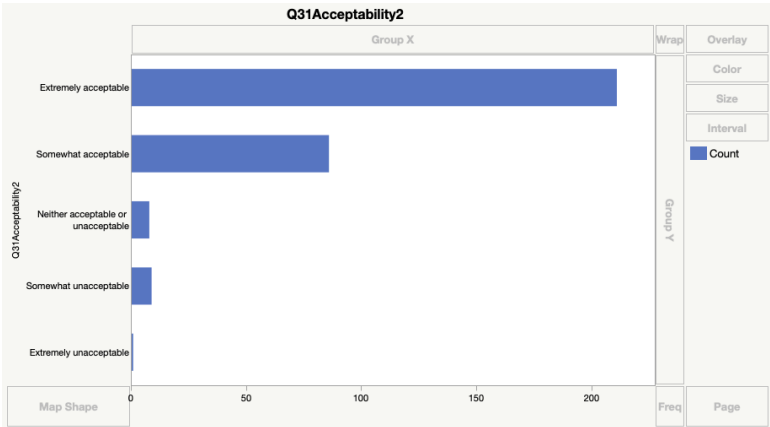


Figure C.5: Respondent acceptability PSS2. (JMP®, Version 15.0. SAS Institute Inc., Cary, NC, 1989-2019.)

Would this park space be acceptable or unacceptable in your local area of primary residence?

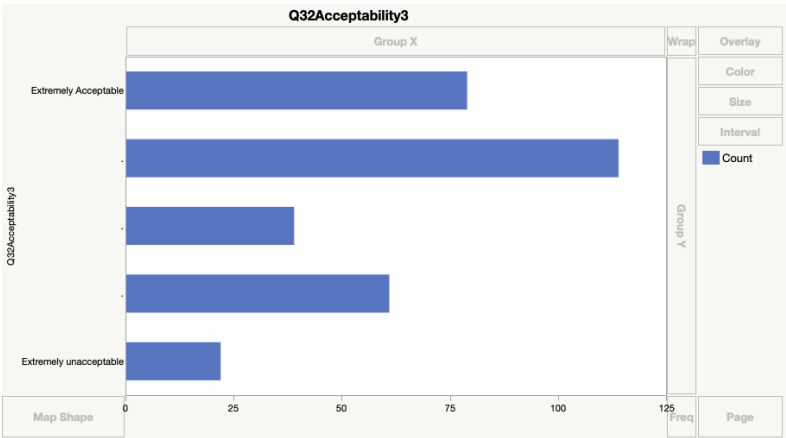


Figure C.6: Respondent acceptability PSS3 (Photo A). (JMP®, Version 15.0. SAS Institute Inc., Cary, NC, 1989-2019.)

Would this park space be acceptable or unacceptable in your local area of primary residence?

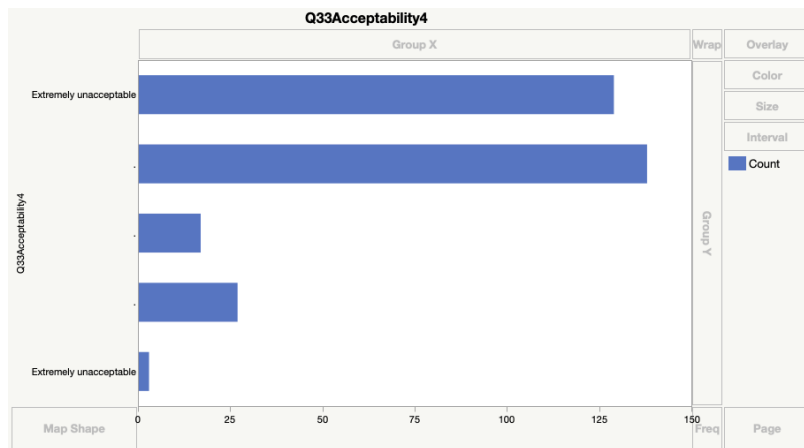


Figure C.7: Respondent acceptability PSS3 (Photo B).JMP®, Version 15.0. SAS Institute Inc., Cary, NC, 1989-2019.

Would this park space be acceptable or unacceptable in your local area of primary residence?

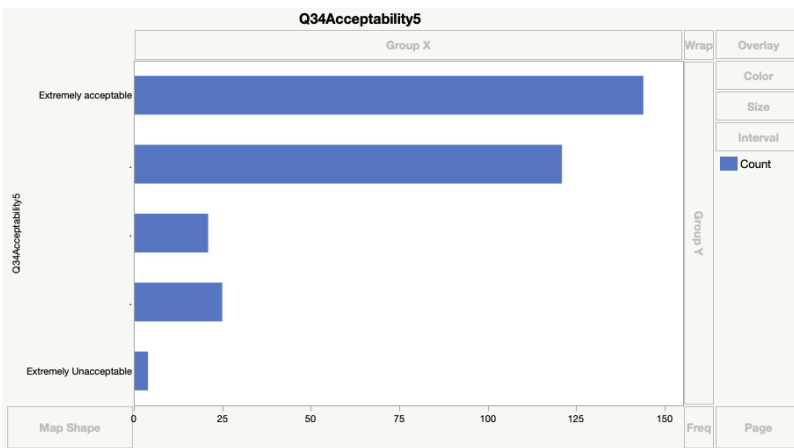


Figure C.8: Respondent acceptability PSS4. (JMP®, Version 15.0. SAS Institute Inc., Cary, NC, 1989-2019.)

Would this park space be acceptable or unacceptable in your local area of primary residence?

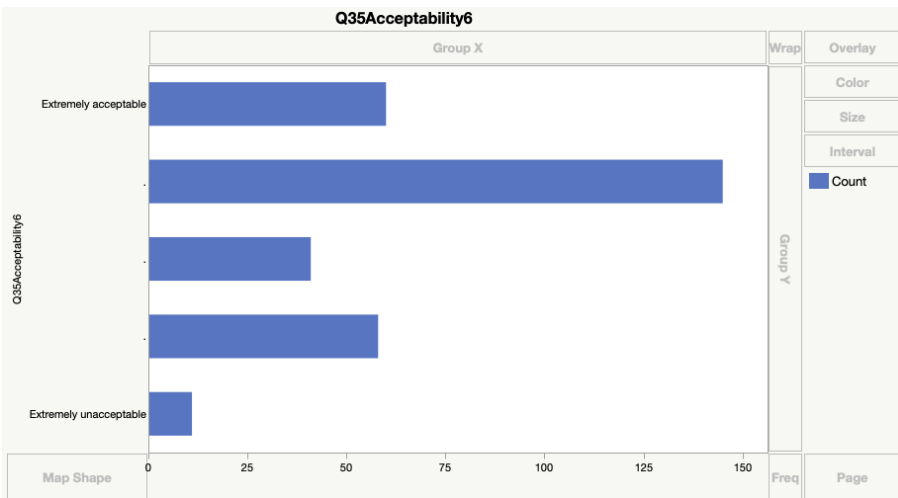


Figure C.9: Respondent acceptability PSS5 (Photo A). (JMP®, Version 15.0. SAS Institute Inc., Cary, NC, 1989-2019.)

Would this park space be acceptable or unacceptable in your local area of primary residence?

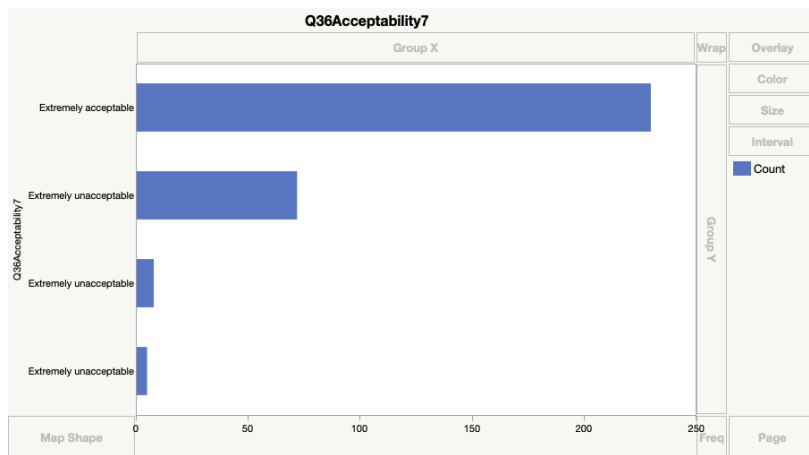


Figure C.10: Respondent acceptability PSS5 (Photo C). (JMP®, Version 15.0. SAS Institute Inc., Cary, NC, 1989-2019.)

Would this park space be acceptable or unacceptable in your local area of primary residence?

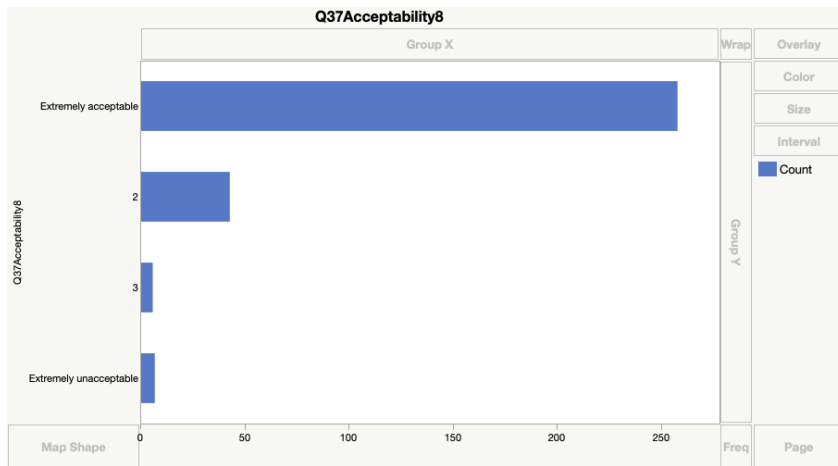


Figure C.11: Respondent acceptability PSS6. (JMP®, Version 15.0. SAS Institute Inc., Cary, NC, 1989-2019.)

Prioritization of park space

Table C.7: Summary of open space priority rankings.

Q38OpenSpaceRank_1		
Value	Count	Percent
Community vegetable gardens	46	14
Ornamental gardens	67	20
Recreation	58	18
Social interaction	66	20
Wildlife habitat	90	28

Q38OpenSpaceRank_2		
Value	Count	Percent
Community vegetable gardens	69	21
Ornamental gardens	51	16
Recreation	78	24
Social interaction	58	18
Wildlife habitat	71	22

Q38OpenSpaceRank_3		
Value	Count	Percent
Community vegetable gardens	68	21
Ornamental gardens	62	19
Recreation	70	21
Social interaction	74	23
Wildlife habitat	53	16

Q38OpenSpaceRank_4		
Value	Count	Percent
Community vegetable gardens	30	9
Ornamental gardens	83	25
Recreation	72	22
Social interaction	81	25
Wildlife habitat	61	19

Q38OpenSpaceRank_5		
Value	Count	Percent
Community vegetable gardens	114	35
Ornamental gardens	64	20
Recreation	49	15
Social interaction	48	15
Wildlife habitat	52	16

Insect Abundance of Select Orders																				
Sampling Area: (PSS-2) PONCE MARKET Date: 08/15/2020 Field Recorders: Greg Huber, Dr. Bodie Pennisi																				
Transect ID	Time of Day	Transect Length (ft)	Actual Sampling Time (min)	Temp (F)	Wind (mph)	Light	Hymenoptera						Diptera		Lepidoptera		Aranea		Total Count	Avg. Count per ft.
							Native Bees		Honey Bees		Wasps		Flies		Butterflies		Spiders			
							#	#/ft	#	#/ft	#	#/ft	#	#/ft	#	#/ft	#	#/ft		
T5	14:30	31.0	3.1	85.0	9.0	10% sun	2	0.06	0	0.00	0	0.00	2	0.06	1	0.03	0	0.00	5	0.16
T6	14:35	29.0	2.9	85.0	9.0	5% sun	1	0.03	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.03
T7	14:40	29.0	2.9	85.0	9.0	5% sun	2	0.07	0	0.00	0	0.00	2	0.07	1	0.03	0	0.00	5	0.17
T8	14:45	29.0	2.9	85.0	9.0	5% sun	2	0.07	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	2	0.07
							Native Bees (#/ft)	Honey Bees (#/ft)	Wasps (#/ft)		Flies (#/ft)		Butterflies (#/ft)		Spiders (#/ft)		All (#/ft)			
							Mean:	0.059	0.000	0.000		0.033		0.017		0.000		0.109		
							Variance:	0.0003	0.0000	0.0000		0.0015		0.0004		0.0000		0.0046		
							Standard Error:	0.0083	0.0000	0.0000		0.0193		0.0096		0.0000		0.0340		
							degrees of Freedom:	3	3	3		3		3		3		3		
							Tn-1, 0.90 :	2.35	2.35	2.35		2.35		2.35		2.35		2.35		
							Lower 90% Confidence Interval:	0.040	0.000	0.000		-0.012		-0.006		0.000		0.029		
							Upper 90% Confidence Interval:	0.079	0.000	0.000		0.079		0.039		0.000		0.189		

Table D.3: Pollinator Study Site 3 (PSS3-East Park Meadow): Insect Density of Select Orders along Transects

Insect Abundance of Select Orders																				
Sampling Area: (PSS-3) EAST PARK MEADOW Date: 08/15/2020 Field Recorders: Greg Huber, Dr. Bodie Pennisi																				
Transect ID	Time of Day	Transect Length (ft)	Actual Sampling Time (min)	Temp (F)	Wind (mph)	Light	Hymenoptera						Diptera		Lepidoptera		Aranea		Total Count	Avg. Count per ft.
							Native Bees		Honey Bees		Wasps		Flies		Butterflies		Spiders			
							#	#/ft	#	#/ft	#	#/ft	#	#/ft	#	#/ft	#	#/ft		
T9	12:45	33.0	3.3	82.0	7.0	85% sun	4	0.12	0	0.00	7	0.21	2	0.06	3	0.09	2	0.06	18	0.55
T10	12:50	24.0	2.4	82.0	7.0	85% sun	2	0.08	0	0.00	1	0.04	1	0.04	3	0.13	0	0.00	7	0.29
T11	1:00	35.0	3.5	82.0	7.0	80% sun	3	0.09	1	0.03	4	0.11	3	0.09	1	0.03	1	0.03	13	0.37
T12	1:22	46.0	4.6	83.0	7.0	90% sun	0	0.00	0	0.00	0	0.00	0	0.00	1	0.02	0	0.00	1	0.02
							Native Bees (#/ft)	Honey Bees (#/ft)	Wasps (#/ft)		Flies (#/ft)		Butterflies (#/ft)		Spiders (#/ft)		All (#/ft)			
							Mean:	0.073	0.007	0.092		0.047		0.067		0.022		0.308		
							Variance:	0.0026	0.0002	0.0086		0.0013		0.0025		0.0008		0.0475		
							Standard Error:	0.0257	0.0071	0.0465		0.0181		0.0249		0.0144		0.1090		
							degrees of Freedom:	3	3	3		3		3		3		3		
							Tn-1, 0.90 :	2.35	2.35	2.35		2.35		2.35		2.35		2.35		
							Lower 90% Confidence Interval:	0.012	-0.010	-0.017		0.004		0.008		-0.012		0.051		
							Upper 90% Confidence Interval:	0.133	0.024	0.201		0.090		0.125		0.056		0.564		

Table D.4: Pollinator Study Site 4 (PSS4-Big Creek Trailhead): Insect Density of Select Orders along Transects

Insect Abundance of Select Orders																		Total Count	Avg. Count per ft.
Sampling Area: (PSS-4) BIG CREEK TRAILHEAD Date: 08/15/2020 Field Recorders: Greg Huber, Dr. Bodie Pennisi																			
Transect ID	Time of Day	Transect Length (ft)	Actual Sampling Time (min)	Temp (F)	Wind (mph)	Light	Hymenoptera						Diptera		Lepidoptera		Aranea		
							Native Bees		Honey Bees		Wasps		Flies		Butterflies		Spiders		
							#	#/ft	#	#/ft	#	#/ft	#	#/ft	#	#/ft	#	#/ft	
T13	10:47	30.0	3.0	77.0	5.0	50% sun	3	0.10	2	0.07	11	0.37	0	0.00	0	0.00	0	0.00	
T14	10:15	23.0	2.3	77.0	5.0	50% sun	0	0.00	0	0.00	4	0.17	0	0.00	0	0.00	0	0.00	
T15	10:25	20.0	2.0	77.0	5.0	60% sun	0	0.00	0	0.00	6	0.30	3	0.15	6	0.30	1	0.05	
T16	10:31	18.0	1.8	77.0	5.0	90% sun	0	0.00	1	0.06	12	0.67	1	0.06	2	0.11	0	0.00	
							Mean:	0.025	0.031	0.377	0.051	0.103	0.013	0.599					
							Variance:	0.0025	0.0013	0.0437	0.0050	0.0200	0.0006	0.1031					
							Standard Error:	0.0250	0.0178	0.1046	0.0354	0.0708	0.0125	0.1606					
							degrees of Freedom:	3	3	3	3	3	3	3					
							Tn-1, 0.90 :	2.35	2.35	2.35	2.35	2.35	2.35	2.35					
							Lower 90% Confidence Interval:	-0.034	-0.011	0.131	-0.032	-0.064	-0.017	0.221					
							Upper 90% Confidence Interval:	0.084	0.072	0.623	0.135	0.269	0.042	0.977					

Table D.5: Pollinator Study Site 5 (PSS5-The Ray): Insect Density of Select Orders along Transects

Insect Abundance of Select Orders																		Total Count	Avg. Count per ft.
Sampling Area: (PSS-5) THE RAY Date: 08/20/2020 Field Recorders: Greg Huber																			
Transect ID	Time of Day	Transect Length (ft)	Actual Sampling Time (min)	Temp (F)	Wind (mph)	Light	Hymenoptera						Diptera		Lepidoptera		Aranea		
							Native Bees		Honey Bees		Wasps		Flies		Butterflies		Spiders		
							#	#/ft	#	#/ft	#	#/ft	#	#/ft	#	#/ft	#	#/ft	
T17	10:54	30.0	3.0	77.0	4.0	70% sun	1	0.03	0	0.00	3	0.10	2	0.07	0	0.00	1	0.03	
T18	11:04	30.0	3.0	77.0	4.0	75% sun	2	0.07	0	0.00	5	0.17	1	0.03	1	0.03	1	0.03	
T19	11:11	30.0	3.0	78.0	4.0	100% sun	2	0.07	1	0.03	8	0.27	2	0.07	1	0.03	2	0.07	
T20	11:20	30.0	3.0	78.0	4.0	100% sun	3	0.10	0	0.00	7	0.23	2	0.07	3	0.10	1	0.03	
							Mean:	0.067	0.008	0.192	0.058	0.042	0.042	0.408					
							Variance:	0.0007	0.0003	0.0055	0.0003	0.0018	0.0003	0.0225					
							Standard Error:	0.0136	0.0083	0.0370	0.0083	0.0210	0.0083	0.0750					
							degrees of Freedom:	3	3	3	3	3	3	3					
							Tn-1, 0.90 :	2.35	2.35	2.35	2.35	2.35	2.35	2.35					
							Lower 90% Confidence Interval:	0.035	-0.011	0.105	0.039	-0.008	0.022	0.232					
							Upper 90% Confidence Interval:	0.099	0.028	0.279	0.078	0.091	0.061	0.585					

Table D.6: Pollinator Study Site 6 (PSS6-Callaway Gardens Butterfly Center): Insect Density of Select Orders along Transects

Insect Abundance of Select Orders																		Total Count	Avg. Count per ft.
Sampling Area: (PSS-6) CALLAWAY GARDENS Date: 08/20/2020 Field Recorders: Greg Huber																			
Transect ID	Time of Day	Transect Length (ft)	Actual Sampling Time (min)	Temp (F)	Wind (mph)	Light	Hymenoptera						Diptera		Lepidoptera		Aranea		
							Native Bees		Honey Bees		Wasps		Flies		Butterflies		Spiders		
							#	#/ft	#	#/ft	#	#/ft	#	#/ft	#	#/ft	#	#/ft	
T21	12:33	15.0	1.5	84.0	5.0	90% sun	2	0.13	0	0.00	2	0.13	1	0.07	3	0.20	0	0.00	
T22	12:39	15.0	1.5	84.0	5.0	100% sun	2	0.13	0	0.00	2	0.13	3	0.20	0	0.00	1	0.07	
T23	12:44	15.0	1.5	84.0	5.0	100% sun	5	0.33	0	0.00	1	0.07	4	0.27	0	0.00	0	0.00	
T24	12:48	15.0	1.5	84.0	5.0	100% sun	1	0.07	0	0.00	0	0.00	8	0.53	1	0.07	1	0.07	
							Mean:	0.167	0.000	0.083	0.267	0.067	0.033	0.617					
							Variance:	0.0133	0.0000	0.0041	0.0385	0.0089	0.0015	0.0100					
							Standard Error:	0.0577	0.0000	0.0319	0.0981	0.0471	0.0192	0.0500					
							Degrees of Freedom:	3	3	3	3	3	3	3					
							Tn-1, 0.90 :	2.35	2.35	2.35	2.35	2.35	2.35	2.35					
							Lower 90% Confidence Interval:	0.031	0.000	0.008	0.036	-0.044	-0.012	0.499					
							Upper 90% Confidence Interval:	0.303	0.000	0.158	0.498	0.178	0.079	0.734					

Zip codes within one mile of the study sites were used in calculating population density (population/square mile). The six study sites represent a cross section of the rural to urban gradient.

PSS1: Atlanta Beltline Eastside Trail (Purple Star)
Context: Urban

Zip Code(s): 30306 30307, 30308, 30312. (Refer to calculations for Atlanta Beltline Eastside Trail Site #1)

AVG POP_DENS_SQMI:
7,236.98

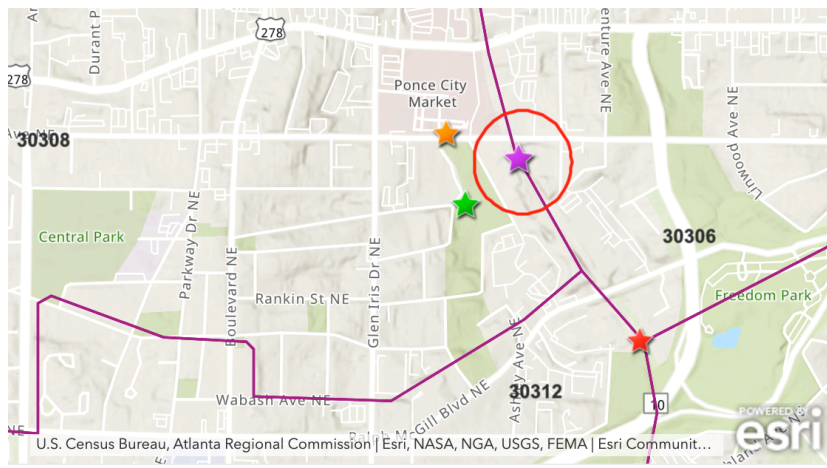


Figure D.1: PSS1 Map, context, and population density.

PSS2: Atlanta Beltline Ponce Market (Orange Star)
Context: Urban

Zip Code(s): 30306 30307, 30308, 30312. (Refer to calculations for Atlanta Beltline Eastside Trail Site #1)

AVG POP_DENS_SQMI:
7,236.98

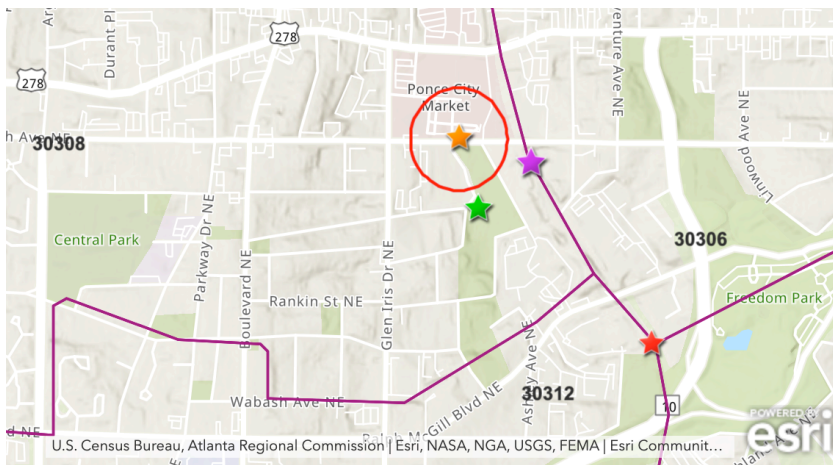


Figure D.2: PSS2 Map, context, and population density.

PSS3: East Park Meadow Subdivision Green Space (1345 East Park Blvd.)
Context: Suburban

Zip Code: 30062
POP2015: 65,662
SQMI: 25.75
POP_DENS_SQMI: **2,549.98**

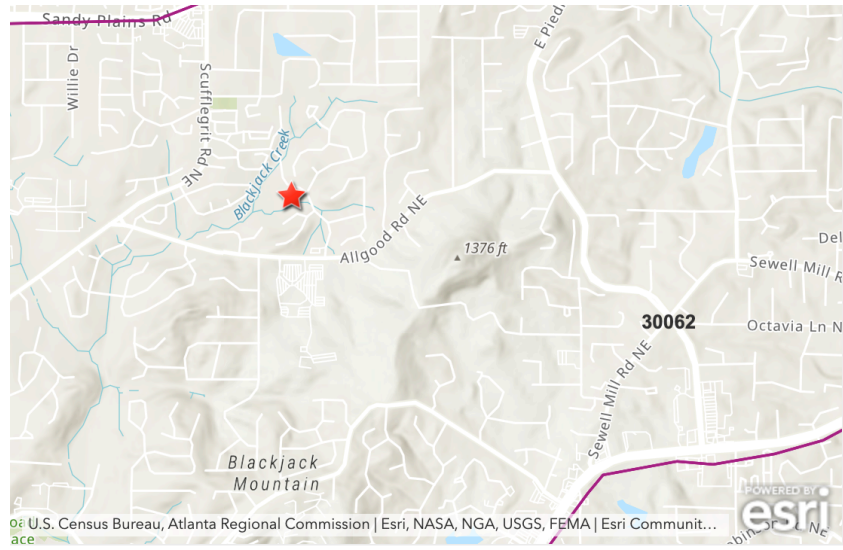


Figure D.3: PSS3 Map, context, and population density.

PSS4: Big Creek Trailhead, Forsyth County, GA.
Context: Suburban

Zip Code: 30040
POP2015: 75,796
SQMI: 58.59
POP_DENS_SQMI: **1,293.66**

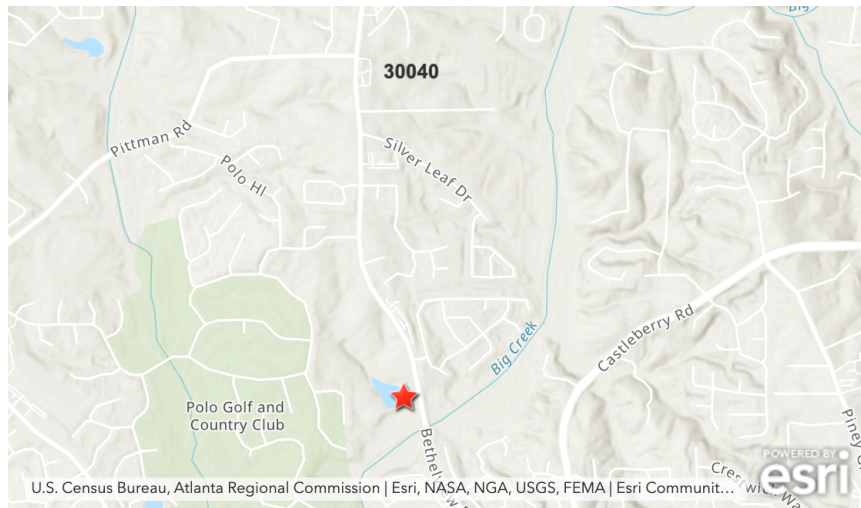


Figure D.4: PSS4 Map, context, and population density.

**PSS5: The Ray, Georgia
Department of
Transportation Visitor's
Center. Troup County, GA.**
Context: Rural

Zip Code: 31833
POP2015: 7,309
SQMI: 104.28
POP_DENS_SQMI: **70.09**

Zip Code: 36854
POP2015: 15,424
SQMI: 57.84
POP_DENS_SQMI: **266.67**

Zip Code: 36863
POP2015: 10,977
SQMI: 76.57
POP_DENS_SQMI: **143.35**

**AVG POP_DENS_SQMI:
160.03**

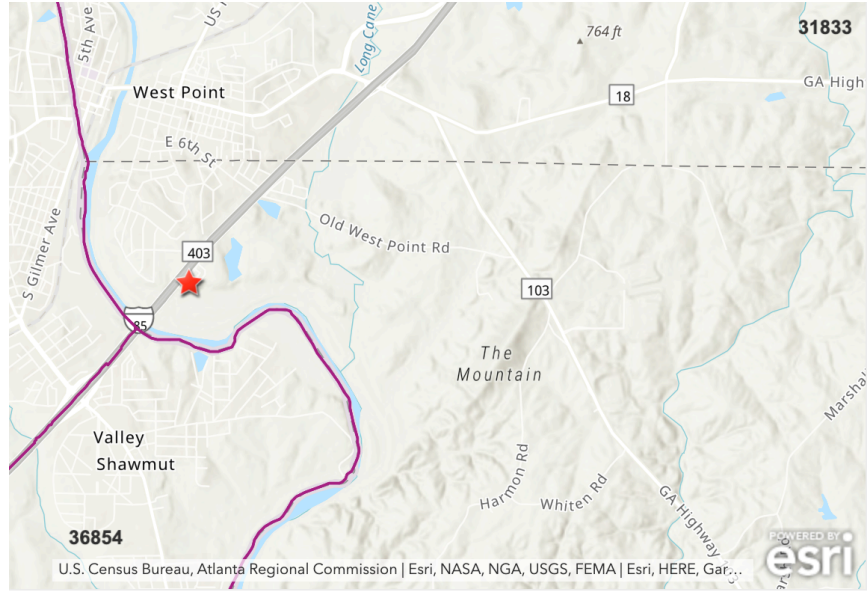


Figure D.5: PSS5 Map, context, and population density.

**PSS6: Callaway Gardens
Butterfly Center. Pine
Mountain, GA.**
Context: Rural

Zip Code: 31822
POP2015: 5,601
SQMI: 129.28
POP_DENS_SQMI: **43.32**

Zip Code: 31823
POP2015: 817
SQMI: 9.21
POP_DENS_SQMI: **88.70**

**AVG POP_DENS_SQMI:
66.01**

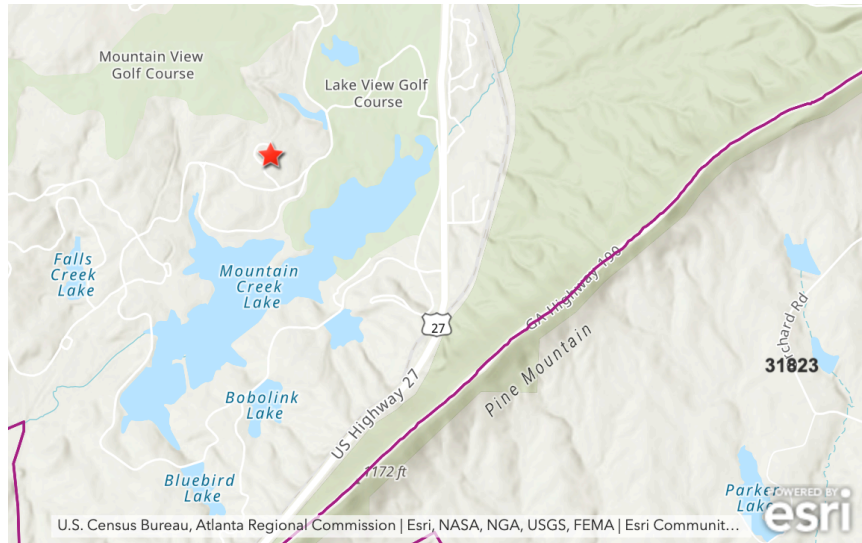


Figure D.6: PSS6 Map, context, and population density.

APPENDIX E

STATISTICAL ANALYSIS

Figure E.1 – Histogram and normal quantile plot showing distribution of the variable for site preference for all sites.

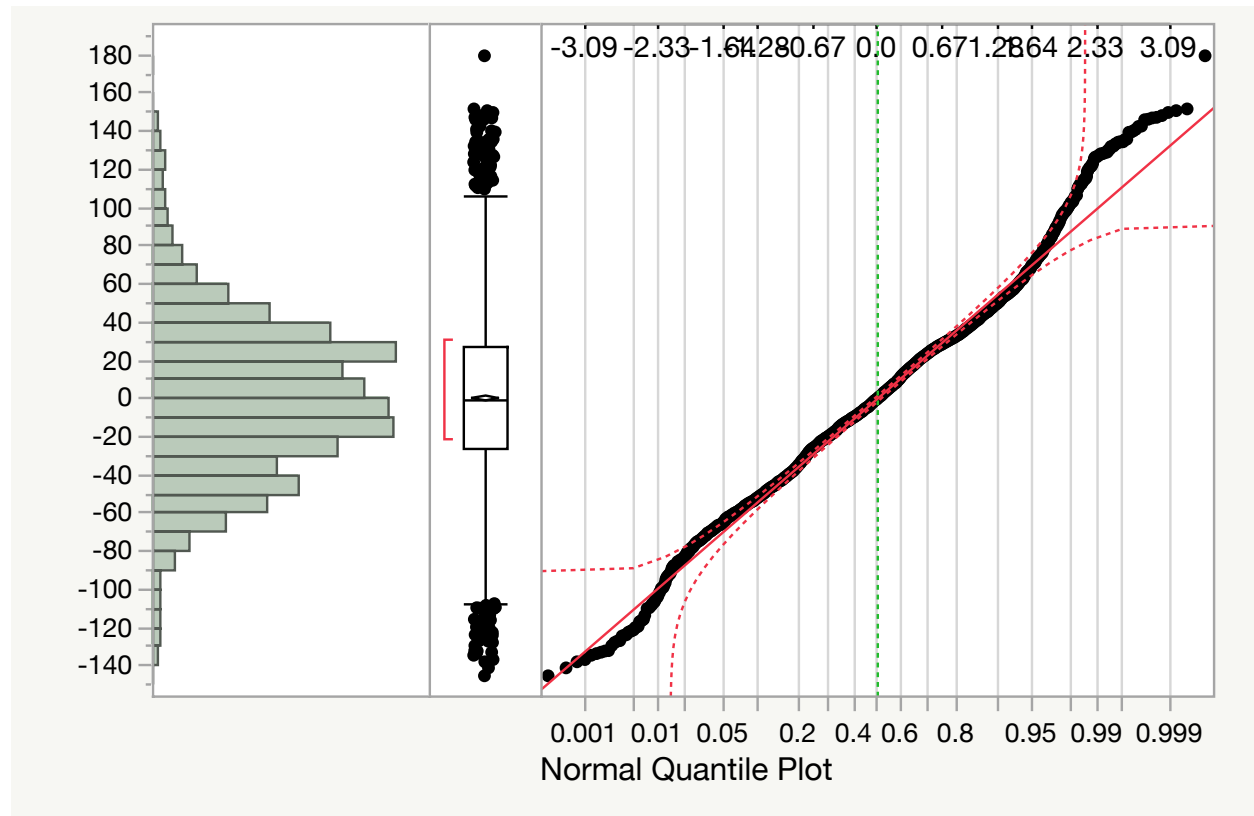
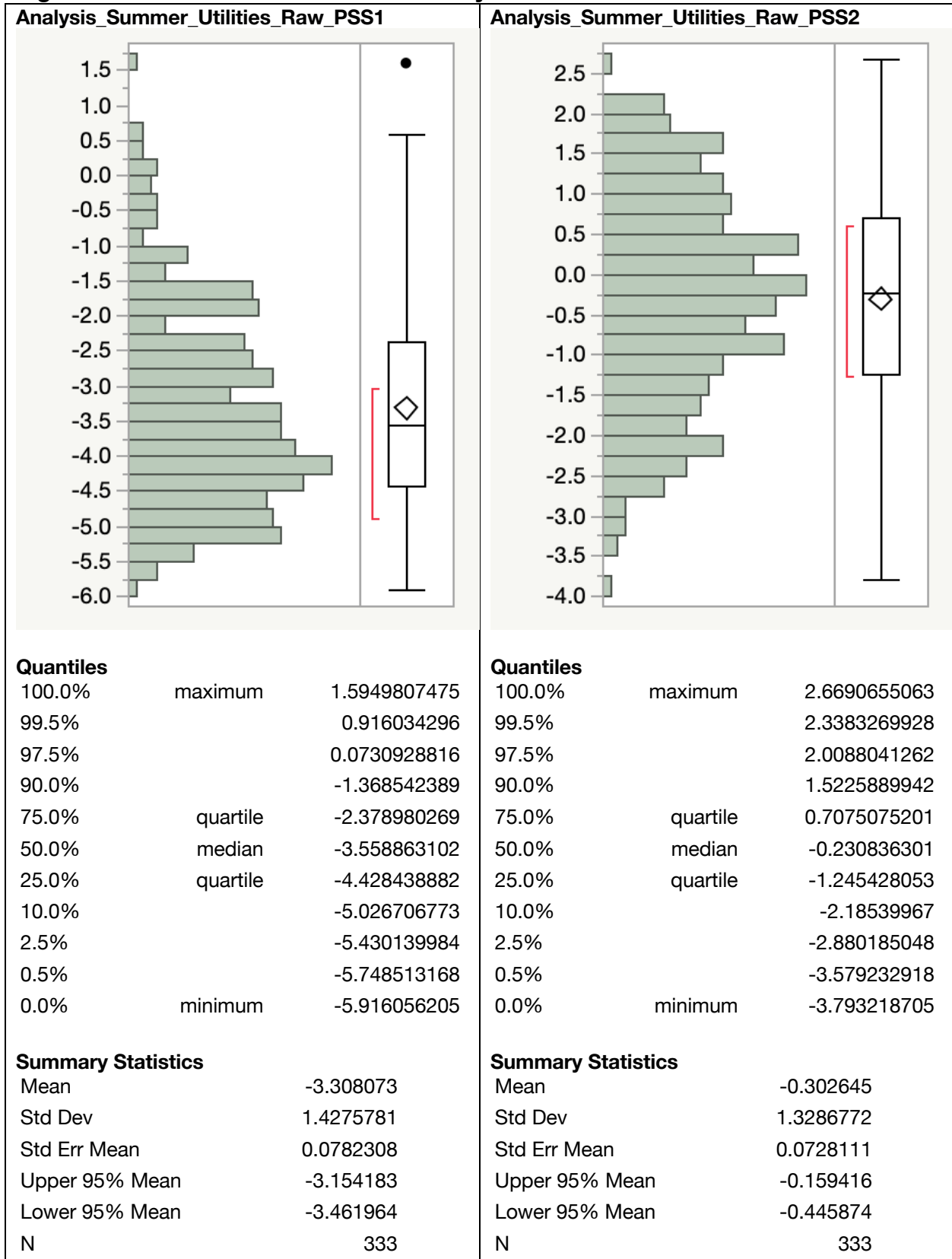
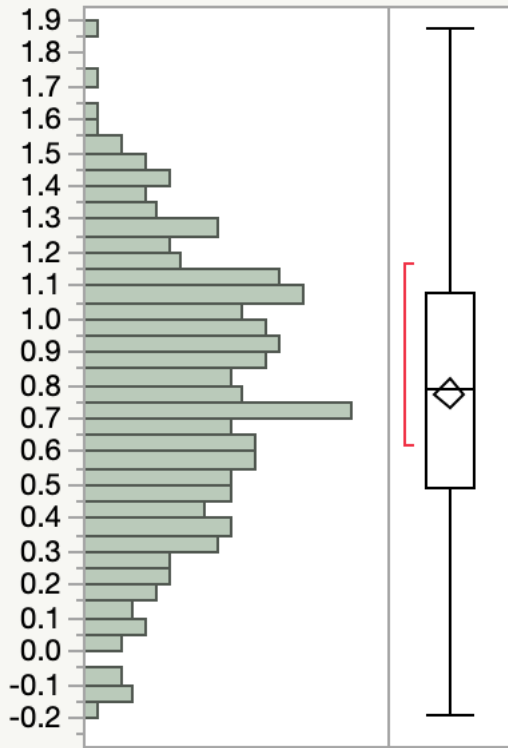


Figure E.2 –Distribution of summer utility scores.



Analysis_Summer_Utilities_Raw_PSS3



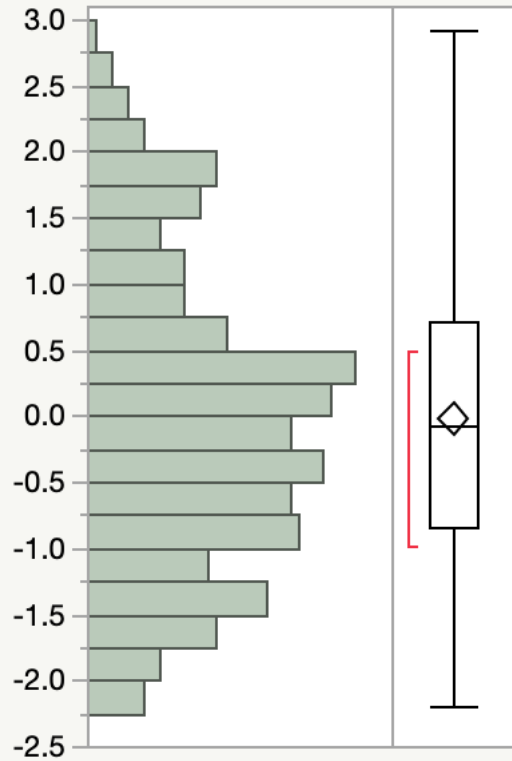
Quantiles

100.0%	maximum	1.874450203
99.5%		1.7761887761
97.5%		1.4924452119
90.0%		1.283517376
75.0%	quartile	1.0786487497
50.0%	median	0.7858299644
25.0%	quartile	0.4874062864
10.0%		0.2501072618
2.5%		-0.039839534
0.5%		-0.154540091
0.0%	minimum	-0.189834067

Summary Statistics

Mean	0.7767306
Std Dev	0.3930387
Std Err Mean	0.0215384
Upper 95% Mean	0.8190995
Lower 95% Mean	0.7343617
N	333

Analysis_Summer_Utilities_Raw_PSS4



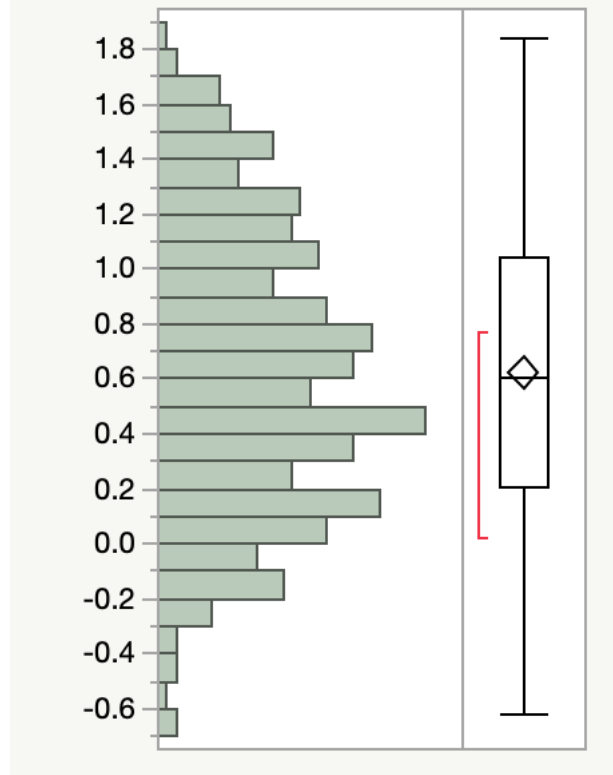
Quantiles

100.0%	maximum	2.9187767605
99.5%		2.7923951526
97.5%		2.3557791393
90.0%		1.7355805907
75.0%	quartile	0.7053593897
50.0%	median	-0.069033042
25.0%	quartile	-0.842663461
10.0%		-1.490003822
2.5%		-1.966924362
0.5%		-2.170480725
0.0%	minimum	-2.193899655

Summary Statistics

Mean	-0.00978
Std Dev	1.146018
Std Err Mean	0.0628014
Upper 95% Mean	0.1137589
Lower 95% Mean	-0.133319
N	333

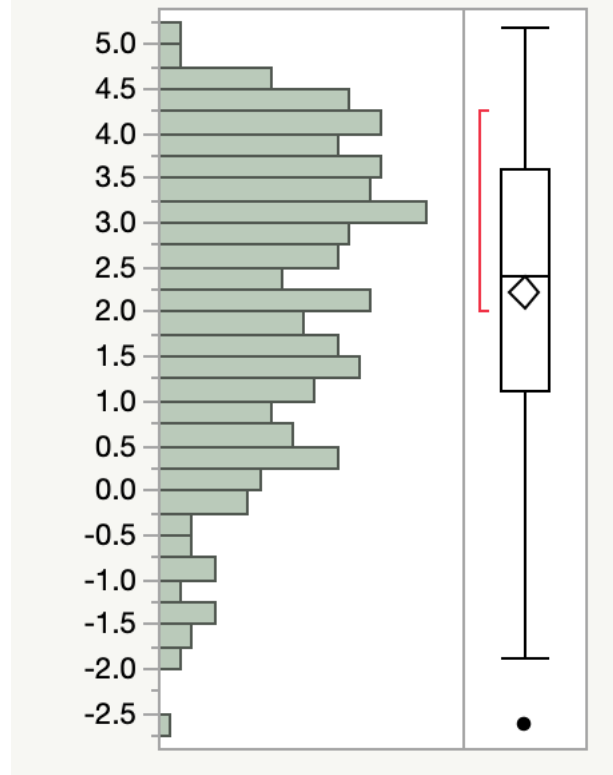
Analysis_Summer_Utilities_Raw_PSS5



Quantiles		
100.0%	maximum	1.8384026099
99.5%		1.8081227062
97.5%		1.6214279619
90.0%		1.3799633851
75.0%	quartile	1.0403039479
50.0%	median	0.6039436333
25.0%	quartile	0.2109770069
10.0%		-0.032842097
2.5%		-0.278927018
0.5%		-0.617456816
0.0%	minimum	-0.621699831

Summary Statistics	
Mean	0.6254005
Std Dev	0.5251157
Std Err Mean	0.0287762
Upper 95% Mean	0.6820071
Lower 95% Mean	0.5687938
N	333

Analysis_Summer_Utilities_Raw_PSS6



Quantiles		
100.0%	maximum	5.1857208404
99.5%		5.0745815167
97.5%		4.6347660431
90.0%		4.2126114711
75.0%	quartile	3.5953092184
50.0%	median	2.4103171409
25.0%	quartile	1.1210095782
10.0%		0.0145281343
2.5%		-1.466155405
0.5%		-2.129531815
0.0%	minimum	-2.62457344

Summary Statistics	
Mean	2.218367
Std Dev	1.6240229
Std Err Mean	0.0889959
Upper 95% Mean	2.393434
Lower 95% Mean	2.0433
N	333

Figure E.3 – Distribution of Winter Utility Scores.

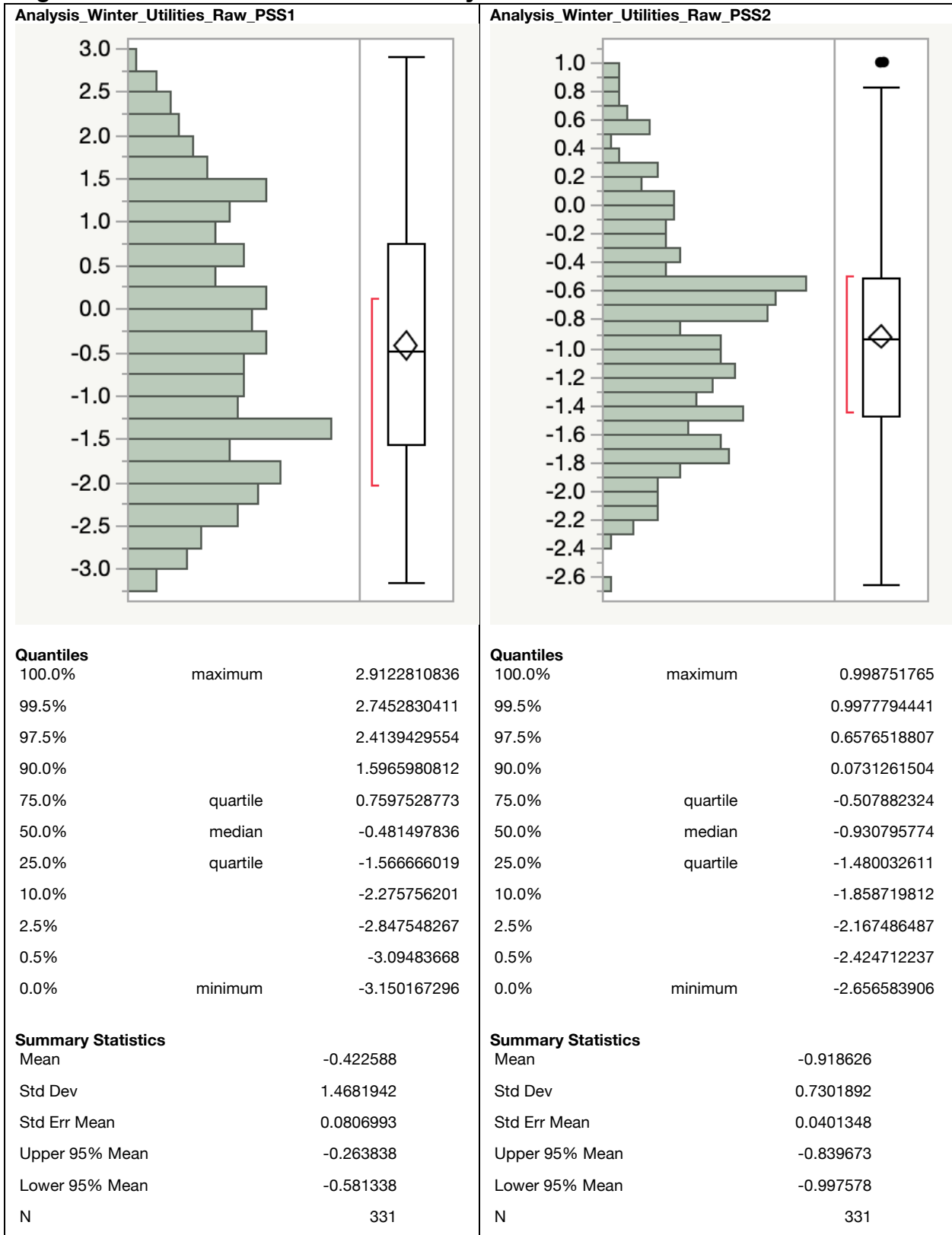


Figure E.3 – Distribution of Winter Utility Scores.

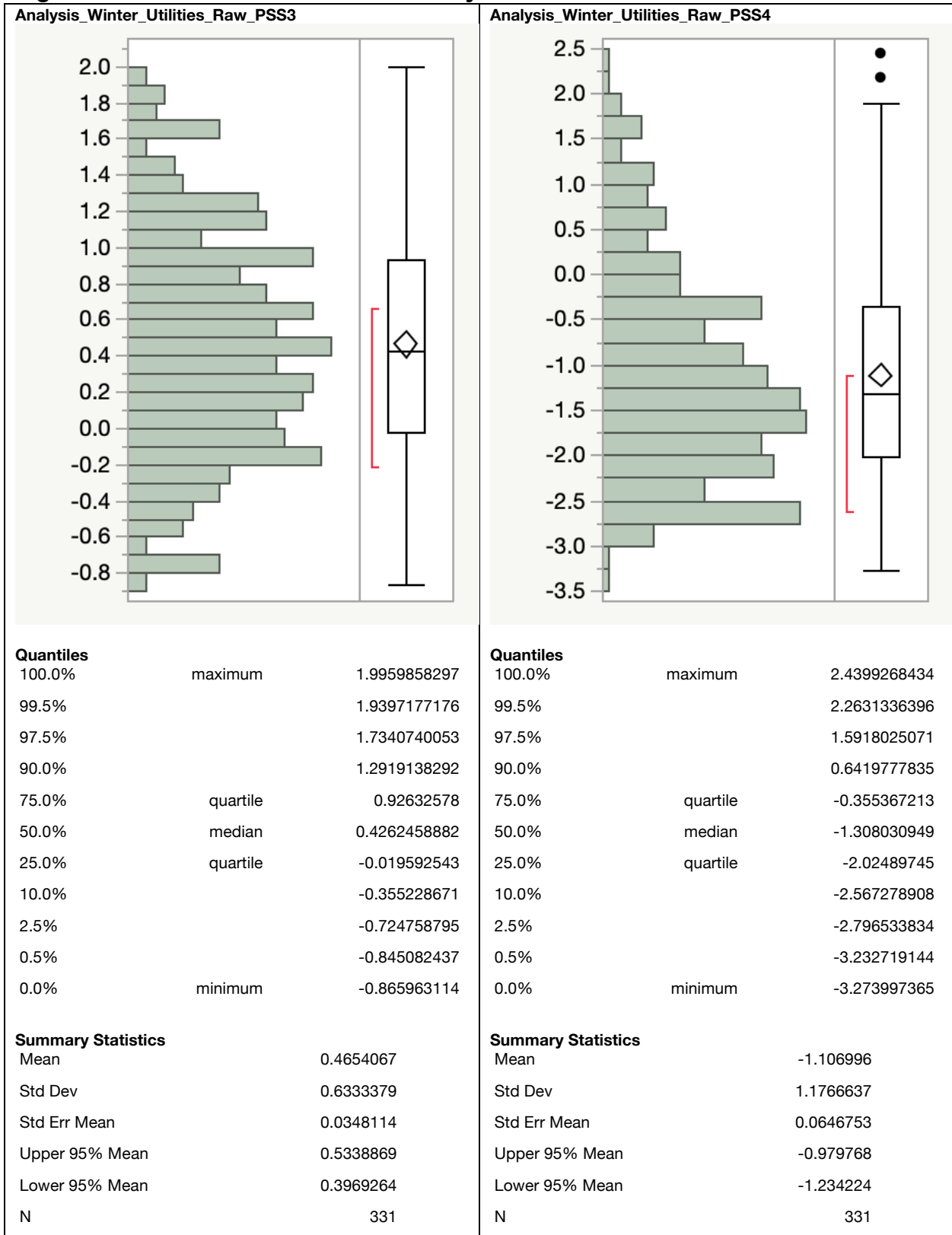


Figure E.3 – Distribution of Winter Utility Scores.

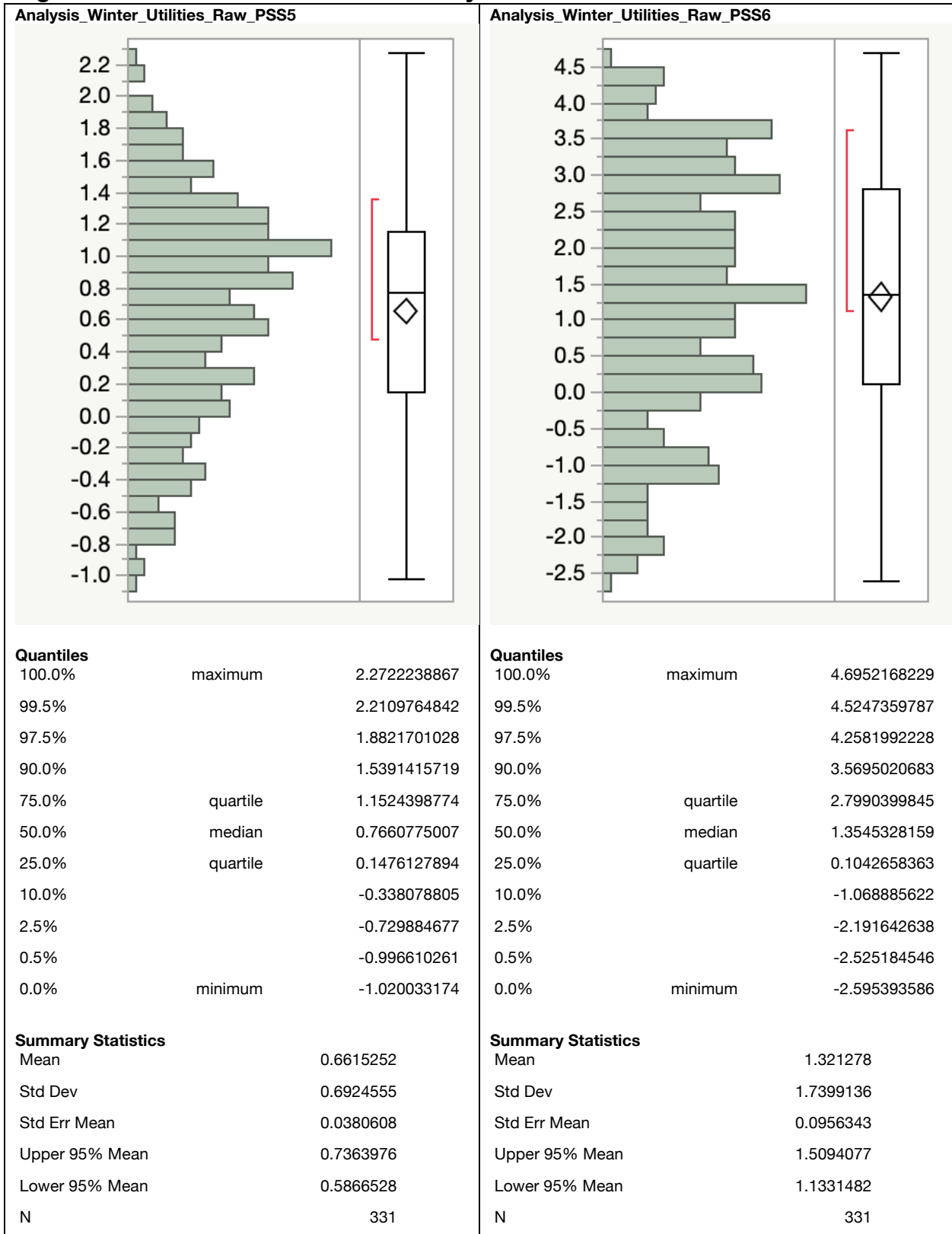
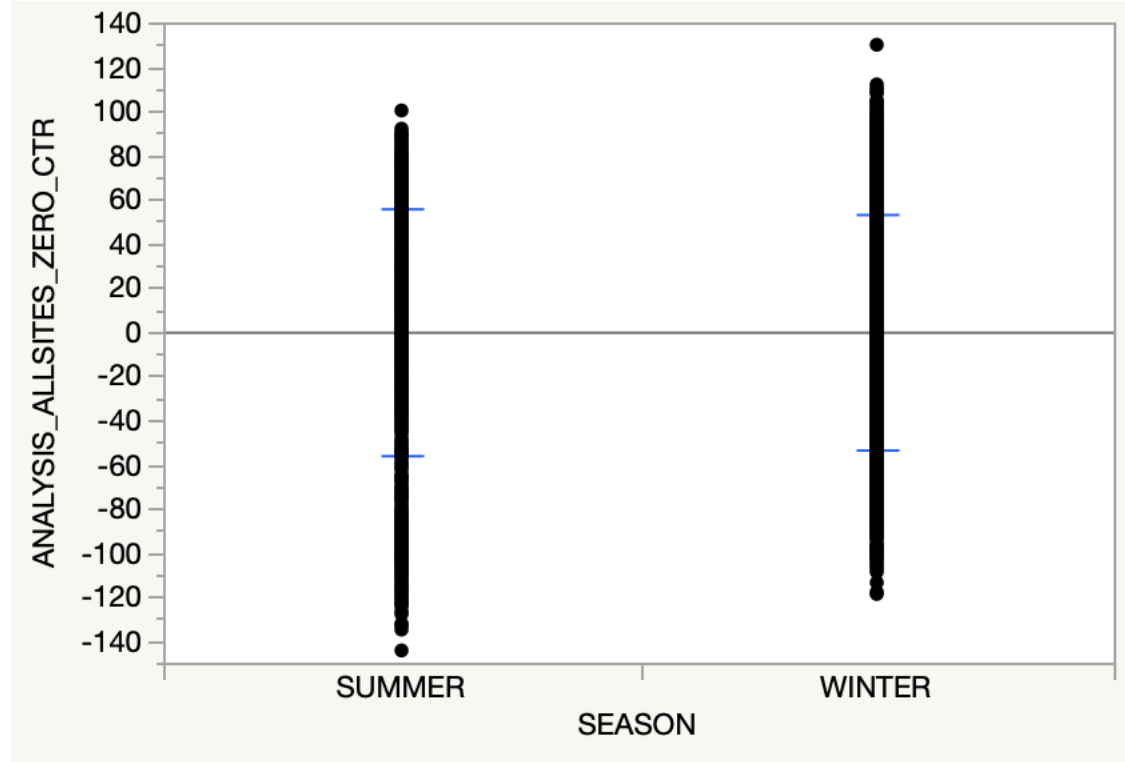
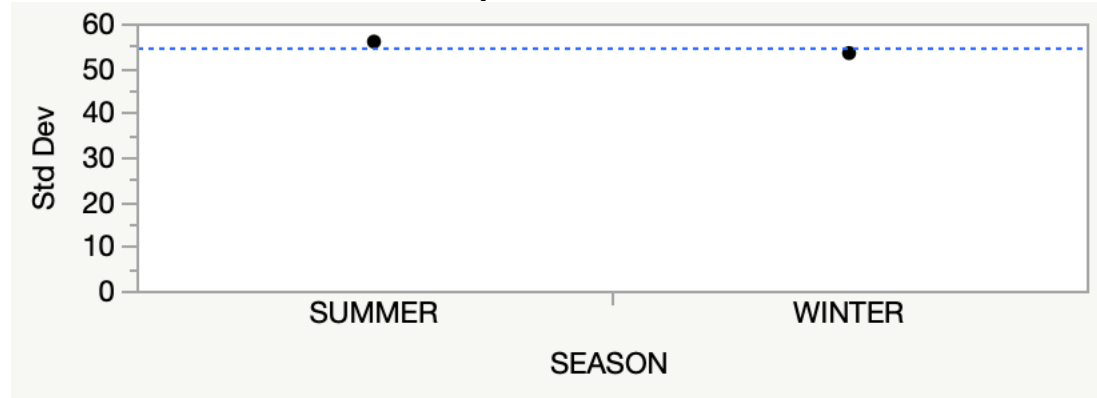


Figure E.4 – Bartlett Test for Equal Variance by Season

Oneway Analysis of ANALYSIS_ALLSITES_ZERO_CTR By SEASON



Tests that the Variances are Equal

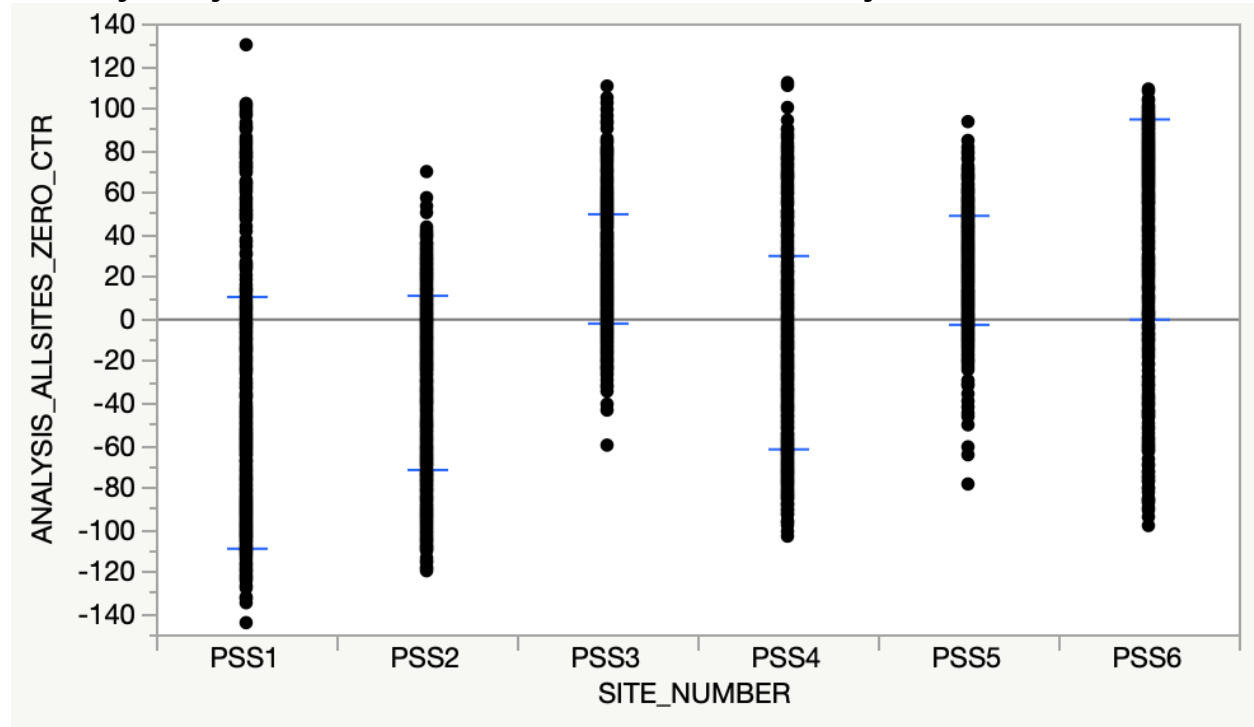


Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
SUMMER	1998	55.90497	44.25768	43.04018
WINTER	1986	53.33334	44.87862	44.87810

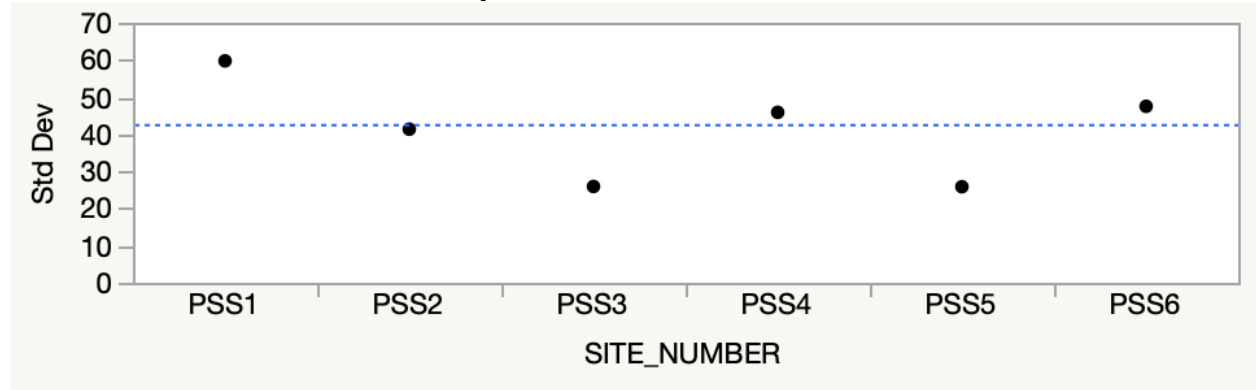
Test	F Ratio	DFNum	DFDen	p-Value
O'Brien[.5]	7.0876	1	3982	0.0078*
Brown-Forsythe	3.0490	1	3982	0.0809
Levene	0.3848	1	3982	0.5351
Bartlett	4.4121	1	.	0.0357*
F Test 2-sided	1.0988	1997	1985	0.0357*

Figure E.5 – Bartlett Test for Equal Variance by Site

Oneway Analysis of ANALYSIS_ALLSITES_ZERO_CTR By SITE_NUMBER



Tests that the Variances are Equal



Level	Count	Std Dev	MeanAbsDif to Mean	MeanAbsDif to Median
PSS1	664	59.74829	48.76028	46.80706
PSS2	664	41.35270	35.32449	34.99494
PSS3	664	25.93476	20.36256	19.88571
PSS4	664	45.88940	36.78393	36.59374
PSS5	664	25.86957	20.64516	20.61331
PSS6	664	47.51349	37.79985	33.32648

Test	F Ratio	DFNum	DFDen	Prob > F
O'Brien[.5]	95.5635	5	3978	<.0001*
Brown-Forsythe	82.0709	5	3978	<.0001*
Levene	128.9540	5	3978	<.0001*
Bartlett	140.3237	5	.	<.0001*