THE BUTTERFLY HIGHWAY: CONNECTING PEOPLE AND NATURE

by

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ABSTRACT

ANGELIQUE GREER HJARDING. The butterfly highway: connecting people and nature. (Under the direction of DR. JANNI SORENSEN)

Many residents in African American neighborhoods in Charlotte, NC, struggle to meet basic needs and lack the capacity to address other quality of life issues such as beautification, social capital, and environmental justice. Urban wildlife, including pollinators, also struggle to meet basic needs due to a lack of suitable habitat available for food and reproduction. Habitat loss is attributed to urbanization, overuse of pesticides, and human landscape preferences for non-native species that provide little or no habitat resources for pollinators. This study explores the interactions of people and nature through a social-environmental intervention, the Butterfly Highway.

The research presented in this dissertation focuses on humans and nature at the intersection of social and ecological systems at the neighborhood, community, and county scale. This study uses a transdisciplinary research approach bridging the disciplines of geography, planning, and conservation. Participatory Action Research and qualitative research methods are used ensure that participants have a strong voice in the study and to more fully understand conservation engagement and participation at multiple scales.

The findings of this work contribute to several areas of knowledge at the intersection of social and ecological systems including: 1) Our understanding of the barriers, benefits, and outcomes of participation in a community based citizen science program. 2) How an environmental intervention can work at the intersection of social

and ecological systems through the framework of ecological wisdom. 3) How a social-environmental intervention can impact governance at multiple scales.

DEDICATION

This work is dedicated to the neighborhoods in Charlotte who welcomed me into their community and helped me bring the Butterfly Highway to life. I also dedicate this work to my family, you were there to save me from myself when I needed it the most. This dissertation wouldn't exist without you.

ACKNOWLEDGEMENTS

I would like to thank my advisor and committee chair, Dr. Janni Sorensen. You stepped outside of your comfort zone and took me under your wing even though I knew nothing of participatory community work and qualitative research and you knew nothing about conservation biology or pollinators. You challenged me to think outside of the box for ways to bridge the two worlds our research is grounded in. It was hard work, but I am forever changed as a researcher because of it. Despite the many challenges, we make a great team and I am excited to continue our work together helping communities fight social and environmental injustice.

To my colleagues and friends in the Charlotte Action Research Project (CHARP), thanks for taking a chance on a biologist when I needed a research home. You taught me about doing work that matters and helped me learn the ropes of neighborhood and community work. Without this space to work in, I might never have come up with the idea for the Butterfly Highway. Each of you have helped me learn how to give the community a voice in conservation research and for that I am forever grateful.

Thank you to the UNC Charlotte Graduate School and Department of Geography and Earth Sciences for supporting me through GASP grants, various assistantships, and other grants that helped to support my studies and launch the Butterfly Highway. Thank you to Paula Gross and staff at the UNC Charlotte Botanical Garden for sharing your native plant knowledge and keeping my plants alive. Thanks to the National Fish and Wildlife Foundation for accepting my original grant to pilot the Butterfly Highway and starting me off on this journey.

Special thanks to Meg Whalen and Crista Cammaroto and the College of Art + Architecture for bringing me into the Keeping Watch family and helping to bridge my university research with my applied conservation work. Habitats and wildlife are beautiful but you have both helped me find a new way to see that beauty through art.

Finally, I am grateful for the support of the North Carolina Wildlife Federation staff and board of directors. Special thanks to Tim Gestwicki for believing in my work and helping to launch the Butterfly Highway across NC. Rarely do dreams become reality, but in this case, mine sure did.

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LIST OF ABBREVIATIONS

BH	Butterfly Highway
CAW	Community Alliance for Wildlife
CBNRM	Community Based Natural Resource Management
CBPAR	Community Based Participatory Action Research
CHARP	Charlotte Action Research Project
IUCN	International Union for the Conservation of Nature
NHA	Neighborhood Association
MCPR	Mecklenburg County Park and Recreation
NBS	Neighborhood and Business Services
NCWF	North Carolina Wildlife Federation
NWF	National Wildlife Federation
NFWF	National Fish and Wildlife Foundation
UNCC	University of North Carolina Charlotte

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CHAPTER 1: INTRODUCTION

More than half of the world's population lives in urban areas. In developed countries, that number rises to 70-80% (The World Bank, 2013). This shift to a majority urban living system affects not only how people live but how they perceive and interact with their environment. Urbanization creates new habitats that are most often not suitable for native species and depletes resources that these species rely on for survival (Brian Czech, Krausman, & Devers, 2000). This results in urban residents experiencing a below average native species biodiversity which creates an extinction of experience with nature (Turner, Nakamura, & Dinetti, 2004). This can impact their ability to have an accurate picture of nature and environmental degradation. As they lose sight of what pristine or wild nature really looks like it creates a shifting baseline of experience with nature from which they can perceive changes to their environment (Pauly, 1995).

In cities, urban green space is often where humans interact the most with the natural environment. The quality of the green space can impact Quality of Life (QOL), recreation, justice, social capital, and wellbeing (Kabisch, Qureshi, & Haase, 2015). Bieri (2013) shows that the greenness of a city has a strong positive correlation with a high QOL. Therefore, the greener a city is, the nicer a place it is to live. A strong connection has been made between access to green space and wellbeing (Hartig, 2008; Mitchell & Popham, 2008; Ward Thompson et al., 2012; Wolch, Byrne, & Newell, 2014). Proximity

to urban green space has been shown to increase well-being and decrease mental distress (Groenewegen, van den Berg, de Vries, & Verheij, 2006; Stigsdotter et al., 2010; White, Alcock, Wheeler, & Depledge, 2013). Domestic gardens occupy a larger proportion of urban greenspace than public gardens. They have also been shown to have a stronger impact on health and well-being than public greenspace (Dennis & James, 2017).

Just as humans are experiencing a connection to nature 'crisis', wildlife are also experiencing a crisis on local and global scales. Cities and urban centers are traditionally built by scraping away the native natural landscape and replacing it with a landscape made of concrete, steel, and asphalt. Urbanization has been identified as one of three primary drivers for species endangerment in the United States (B. Czech & Krausman, 1997). This has affected all urban wildlife including insects and birds. Species richness of wild bee and other pollinator species has declined over the last 50 years due to habitat loss, pesticides, and disease (Goulson, Nicholls, Botias, & Rotheray, 2015). Managed honeybee populations have also declined both in the US and Europe while demand for insect crop pollination services has increased. It is feared we may be nearing a "pollination crisis" from the decline in pollinators combined with an increased demand for pollination services.

In addition to increasing QOL for people, urban gardens have the potential to provide considerable benefits to wildlife. As rural habitat quality decreases, urban backyard refuges become increasing important for native biodiversity and wildlife (Rudd, Vala, & Schaefer, 2002). Compact urban neighborhoods with both single family and multi-family homes have been shown to support bee communities and pollination services as long as there are diverse and abundant mix of flowering plants available.

These impacts aren't just limited to backyard gardens but can also be seen in container gardens planted with appropriate nectar and pollen producing plants. A study of New York City balcony gardens found that containers planted with purple cone flower could attract bees from hives located several blocks away (Matteson & Langellotto, 2010, 2009).

In addition to providing wildlife habitat, the residential urban garden can contribute to the production of urban ecosystem services. This can include storm water runoff and flood mitigation, energy conservation, and temperature regulation (Cameron et al., 2012). While individually these parcels make a small contribution, collectively they make a much larger impact. Strategies for creating largescale voluntary urban habitat stewardship are needed (Cerra, 2017).

Biodiversity conservation has traditionally been left to the biologists and ecologists to figure out. However, it has become obvious that this is not enough to solve some of our most pressing conservation challenges. So many of our environmental issues are a result of people and the choices they make. To come up with sustainable and lasting solutions for biodiversity conservation, people must be a part of the equation.

Conservation social science is a growing field of study but it primarily uses social science methods to better understand environmental systems (Bennett, Roth, Klain, Chan, Christie, et al., 2016; Bennett, Roth, Klain, Chan, Clark, et al., 2016; Mascia et al., 2003). A more holistic view of social and environmental systems is needed to better understand both the human and environmental inputs and outcomes. Examples of holistic interventions are needed to fill this gap.

This dissertation presents an intervention called the Butterfly Highway designed to address social and environmental issues affecting urban communities and wildlife. Specifically, this intervention brings together the needs of the community with the needs of the environment. Most interventions are designed to narrowly address a single need. A unique quality of the Butterfly Highway intervention is it can address both community and environmental needs. Charlotte, NC, is the study area of focus as it demonstrates a strong need for this type of intervention. In particular, the African American community in Charlotte has disproportionately experienced challenges in terms of overall QOL due to racial segregation and economic disparity. The community has also experienced a disproportionate lack of access to nature, higher exposure to environmental threats, and reduced access to resources. The following sections provide background information about the environmental and community context of Charlotte that are relevant to this study. The aim is to provide a justification for why a social and environmental intervention was needed in the Charlotte African American community.

1.1 Charlotte environmental context

Charlotte, NC, is a rapidly growing metropolitan area that has experienced major land use changes since the 1970's. Rapid urbanization has resulted in large scale habitat conversion from farmland and forests to asphalt and concrete. Healthy and abundant trees are indicators of a healthy ecosystem (American Forests, 2010). Figure 1 illustrates tree loss that occurred in Mecklenburg County from 1985-2008. Areas colored red are those that has trees in 1985 but by 2008 they had been removed for development. During this period, there was a 33% loss of tree canopy, 3% loss of open space, and a 60% increase in urban area. It is estimated that this resulted in a loss of the removal of 3.8 million

pounds of air pollutants at a cost of $8.8 million per year. Creeks and streams are also being impacted by this tree loss and watersheds such as McDowell Creek Subwatershed, a watershed vital to protecting clean drinking water, has been identified as being impaired and unfit to swim in. This significant tree loss has also impacted the air quality in Charlotte. Trees help to cool the air and reduce the temperature in the city's urban heat island. This cooling can reduce ground level ozone, particularly in the hot summer months.

In additions to the impact on people, these land use changes have also resulted in a loss of habitat for urban wildlife. While Charlotte is known as the 'City of Trees', the tree canopy has experienced tree loss due to tree death, storms, and development. In 2011, Charlotte City Council pledged to support a community goal of a 50% tree canopy by 2050. In 2015, Charlotte become a National Wildlife Federation (NWF) Community Wildlife Habitat, a designation reserved for cities that reach a high level of environmental conservation action and include a large number of NWF Certified Wildlife Habitats. Figure 2 shows the distribution of NWF Certified Wildlife Habitats in Charlotte. The lighter color areas with stars represent the areas with the lowest number of Wildlife Habitats. This correlates with the location of the majority African American community in Charlotte.

The unmitigated sprawl exemplifies a city that is reluctant to intervene in the free market and can be described in Molotch's (1976) term as a "Growth Machine". Sorensen, Currie and Gamez (2014, p.9) describes it as follows: "…rapid growth propelled Charlotte to national prominence as a financial powerhouse while contributing to a physical landscape characterized by sprawling, single-family subdivisions on an

increasingly wide suburban footprint. Charlotte's population increases plus suburban expansion were seen as a formula for success, and local planning policies in the 1980s seemed to have framed all growth as positive".

Figure 3 uses citizen science reported data from eBird to illustrate the spatial landscape of citizen science participation in Charlotte, NC. Large geographic gaps in citizen science participation exhibit a pattern similar to that of wealth, poverty, and race in Charlotte. The areas that are the poorest and home to the highest percentage of minority residents have the least number of citizen science participants.

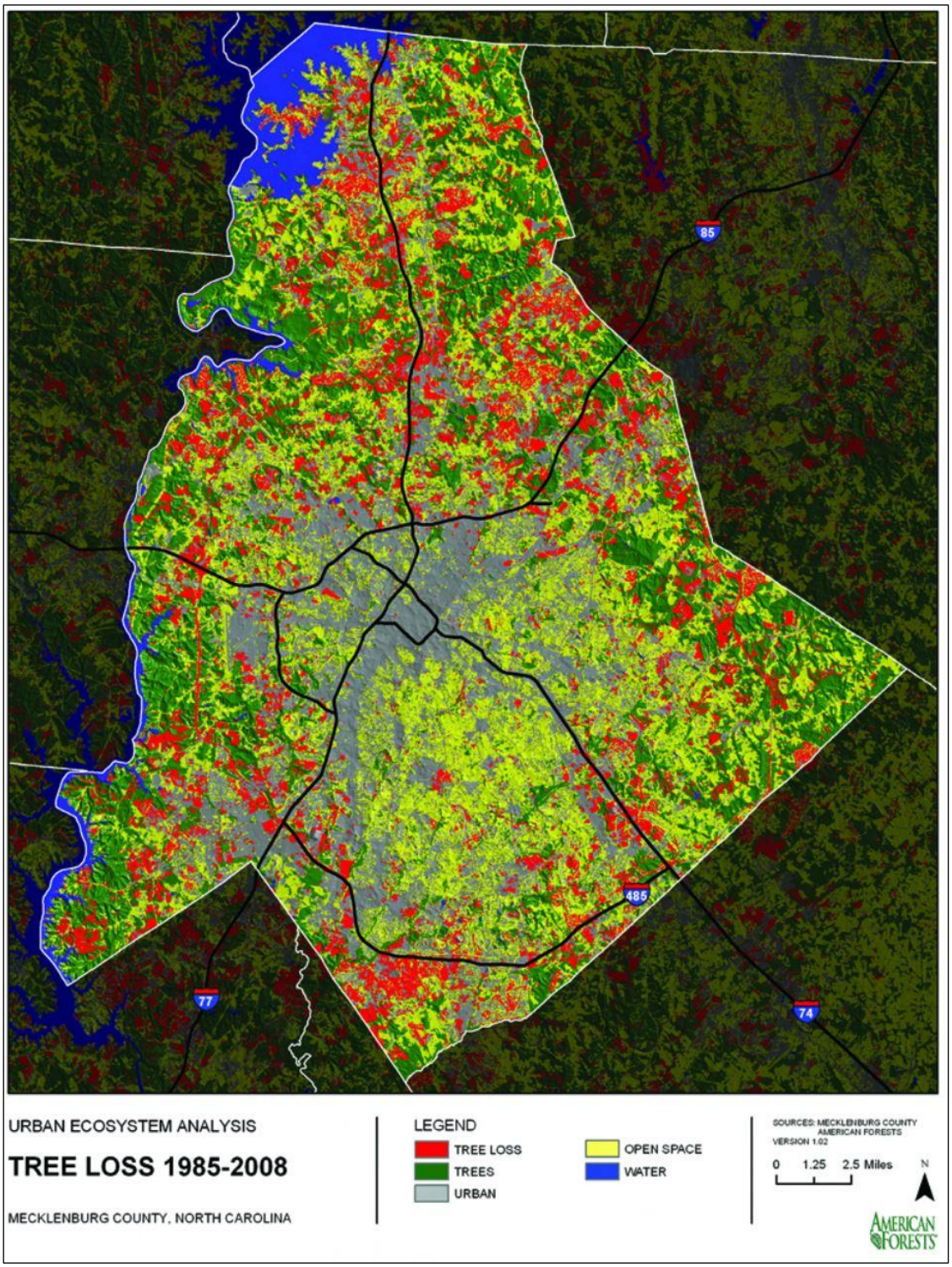

Figure 1. Charlotte tree loss from 1985-2008 (American Forests, 2008).

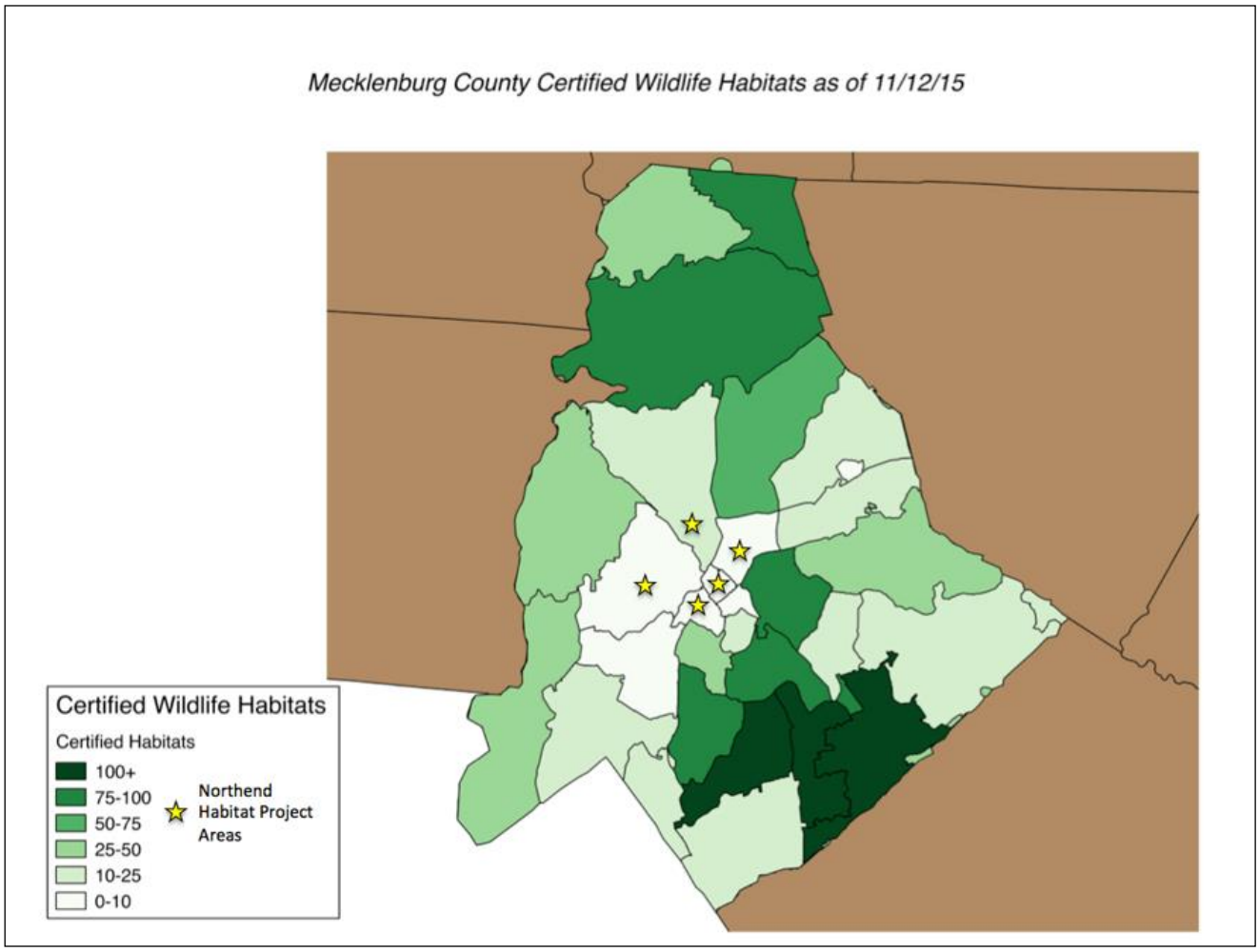

Figure 2. Distribution of National Wildlife Federation Certified Wildlife Habitats in Charlotte, NC. Data from NWF/NCWF.

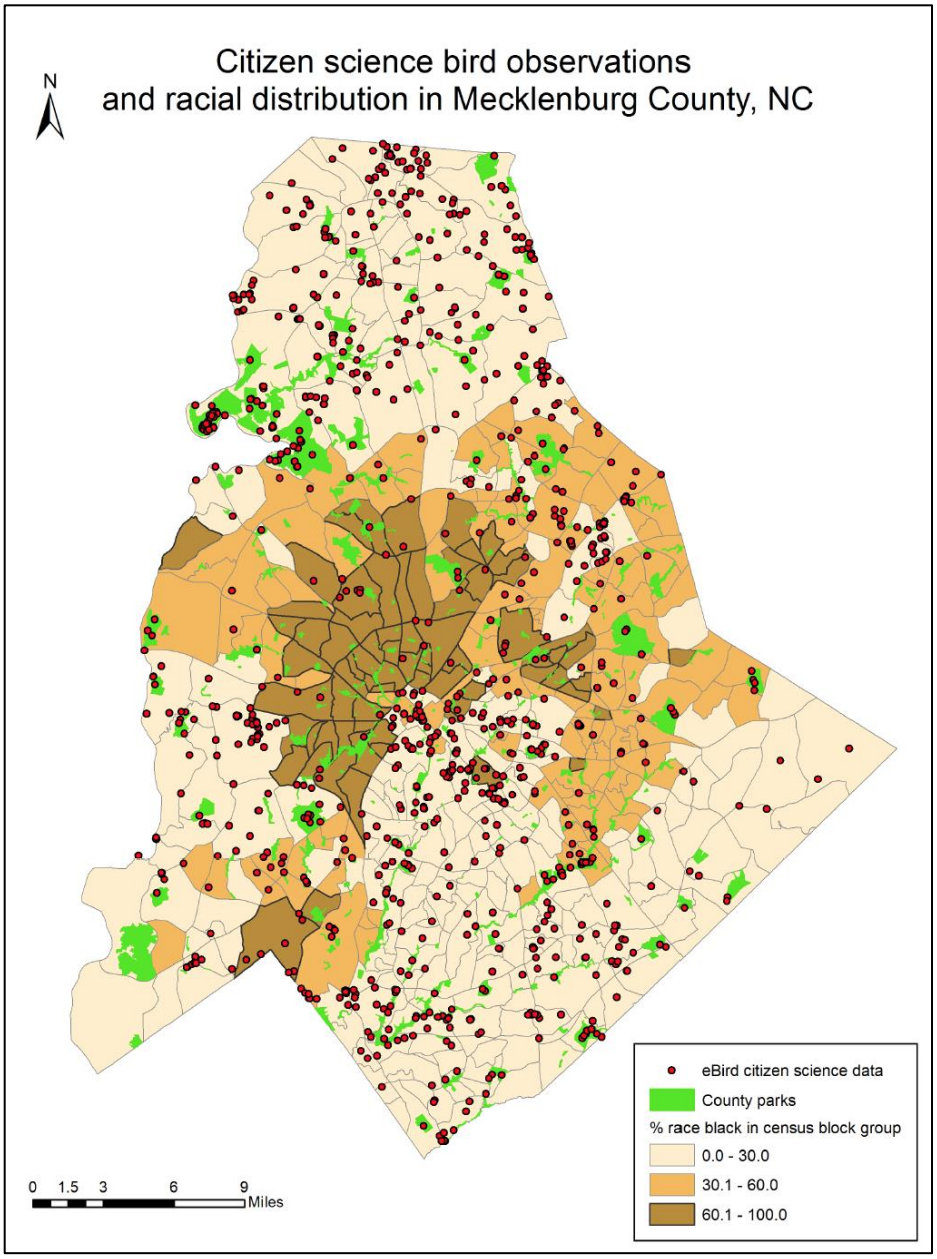

Figure 3. Citizen science reported bird observations and % black distribution in Mecklenburg county. Data from 2010 US Census and eBird.

1.2 Charlotte community context

The people and cultural fabric of cities is driven by shifts in politics, economics, environment, and the social climate over time. Historic conditions also play a major role in the shape of cities specifically influencing where people live, work, and play (Ingalls & Heard, 2010). Charlotte is a city that has experienced all of these shifts, impacting the texture of the city. The African American community in Charlotte and Mecklenburg County has been most deeply impacted, changing from a county where 40% of the population were slaves to one with "salt and pepper" neighborhoods in the early 1900's and finally to a city that seems to perpetuate residential racial segregation (Charlotte-Mecklenburg Historic Landmarks Commission, n.d.).

After emancipation, freed African Americans wanted to buy land but lacked finances and struggled to find work off the farm (Charlotte-Mecklenburg Historic Landmarks Commission, n.d.). Up until the Second World War, Mecklenburg County remained largely rural despite the growth experienced in Charlotte. White farmers were frustrated and angry over the loss of their slave labor. This resulted in large numbers of former slaves becoming tenant farmers. Between 1925 and 1940, a majority of African American farmers were tenants.

The struggles faced by African Americans post emancipation were difficult. Angry whites ridiculed them for ruining the "white lifestyle" (Charlotte-Mecklenburg Historic Landmarks Commission, n.d.). The African American community retreated to their newly established churches for sanctuary. Between 1865 and 1870, four exclusive African American churches were built in Charlotte that served as anchors for the neighborhoods that developed around them. Additional churches sprung up in areas

further outside of the city including rural areas. Most of these churches are still in existence today.

The majority of African Americans found work as common laborers or in the service sector (Charlotte-Mecklenburg Historic Landmarks Commission, n.d.). Only a few were merchants, and fewer still were professionals or in the upper class. African Americans in Charlotte sought out services such as doctors and lawyers from their own community. By the early 1900's most African Americans businesses were located in a central part of Charlotte. This resulted in a drifting apart of the white and black worlds.

Second Ward was home to an area known as Brooklyn, the largest African American neighborhood in Charlotte and center of the African American business district (Charlotte-Mecklenburg Historic Landmarks Commission, n.d.). The boundaries of this area were between South Brevard and East Trade Streets. African Americans from not just this neighborhood but all over Charlotte came to do business in Brooklyn. From barber shops and tailors to banks, most anything could be found here. In many ways, it was if a second city had been built within a city to serve the African American community (Ingalls & Heard, 2010). This phenomenon was not unique to Charlotte and similar patterns of segregation can be found in cities across the south.

Charlotte was largely ignored during the Civil War, and in post war times African Americans and whites in Charlotte often lived side by side in "salt and pepper" neighborhoods. There was no real "black side of town" but by the early 1900's Jim Crow segregation laws required that blacks lived separate but equal (Charlotte-Mecklenburg Historic Landmarks Commission, n.d.). This resulted in creating concentrations of

African Americans in certain sections of the city. Several neighborhoods grew up around the Biddle Institute (now Johnson C. Smith University) and around trolley lines. Washington Heights was the first street car suburb developed specifically for the African American middle class in Charlotte. It is one of the few, if not the only one in America (T. Hanchett, 2014). The Cherry neighborhood was built by a white landowner, John Meyers, to create a neighborhood with amenities similar to Elizabeth (an affluent white neighborhood) that provided separate but equal amenities to black residents. Little to no funding for development was aimed at the African American community in Charlotte and by the 1930's, some of the worst poverty and living conditions existed in black neighborhoods.

The end of the Second World War brought the beginning of many changes to Charlotte's urban residential neighborhoods as white soldiers returning from war were in need of housing which resulted in a white flight from city center into the suburbs (Charlotte-Mecklenburg Historic Landmarks Commission, n.d.). Money for urban development left the city and resulted in the deterioration of many historic urban black neighborhoods. In some cases, this resulted in the complete removal of neighborhoods as part of urban renewal projects. This also made room for the growing central business and financial district. For those that could afford to move to the suburbs, new contemporary middle class African American neighborhoods were constructed to provide a source for new housing stock for the city's black residents. These neighborhoods included Double Oaks, University Park, and Northwood Estates.

The initial cause of residential segregation in Charlotte was based on economics (T. W. Hanchett, 1988). When the textile mills came in, they brought white outsiders in

to work in the mills and populate the towns that served the millworkers. Most textile mills only employed white workers and the few that employed black workers had them working in separate areas from the whites. Politics helped to push the divide even further. Affluent Charlotteans felt threatened by the rise of the Populist Party comprised of farmers, factory workers, and African Americans. Through manipulating the state constitution, the Democratic party in NC managed to completely disenfranchise black voters by implementing a literacy test which effectively stripped away their right to vote.

The "commercial civic-elite" used their power to transform Charlotte into a network of homogenous elite neighborhoods such as Myers Park and Eastover (T. W. Hanchett, 1988). This changed what Charlotteans found desirable in a neighborhood and allowed developers to design homogenous and restricted spaces in the urban landscape. One such neighborhood, Piedmont Park, listed in the deeded covenant that African Americans could not own or rent homes in the neighborhood. They also mandated that homes must cost at least $1,500 to keep poor whites out of the neighborhood as well. Many other neighborhoods followed suit including Myers Park, Wilmore, and Wesley Heights.

Of the earliest developed black villages in Charlotte, there are only two that remain standing (T. W. Hanchett, n.d.). All of the rest have been demolished. The oldest is Biddleville with JCSU at the center of the neighborhood. Biddleville was developed in 1871 to house faculty and staff for Biddleville University (now JCSU). The Cherry neighborhood, was created as a "model black neighborhood" by the white Myers family. Cherry and Biddleville are the only two of the early black neighborhoods whose origins are known.

Between 1960 and 1967, 1,480 buildings in Brooklyn were bulldozed using federal funds in the name of "urban renewal". Instead of seeing a bright and vibrant community, white business leaders saw the area as a threat to the commercial business district (Ingalls & Heard, 2010). The area went from having a population of 3,569 in 1960 to only a single resident in 1970. This time period also brought highways through neighborhoods such as McCrorey Heights, Lincoln Heights, Greenville, and Biddleville.

African American neighborhoods in Charlotte originated between the end of the Civil War and 1920 (Ingalls & Heard, 2010). Most of the Black Charlotte suburbs were developed in the late 1890's to early 1900's. Ingalls and Heard propose a typology of African American neighborhoods in Charlotte based on social, economic, and historical influences. These neighborhood types include In-Town Residential Concentrations, Rural Villages and Concentrations, Separate Villages (Rim Villages and Streetcar Suburbs), and Auto-Oriented Suburbs. During the 1960's most if not all of the Black neighborhoods in Charlotte experienced significant change because of urban renewal efforts.

The major In-Town Residential Concentration neighborhood was Brooklyn, which was demolished to make way for urban renewal projects (Ingalls & Heard, 2010). In the 1970's, 4th Ward experienced gentrification led by two major banks in town. Within a decade, black residents were pushed out to make room for white residents. Residents of 3rd Ward were replaced by a NFL stadium and the development that followed diminished the presence of African Americans in this ward as well. The Hope VI program championed by President Clinton removed most of the remaining In-Town black residents when First Ward's public housing project, Earl Place, was replaced by a mixed- income housing development. Urban renewal and gentrification reduced the In-

Town African American population from 12,272 in 1960 to 2,882 in 1970. All that remains of these neighborhoods are a couple of churches and two shotgun houses.

The Cherry neighborhood developed as a Rim Village on the edge of white affluent Myers Park (Ingalls & Heard, 2010). Much like Brooklyn, it had its own services such as churches, stores, and schools. Cherry still exists as a neighborhood today. There were two Streetcar Suburbs in Charlotte, Biddleville and Washington Heights. These neighborhoods were located at the edge of town and had a slightly better housing stock.

As Charlotte grew, a pattern developed of white neighborhoods establishing to the south and east and black neighborhoods to the north and west (Ingalls & Heard, 2010). In the 1950's and 60's, new housing stock was desired by Charlotte's upper and middle class black community. McCrorey Heights, University Park, Northwood Estates, and Hyde Park all came about to fill this housing need. These neighborhoods were built as "modern" suburbs but they have since aged and become less desirable housing options for young black families. As residents aged and retired, the neighborhoods and surrounding suburbs became economically stagnated. Some neighborhoods became home to Afrocentric community activists as a way to preserve and showcase these neighborhoods. Though many of them have met with unexpected pushback from other older residents as their views and perspectives were viewed as radical.

This story of African American neighborhoods in a new south city is not unique to Charlotte and one that is repeated across the south in cities such as Atlanta, Nashville, and Birmingham. There are sharp lines of racial divide (Figure 4) where neighborhoods

are either 95% black or 95% white. Income, education, and median household income follow similar patterns in this community.

Significant, when we look at the patterns of environmental degradation and lack of participation in citizen science that follow the crescent and wedge pattern that appears in racial and economic segregation. This establishes a strong justification for looking at environmental and social systems together to begin to uncover interventions that could simultaneously address these overlapping problems.

Ecological Wisdom, is a theoretical framework largely focused on the importance of local wisdom and knowledge of the environment to make appropriate decisions (W.-N. Xiang, 2014; W. N. Xiang, 2016). Ecological wisdom is an emerging theoretical framework of social-ecological systems that includes local knowledge or ‘wisdom’ as a primary input driving the model. The framework of ecological wisdom, as will be described and discussed in chapter 2 in detail, provides theoretical framing for this dissertation.

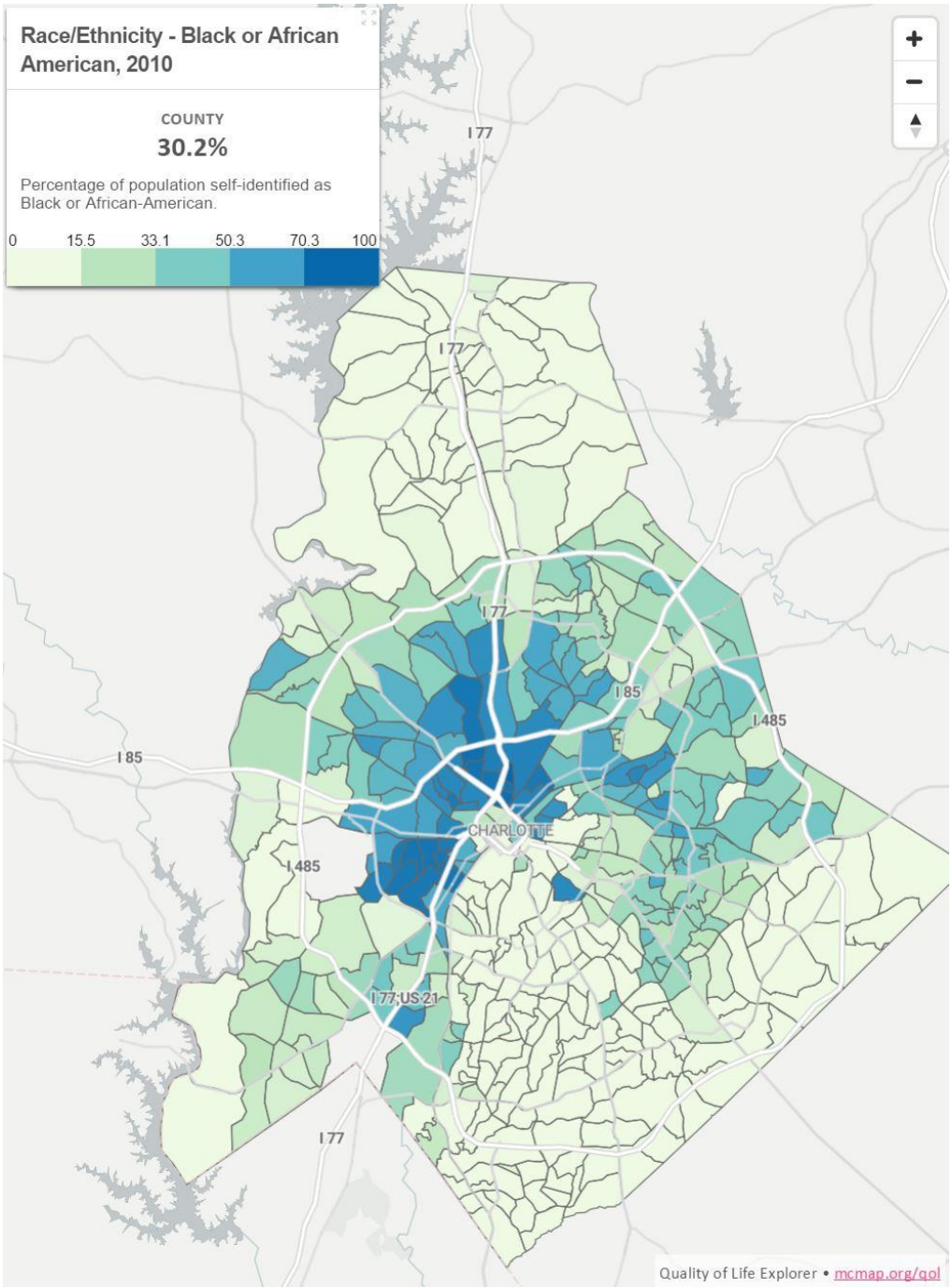

Figure 4. Racial distribution in Charlotte by block group. Data from Charlotte QOL study www.mcmap.org/qol.

1.3 CHARP

The Charlotte Action Research Project (CHARP) is a research group led by Dr. Janni Sorensen at the University of North Carolina Charlotte. The primary focus of this group is to lead participatory action research in underserved neighborhoods in Charlotte. Many of the challenges these neighborhoods face are rooted in the history of African American neighborhoods in Charlotte outlined in the previous section. Through my work as a research assistant for CHARP, I attended numerous neighborhood and community meetings. At these meetings and through personal conversations, community members expressed a concern about finding new ways to increase the quality of life for residents in their neighborhoods. Many of these conversations were with community leaders who work as advocates to address critical needs issues such as housing, education, and safety. Beautification and other quality of life issues have also been identified as something very important to the community but since these issues fall lower on the hierarchy of needs, they are often not addressed due to a lack of capacity and resources. Community knowledge of a need to improve the quality of life combined with my scientific knowledge of habitat needs for urban wildlife, led to the idea that became the Butterfly Highway.

1.4 Butterfly Highway intervention

The Butterfly Highway intervention is designed to address environmental and social issues in urban neighborhoods. The physical Butterfly Highway is a network of sustainable perennial pollinator gardens that were installed in six African American neighborhoods, that each are part of the history outlined above. Gardens were built in residential yards, multi-family housing, parks, recreation centers, and other pockets of

underutilized green space. The Butterfly Highway is a way to improve beautification and the green infrastructure in urban neighborhoods as well as mitigate the effects of urbanization on native butterfly and pollinator populations. Through participation in this project, it was expected that community members would become more knowledgeable about conservation issues within their community and become vested in achieving long term positive conservation outcomes. The outcomes of this research contribute to the knowledge of how minority communities interact with nature and how citizen science can be more than a data collection method but can be used for community building and empowerment.

The Butterfly Highway takes a starting point in social justice research that was conducted as a part of CHARP. Each member of the CHARP research team works as a liaison with one or more of CHARP's partner neighborhoods. Many of the issues CHARP works on with neighborhoods involve negative issues such as safety, housing, or food security. While these are often the topics that come up most at neighborhood meetings, there are almost always discussions about wishes and desires for neighborhood beautification. However, very little action occurs around this issue. It was generally observed that neighborhood residents were frustrated about how difficult it can be to address beautification. The reasons most often cited were the cost of beautification

projects or too many short-term renters who don't care about making their yards look nice.

CHARP partner neighborhoods that expressed an interest in neighborhood beautification were invited to be a part of the Butterfly Highway project. Neighborhood leaders were asked if the Butterfly Highway project could be presented at a neighborhood or community association meeting. Participants were recruited directly from those meetings. Additionally, leaders reached out to neighbors that do not regularly attend meetings that they felt would enjoy participating in the project.

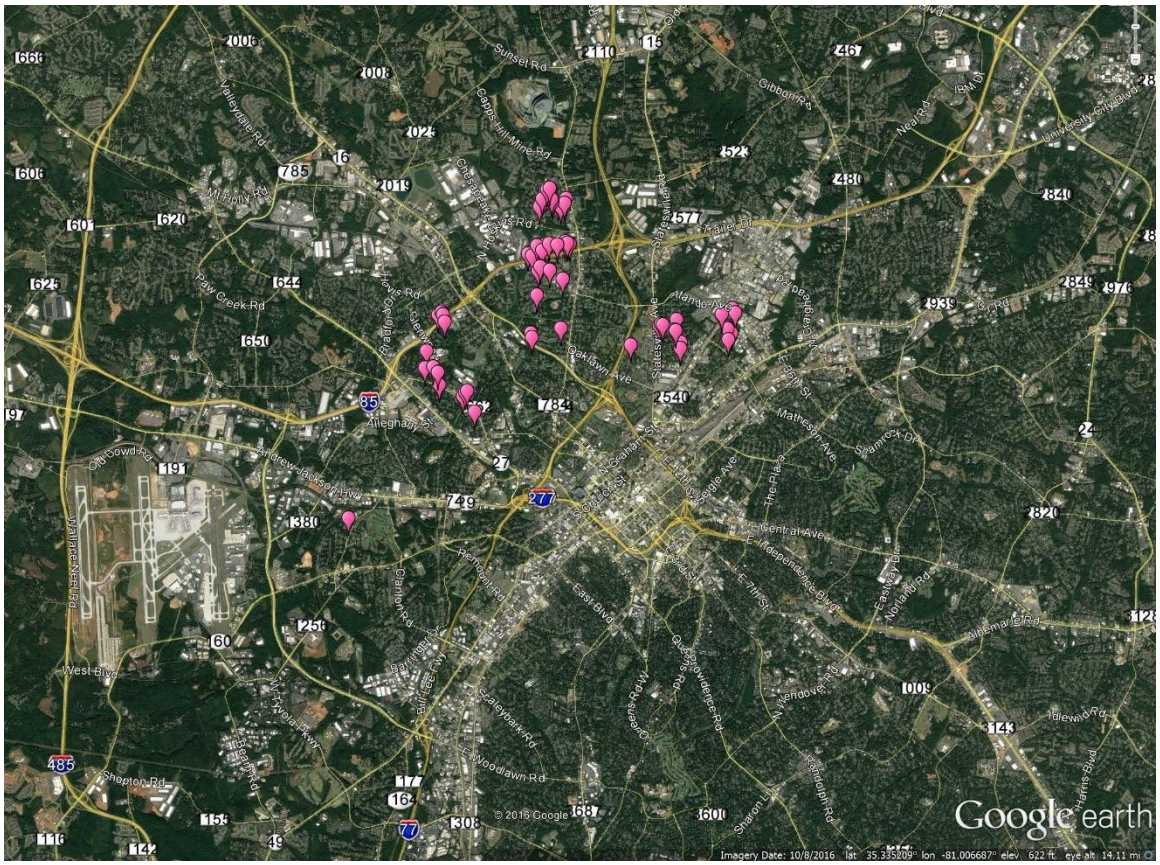

Figure 5. Butterfly Highway participants.

Garden installation and observations

During April –June 2015, 49 gardens were installed in single family residences, in low income African American neighborhoods in Charlotte, NC. Two additional gardens were installed at apartment complexes in two of the neighborhoods for a total garden count of 51. Figure 5 is a map of Butterfly Highway participants in Charlotte. All of the gardens were planted with drought tolerant perennials that are native to Mecklenburg County. Majority of the gardens were 4'x4' raised beds made of natural pressure treated wood and filled with 6" of a soil mixture called "Gardener's Delight" purchase from Wallace Farms, a Charlotte based soil farm. See Figure 6 for example of a Butterfly Highway garden during summer 2016, one year after initial planting.

Figure 6. Butterfly Highway participant garden. Summer 2016.

Plants used in the garden were selected based on several factors: suitability as nectar plants, plants known to be butterfly host plants, plants native to Charlotte, and drought tolerant plants that would require the least amount of maintenance for participants. Paula Gross with the UNC Charlotte Botanical Garden assisted with plant selection using these guidelines. Plants were purchased as landscape plugs (5" root) from Northcreek Nursery in Landenberg, PA. Northcreek is a neonicotinoid free nursery that specializes in selling wholesale native landscape plugs. Neonicotinoids or "neonics", a systemic chemical fertilizer that is suspected to be a threat to pollinator health, has not been used on these plants. Plants from "big box" garden stores such as Lowe's and Home Depot do sell flowering plants treated with neonicotinoids and should be avoided when planting gardens for pollinators. Initially I had considered growing the plants from seed but decided that the project had a much higher chance of success starting the gardens from plugs. Most perennial plants require period of cold moist stratification to germinate and the timing of the project did not allow for enough time for this process.

The UNC Charlotte motor pool loaned us an old F150 truck that was not currently in use for the duration of the project. Soil was purchased in bulk from Wallace Farms on an as needed basis. Wallace Farms, is a local soil and composting company. The mix we used to fill the beds was called Gardener's Delight and contains a mix of soil, mulch and manure as the fertilizer. The plants were delivered to the UNC Charlotte Botanical Garden and cared for in their greenhouse cold room while the gardens were being installed. All of the boards for the beds were pre-cut and stored on campus.

Participants were provided a notebook that included instructions for participation, a butterfly identification guide, observation recording sheets, and any other material they

may need as a part of the project. Participants were given the opportunity to select the plants for their garden from a group of plants pre-selected as native and drought tolerant. Participants were engaged from the beginning of the project as way to provide a sense of participation and ownership in the process. Residents also selected the location for their garden on their property based on availability of sunlight as the particular plants selected required a minimum of 6 hours of sun to thrive. Gardens were located in both front and backyards of homes.

Additionally, several multi-family residential units within the neighborhoods participated in the project. These include Glenwood Point apartments (in Greater Enderly Park) and Moore Place (Druid Hills). The Moore Place garden was a large garden located in the front of the building and has served as a demonstration garden. The Glenwood Point garden was installed next to their community garden. Several other demonstration gardens were built at Mecklenburg County Park and Recreation (MCPR) sites. The first was planted at the Bette Rae Thomas Recreation center that is located in the Enderly Park neighborhood. These gardens were built using the same flowering plants that were offered to the residents. A “Butterfly Highway” sign was given to each participant to place in their front yard to designate that they were a part of the Butterfly Highway.

1.4 Introduction Summary

The proceeding sections set the stage for how history, politics, and development may have influenced the social-environmental issues in the African American community in Charlotte. Neighborhoods have experienced a century of challenges due to Jim Crow laws of segregation, gentrification, and urban renewal. Each of these have contributed to

the creation of African American enclaves in Charlotte that are struggling to redefine themselves amidst poverty and urban decay.

This community has also been shaped by the industrial revolution which brought environmental justice issues including air, water, and noise pollution. Neighborhood parks are sparse of amenities and only receive the basic maintenance and repair. Access to resources can also be limited as city grants are limited to recognized neighborhood associations run by homeowners even when renters make up the majority of the residents.

Rapid urbanization in Charlotte has reduced available habitat for wildlife including pollinators. Areas that were once forests and meadows are now housing developments and shopping centers. Infrastructure such as roads and parking lots needed to accommodate this growth have created pressures on water, air, and soil ecosystem services.

The Butterfly Highway intervention was designed as a way to address a community identified need of beautification and a researcher identified need of habitat for pollinators. Neighborhoods were unable to find solutions on their own and the intervention created an opportunity to bring in outside resources to assist with beautification. In return community members participated in a citizen science project to care for and monitor a pollinator habitat. The Butterfly Highway was able to intervene in both a social and environmental community issue.

The following section will establish the specific research questions this study sets out to answer and tie these questions to a theoretical framework of Ecological-Wisdom.

Ecological Wisdom and how the Butterfly Highway contributes empirical research to the theory is discussed in Chapter 2.

1.6 Research statement and anticipated outcomes

The research presented in this dissertation provides insight to how humans and nature in urban environments interact at the intersection of social and ecological systems. Specifically, I look at these interactions at the neighborhood scale. This study is transdisciplinary in the research approach; bridging the disciplines of geography, planning, and conservation science. The field of geography is central to this study as the importance of place is the thread that connects all of the themes within this research. Qualitative and Participatory Action Research methods are used to focus the research lens on the human perspective of conservation engagement and participation.

The purpose of this study is to add empirical knowledge to the Ecological Wisdom theoretical framework including lessons on the importance of participation and constraints/barriers to participation in projects at the intersection of social and ecological eco-systems. Empirical research is also needed to explore the role of ethics and values as we engage in participatory, practice based research. Equally important are contributions to the conversations about ecosystem services and adaptive management from the perspective that evolves as neighborhood residents and academics establish a partnership to learn about these issues by engaging in an intervention established to intervene in both the social and environmental challenges discussed in the introduction to this dissertation. Additionally, the findings of this work will contribute to our understanding of participation in social-ecological interventions. The research questions specifically inquire about empirical contributions of the Butterfly Highway to the Ecological Wisdom framework.

Research questions:

1. What is learned from practice while implementing an intervention at the intersections of social and ecological systems about the motivations and barriers to participation in a social-ecological intervention for participants at multiple governance levels ranging from participants in the intervention to government employees interacting with the project? And,
2. What are the outcomes of participation in a social-ecological intervention for participants at multiple governance levels? And, finally,
3. How can a social-environmental intervention contribute to our understanding of an adaptive management planning framework *within the theoretical framework of* Ecological Wisdom?

CHAPTER 2: THEORETICAL FRAMEWORK

The research questions being addressed in this study stem from challenges faced at the intersection of social and ecological urban ecosystems. The Butterfly Highway intervention was designed to help neighborhoods address social-environmental challenges that they have been unable to address to date. The theoretical framework of Ecological Wisdom will be used to build an understanding of how the Butterfly Highway can address these challenges. The Butterfly Highway is an example of an empirical study that can add to the knowledge of Ecological Wisdom. This chapter presents the key literature in Ecological Wisdom and the components that feed into the conceptual model proposed by Patten (2016) in Figure 5. These components include knowledge, participation, ethics and values, constraints, adaptive co-management, and ecosystem services. While Ecological Wisdom as practice may be a developing theoretical construct, the philosophy behind the theory has origins rooted in Eastern though around humans and their interactions with nature. Early work in this thought area include deep ecology, ecosophy, and feminist ecology (Cheney, 1987; Naess, 1984; Robert Sessions, 1991). Ian McHarg is known for bringing this philosophy into the planning practice and his work has been influential in defining the Ecological Wisdom movement (McHarg, 1969; Wagner, Merson, & Wentz, 2016; Yang & Li, 2016a).

2.1 Ecological Wisdom

Humans and nature are constantly interacting in a feedback system that reflects change and adaptation. Sustainability, social-ecological systems, and Coupled Human and Natural Systems (CHANS) are all frameworks used to try to quantify, qualify, and interpret these relationships (Liu et al., 2007). Each framework is intentional about including the human or social component in their models.

Ecological Wisdom, recognizes the importance of both an individual and group's knowledge of place regarding the creation, design, planning, and management of an ecological project (W.-N. Xiang, 2014). It is a construct rooted in the ecological and intellectual traditions of Eastern thought that synthesizes ancient thoughts on nature and society with those of modern society (Young, 2016). Ecological wisdom has the potential to create a new paradigm in planning and cause the focus to shift from smart cities to ecologically wise cities that regenerate and create instead of just sustain. Patten (2016) argues that ecological wisdom as a management concept is a way to integrate the processes of human and natural systems (Coupled Human and Natural Systems – CHANS) to allow both systems to be sustainable over time. See Figure 7 for Patten's conceptual diagram of inputs into the ecological wisdom model.

Ecosophy is often used as a synonym for ecological wisdom but where ecosophy focuses primarily on the *Sophia* (theoretical wisdom), ecological wisdom also emphasizes phronesis or practical wisdom (Naess, 1973, 1989; W.-N. Xiang, 2014). Ecological wisdom largely focuses on the importance of local wisdom and knowledge of the environment to make appropriate decisions. In this context, local knowledge of the community from an insider's perspective is key to the outcomes of this research.

Ian McHarg is well known in the design and planning professions for his work using nature to influence his practice. McHarg believed that knowledge of place should guide action and he explored this idea in his book, *Design with Nature* (McHarg, 1969). This study takes the concept of knowledge of place and expands it past the ecological knowledge to include local knowledge of culture and history of place that is driven by community residents. Yang & Li (2016) demonstrate how Ecological Wisdom was used in practice by McHarg when he designed The Woodlands development outside of Houston, TX. Within this housing development, he created a multi-functional landscape that incorporated nature into the design process.

Xiang (2016) explores the idea of ecophronesis as a way to build upon Norwegian philosopher Arne Naess' concept of ecosophy (Naess, 1973, 1989). Ecosophy was meant to be a synonym for ecological wisdom and represent the human attitude towards nature (Liao & Chan, 2016). Xiang argues that ecophronesis places an emphasis on the practice of ecological wisdom, driven by "human beings' enlightened self-interest" (W. N. Xiang, 2016). Xiang believes the challenge comes when human self-interest is in conflict with the natural world. The hope is that ecophronesis can help bridge the gap between scientific theory and ecological practice by inspiring people to act with a wisdom focused approach to ecological practice.

In this study, Ecological Wisdom provides a way to address needs on the communities' terms through participatory knowledge creation. The typical method is for experts to prescribe ways to do things from the top down. Such as prescribing that we need to create smart cities and then planners and designers take the lead and build our smart cities. Ecological Wisdom presents an opportunity for communities to be a part of

the process of determining what and how they feel is the best way to begin to bring nature back to the city, their community, and neighborhoods.

Empirical evidence that Ecological Wisdom can be both actionable and practical in urban settings is largely missing from the literature. The follow sections of this chapter identify specific areas where the Butterfly Highway can provide this evidence as well as fill in gaps in the knowledge.

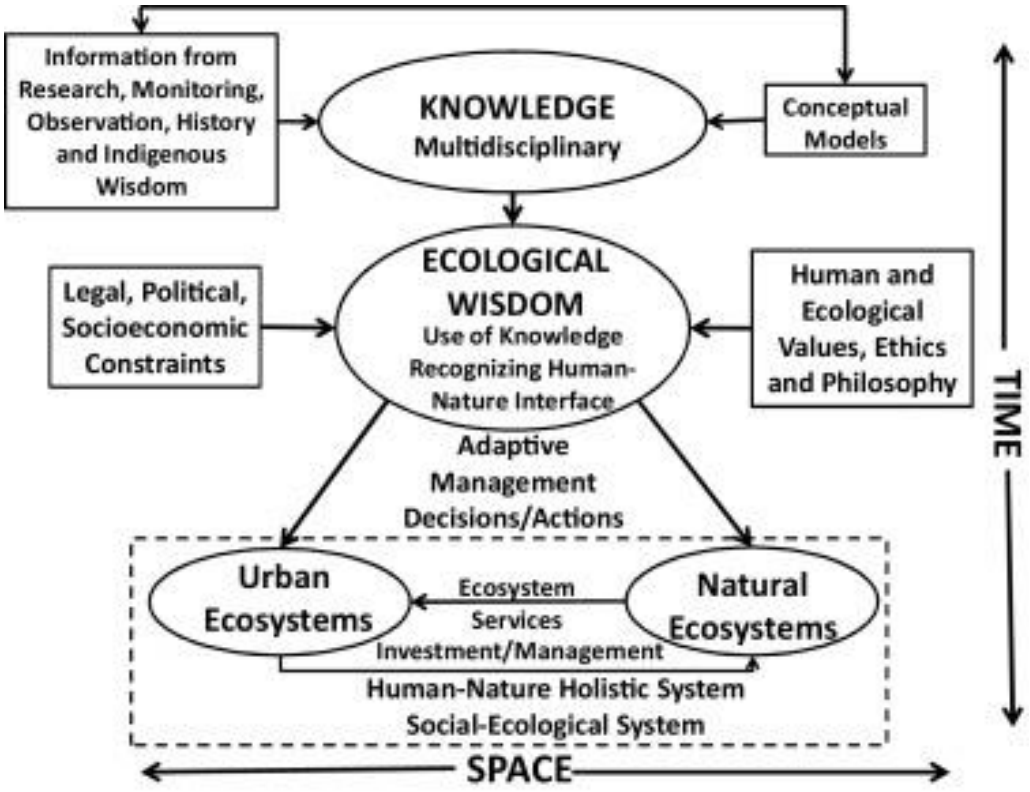

Figure 7. A conceptual diagram of factors that influence ecological wisdom showing how ecological wisdom as a centric process influences adaptive management that determines the sustainability of urban and natural ecosystems as they interact within an integrated holistic social-ecological system. (Patten, 2016).

2.2 Ecological Wisdom – knowledge

Ecological wisdom places emphasis on the importance of traditional or local ecological knowledge (TEK) to creating a sustainable social-environmental management system. Several terms are used interchangeably for TEK including traditional knowledge, indigenous knowledge, local knowledge, and environmental knowledge (Berkes, Colding, & Folke, 2000; M. Gadgil, Berkes, & Folke, 1993; Madhav Gadgil, 1992; Uprety, Asselin, Bergeron, Doyon, & Boucher, 2012). Ecological is typically used as part of the term to include the interplay of humans and their environment but this is not exclusive to indigenous knowledge and can come from a range of sources and experiences. There are several definitions of TEK in the literature (Berkes et al., 2000; M. Gadgil et al., 1993; Madhav Gadgil, 1992). Berkes et al. (2000) defined it as a "cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment".

Ecological knowledge is often gained from traditional or indigenous groups who have a long-established connection to nature and the environment in which they live (Huntington, 2000). To pursue ecological wisdom in urban ecosystems, we need to look for alternative ways to obtain local ecological knowledge. In the case of the African American community in Charlotte, most of the urban residents have experienced a disconnect from traditional ecological knowledge. However, they still have important insider knowledge to the ecology of their community including human and social ecology. This insider local knowledge of how community members engage with the

social and natural environment could be a key component of understanding how we can implement an ecologically wise model of management in their community.

Local knowledge can be defined as information in a local context that includes circumstances, relationships, and community characteristics (Corburn, 2003). To distinguish this from professional knowledge, it is the knowledge that is held by the local community in both a geographic and contextual sense. The community can be a neighborhood or a group that shares a similar culture, religion, or interests. Individual and group knowledge is key to expressing ecological wisdom in planning and design. In this study, local knowledge represents both group and individual knowledge.

Corburn argues that local knowledge can contribute key political and technical insight to solving environmental issues despite the view of many professionals that claim the public needs to be formally educated to have meaningful participation in environmental decisions. He presents a model of environmental decision-making called "co-production" in which local knowledge that professional science has excluded is re-valued for inclusion in analyses.

Popular education is another form of learning through local knowledge. It is a teaching methodology that aims to empower marginalized citizens by learning through action (Wiggins, 2011). A Brazilian educator, Paulo Freire, is attributed with developing this methodology through his work with the poor in Brazil (Freire, 1970). Popular education is inclusive and accessible, can help address issues that people face in their own communities, is focused on lived experiences, and is a way to develop leadership in communities.

The inclusion of local knowledge can also contribute to an enhanced procedural democracy that includes previously excluded and marginalized voices in the research process. This allows communities to ensure problems and solutions are defined and addressed in ways that make sense to the local community. It also creates transparency in the research process, which helps to build a sense of trust and ownership in the community. Finally, local knowledge can help streamline the effectiveness of environmental interventions as community members can help identify strategies that best align with local realities (Reed, 2008).

A study of urban community gardens in Stockholm, Sweden, investigated the social-ecological memory of how gardening knowledge is learned and shared by gardeners (Barthel, Folke, & Colding, 2010). There is a strong connection to transference of local knowledge and learning by doing from one generation to another. They found that oral communication was the most important way knowledge was shared because gardeners would share learned experiences while in the shared garden space. Their results suggest that community gardens or other shared garden spaces can provide opportunities for local knowledge to be continually transmitted from one generation of participants to the next. This knowledge transfer can help support urban ecosystem services and increase ecological knowledge.

Berkes et al. (2000) present a broad enough definition of TEK that it can be used to include urban local knowledge as a component of Ecological Wisdom. Neighborhood residents have a unique insight into their local environment that cannot be replaced by outsider knowledge. Inclusion of local knowledge in the management process relies on neighborhood residents' ability and desire to be included. The process of inclusion

through Participatory Action Research methods as well as motivations and barriers to participation will be discussed in the next section.

2.3 Ecological Wisdom – participation

In ecological wisdom, participation of the local community is essential to bringing knowledge of the local environment to the process. Without local knowledge, ecological wisdom is a lopsided model that only represents the voice of experts that are typically outsiders in the community. Including the local voice in community and environmental management can be challenging. Identifying the motivations and barriers to participation is an important step to bringing the local voice into community conservation planning and management. One approach is to use the Participatory Action Research (PAR) framework.

Participatory research outside of citizen science is still a developing concept in conservation. Citizen science participants typically have no formal training in science but contribute to data collection in projects that range from astral observations to reporting backyard birds. There has been much debate over the vetting and validation of citizen collected data (Bonter & Cooper, 2012; Cooper, Dickinson, Phillips, & Bonney, 2007; Kremen, Ullman, & Thorp, 2011). However, there is still a gap in the knowledge about the outcomes for communities and participants of citizen science projects. Most of the research on participation outcomes focuses on gains in scientific literacy and natural resource management (Dyer et al., 2014; Mandarano, 2008; Westphal, 2003). Individual empowerment has also been cited as an outcome (Paul Florin & Wandersman, 1990; Fraser, Dougill, Mabee, Reed, & McAlpine, 2006; Westphal, 2003).

Participatory Action Research

Participatory Action Research (PAR) can be defined as a collaborative research model where professional researchers and participants work together through all steps of the scientific process to identify solutions relevant to the community (Cooper et al., 2007). Three key elements of participatory research were outline by Finn (1994):

1. PAR responds to the needs and experiences of the community.

2. PAR creates a collaborative research environment between the community and researchers.

3. PAR promotes common knowledge and community awareness.

PAR methods are regularly used as a way to connect and engage communities in research in the social sciences but it has only been used in a limited capacity in conservation science (Cooper et al., 2007; Shanley & López, 2009). Typical citizen science projects do not function in a true PAR fashion as they often occur at large scales and do not incorporate collaborative or collective action (Cooper et al., 2007).

It can be difficult for university researchers to separate themselves completely from the conferred social status that a university affiliation carries (L. Smith, Bratini, Chambers, Jensen, & Romero, 2010). To be more effective in PAR relationships, university-based researchers must practice self-awareness of their stereotypes and role as the 'expert'. Researchers should practice the concept of mutuality and trust and strive not to become complacent about their role. Researchers should also be prepared to push back against mainstream stereotypes of poor or communities of color even when community

members themselves or members of community based organizations are perpetuating them. Finally, they add that researchers must resist the urge to manage, control, or hasten a community project towards completion and that action may need to occur sooner or later than their research protocol would prefer.

Natural science and social science components are not often well integrated in research (Fajber & Vernooy, 2006). Many natural resource management researchers have limited knowledge of and experience with social science research methods and social science researchers are unfamiliar with natural science approaches to research. This lack of a common research language and 'gender blindness' can make the development of a holistic approach to research difficult. Fajber and Vernooy noted that natural science researchers that were given the opportunity to integrate PAR methods and tools and encouraged to focus on social and gender issues changed their approach to research design and implementation in future research activities.

Minkler (2004) gives a good overview of the concepts of community-based participatory action research (CBPAR). The core ideal of CBPAR is the deconstruction of power, sharing of knowledge, and focusing the research on topics the community is interested in. CBPAR is rooted in action based involvement and critical reflection. It is not a method but rather a research orientation, which can be included in many quantitative and qualitative methodologies. A key feature that distinguishes CBPAR is that the area of research is determined by the community not just the researcher.

Minkler discusses the issue of handling insider-outsider tensions and why even with a long history of trust in a research relationship it is still important to examine the

possibilities for misunderstanding and tension. The potential reward to a community for their involvement should be set in the areas of gaining new information and knowledge instead of defining potential outcomes so there is no resentment for unfulfilled "promises". She also notes that issues with race should be carefully considered since the researcher often does not share the same cultural, ethnic, or racial background as the community they are working with which can lead to issues of racism.

Participation

Citizen science, also referred to as Public Participation in Scientific Research, is a research model where the public participates in conducting scientific research alongside academic researchers (Bonney et al., 2009). Participation in citizen science primarily involves collecting data on local to global scales. Community Based Natural Resource Management (CBNRM) provides a way for community members to engage in managing and monitoring the natural resources in their community. Participants in citizen science and CBNRM share similar motivations and barriers to participation.

Motivation for participation

Participation in grassroots organizations is strongly correlated to civic duty, informal neighboring, and involvement in religious or other community organizations (Perkins, Brown, & Taylor, 1996). The more people are engaged and connected to their community, the more likely they are to be involved in activities in their community. Perkins et al. also found that participation was also motivated by self-efficacy and self-interest. Self-interest can be in the form of knowledge gain, incentives, or prestige.

Prestby et al. (1990) found a correlation between incentives for participation and cost management for participation. They did not find a relationship between specific types of incentives but cost management efforts were related to an increase in personal benefits. Their findings suggest that personal cost reducing efforts such as reduced time constraints or childcare could increase participation.

It has been found that blacks, especially those from lower income households, are more likely to participate in voluntary community organizations than whites (P. Florin, Jones, & Wandersman, 1986). Florin et al. also looked for common factors that would predicted a high level of participation from one member over another. They found that sense of rootedness (homeownership, family), citizen duty, valuation of community, and expectations of influence were all positively correlated with a high level of participation. They also found that the more middle class and educated a person was, the more likely they were to participate.

Participants in Project Nestwatch (Evans et al., 2005) were used to assess the impact of informal scientific education on scientific literacy and sense of place. Participants in the Nestwatch study cited a range of motivations for participation. All respondents said they wanted to help with an "authentic" research project. Others wanted to learn more about birds, their local environment, and some just wanted to participate because the Smithsonian was involved.

A study by Donovan and Mills (2014) examines motivations and outcomes of participation in a city wide tree planting program. They found that residents of lower socio-economic status neighborhoods were less likely to participate than those that lived

in wealthier neighborhoods. They argue that this could exacerbate existing environmental justice issues such as air quality and storm water mitigation. They concluded that to increase participation in these programs, there is a need for greater incentives for participation and that programs should be tailored specifically to reach these communities.

For a project to be successful, it is important to establish participant's motivations for participation in citizen science (Singh, Danell, Edenius, & Ericsson, 2014). This was established through participant observations of neighborhood associations during the development phase of the Butterfly Highway. During this time, resident's connection to place and the importance of beautification was identified as a primary motivation for participation.

Barriers to participation

Pandya (2012) illustrates many barriers to participation in citizen science, which are many of the same barriers that planners using CBNRM also experience. These barriers fall into two main groups, mechanistic and social. Mechanistic barriers are issues such as access to natural areas, access to transportation, time available for participation, and childcare to allow parents to be participants (Rodríguez-Izquierdo, Gavin, & Macedo-Bravo, 2010). Examples of social barriers to participation in CBNRM are participants not being comfortable in natural areas, lack of science knowledge, and not being familiar with the cultural norms and social practices of environmental planning. Other studies have shown that the lack of knowing such opportunities exist is a primary barrier to participation (Bruyere, Billingsley, & O'Day, 2009).

Perceived social barriers can also be strong barriers to participation. One study examined “mechanisms of exclusion” in a Toronto, Canada, Hispanic community (Gibson-Wood & Wakefield, 2013). Exclusion mechanisms included economic marginalization, access to natural spaces for participation, the narrow way “environmentalism” is defined in organizations, and the “whiteness” of environmentalism. The study suggests that there is a lack of power in the decision-making process (procedural justice). They also point out that even the definitions of “environmentalism” can be discriminatory and disempowering.

Parisi et al. (2004) found that economically disadvantaged communities are less likely to participate in environmental activities. In part, they contribute these findings to high levels unemployment and poverty. However, these did not contribute to lack of participation in collective environmental effort. They conclude there must be other underlying issues such as a social and political climate that undermine community civic engagement.

Costs associated with participation must also be considered as a barrier (Prestby, Wandersman, Florin, Rich, & Chavis, 1990). Organizational costs include not feeling welcome or a part of the group, feeling that the organization never achieves action, or having a difference of opinion of goals or actions from the group. Personal cost of participation can also be a major barrier to participation. Personal costs include time to participate, giving up other activities, and having children or other dependents to care for.

Trust is needed for successful collective action. It takes time to build trust but it is also easily broken when promises aren’t met (Gambetta, 1990). Local communities are

often not engaged in the decision-making process and when they are brought in at later stages of the development process, community members may feel that they are being instructed as to what to do from a top down manner (Rodríguez-Izquierdo, Gavin, & Macedo-Bravo, 2010). Often this results in the feeling that participant's opinions are just tokens in the process and not really valued.

Power inequalities within groups may lead to a barrier for some members to participate. This inequality could be a result of age, gender, or education (Reed, 2008). The process of engagement should be evaluated to intentionally deal with issues of power and present opportunities that can be equally accessed by all members of a community. This will also make the participation process seem more fair and unbiased. This process should also include opportunities for two-way learning between participants and researchers.

There may also be cultural barriers to participating in a project that focuses on wildlife, specifically native plants to attract wildlife. Several studies have found that African Americans may prefer landscapes that primarily contain turf grass over other natural elements (Kaplan & Talbot, 1988; Van Velsor & Nilon, 2006). Unframed wild landscapes may not be appealing to those who are not trained to look for ecological function in a landscape and may be perceived as messy and unkempt (Nassauer, 1995). Landscapes that appear to be uncared for have been found to encourage crime (Nassauer & Raskin, 2014).

Another barrier to participation in a wildlife conservation project is perceptions of human wildlife conflict, particularly in urban spaces. Human wildlife conflict occurs

when wildlife negatively impacts humans or humans negatively impact wildlife (Madden, 2004). Dominance of wildlife and mutualism are the two predominant theories on how humans and wildlife interact (Dietsch, Teel, & Manfredo, 2016; McCoy, Bruyere, & Teel, 2016). Insects especially have an extreme negative perception in society (Lemelin, 2013). This study aims to shift a community from a dominance structure to a mutualistic one in which humans and insects can exist in harmony.

Clarke and Agyeman (2010) looked at reasons for non-participation in local sustainability programs by black and minority ethnic groups in the UK. They used a combination of semi-structured interviews, in-depth interviews, and focus groups with members of the city council, community members and minority participants in sustainability programs. They identified one major theme, 'different approaches to engagement', and two sub-themes, 'different mindset' and 'self-empowering spaces', that are based on differing perspectives of interacting with the environment based on race and ethnicity. For example, a Rastafarian group was interviewed and said that they didn't feel comfortable participating in sustainability programs because they perceived the programs to be run by "white people in ties" and felt they would not fit in. The group said they would prefer to be involved in actual environment promoting activities instead of council facilitated meetings. The feeling of 'self-empowering spaces' is seen in an effort to do grassroots work within their own community, similar to groups that have engaged in environmental justice issues.

Clarke and Agyeman conclude that while culture is not a primary determinant of participation in environmental programs, it does help to highlight that differences in cultural groups shapes how they construct their environmental identities. This knowledge

can help planners and those working in sustainability programs to develop a ‘culturally sensitive framework’ of agency, empowerment and disempowerment to use when engaging culturally diverse groups.

Location of diverse green space is more often present in wealthier neighborhoods than in lower income communities (Iverson & Cook, 2000). Because of the importance of exposure to nature to conservation action, inequitable distribution of urban parks can contribute to low minority participation in environmental action (Dunn, Gavin, Sanchez, & Solomon, 2006). Dunn et al. argue that if we want to increase minority participation in conservation, conservationists need to focus on the quantity and distribution of green space. This can be accomplished through urban restoration projects, greenways, and community gardens.

Negative experiences with wildlife have been found to impact future connections and experiences with wildlife in both urban Latino and African American adolescents (Van Velsor & Nilon, 2006). These experiences can further impact future chances of engagement and connection to nature. To create positive experiences, it is important to foster appreciation through providing access to wild spaces so they can experience nature in their day to day life. Children should also be exposed to wildlife at a young age before they begin to develop fears and negative perceptions of wild animals.

Outcomes of participation

The contribution of citizen science to expanding scientific knowledge is well documented, but the benefits to participants in citizen science projects are not as robust (Bonney et al., 2009; Bonter & Cooper, 2012; Cohn, 2008a; Cooper, Dickinson, Phillips,

& Bonney, 2007; Schmeller et al., 2009). Outcomes for participants that have been identified in the literature: community and individual empowerment, trust building, reconnection with place, and reciprocity.

Participants in Project Nestwatch (Education, 2002) were studied to assess the impact of informal scientific education on scientific literacy and sense of place. Surveys, interviews, open-ended interviews, and participant initiated emails (57 emails) were included in the analysis. Survey questions included demographics, education, level of bird knowledge, birdwatching experience, level of participation in environmental activities, and motivation for participation.

Participant in the Nestwatch study identified the primary personal outcome as increased scientific knowledge. The two factors that contributed most to this were their initial interest and motivation to participate and the interactions between researchers, staff, and participants. One participant stated that he likely would not have done the project on his own if the researchers from Nestwatch had not come and spent time working with him. In the analysis of the emails, researchers found that the content was focused on topics of scientific inquiry such as concerns about the quality of the data they were collecting to uncertainty about the final outcomes of the data. The interviews showed a strong increase in knowledge of bird ecology.

Behavior change was also observed in the Nestwatch study participants. More than half the participants made changes to their yard to become more suitable bird and wildlife habitats. Behavior change was also observed in a study of participants in a

Master Naturalist course which required participants to spend approximately 40 hours working with scientists or experts (Main, 2004).

Additional studies have also confirmed that participants in citizen science projects gained scientific literacy (Braschler, Mahood, Karenyi, Gaston, & Chown, 2010; Brewer, 2014; Cronje, Rohlinger, Crall, & Newman, 2011; Fernandez-Gimenez, Ballard, & Sturtevant, 2008; Jordan, Gray, Howe, Brooks, & Ehrenfeld, 2011), a better understanding of scientific methods and processes (Trumbull, Bonney, Bascom, & Cabral, 2000), improved access to scientific information (Fernandez-Gimenez et al., 2008), and increases in scientific thinking (Trumbull, Bonney, Bascom, & Cabral, 2000). Strengthened connections between participants, nature and place have also been well documented (Devictor, Whittaker, & Beltrame, 2010; Fernandez-Gimenez et al., 2008; Overdevest, Orr, & Stepenuck, 2004) as well as increases in social capital, social learning, and trust (Danielsen, Burgess, & Balmford, 2005; Fernandez-Gimenez et al., 2008; Haywood, 2014; Overdevest et al., 2004; Roth & Lee, 2002).

A study of participants in collaborative environmental monitoring found that participation in a monitoring project can lead to a shared ecological understanding among participants, can help to build trust within the community and the group, and can foster social learning and community-building (Fernandez-Gimenez et al., 2008). Participants felt they gained a greater appreciation for management practices and for how complicated an ecosystem is. They also learned to challenge their preconceived assumptions about the environment and environmental practices. Collaborative monitoring was observed to be a direct way to reconnect people with the land and highlight the interconnectedness between ecological and human communities. Trust building between participants was an

additional outcome as well as trust building between environmental organizations and the communities.

Empowerment is a mechanism that enables communities to gain control over their affairs (Paul Florin & Wandersman, 1990). It is expected that participation in citizen science can empower participants because they are able to contribute to resource management decisions and the data is collected by the people that are most likely to be affected by those decisions (Dickinson et al., 2012). A study by Prestby et al., (1990) indicated that an increase in participant benefits and a decrease in participant costs of involvement in community organizations should contribute to increased participation. Therefore, there will be an increase in empowerment through acquiring new skills, knowledge, and experiences.

Citizen participants in community-based volunteer organizations such as CBNRM receive benefits that correlate with the extent of their involvement (Ohmer, 2007). Those that have a higher level of involvement receive the most benefits which can include self-efficacy, collective efficacy, and sense of place. Examples of self-efficacy are leadership competence, influence in decision-making, knowledge, and skills in neighborhood development and sense of community. An earlier study by Prestby et al. (1990) also showed that the more active a participant was in an organization, the more personal, social, and communal benefits they received. For example, a participant did not learn new skills by simply attending meetings. They had to be engaged in public speaking, organizing, or writing to gain new skills.

2.4 Ecological Wisdom - ethics and values

Ethics and values in Ecological Wisdom are based on the importance people place on the environment when establishing an environmental management system. Geographic place, history, and politics can impact the values people place on the environment and ethical considerations can be driven by how connected people are to the environment around them. In the Charlotte African American community, environmental justice, connection to nature, and connection to place are the biggest contributors to the ethics and values inputs of the Ecological Wisdom model.

Environmental justice

The environmental justice movement was launched in 1982, in Warren County, North Carolina, during the protests against a PCB landfill that was to be situated in a predominantly African American community. This launched an investigation into the racial composition of communities most heavily impacted by toxins and hazardous sites. The traditional environmental justice discourse focuses on the unequal distribution of harmful things such as toxins and dumps to poor communities and communities of color. In his seminal book on environmental justice in the south, *Dumping in Dixie*, Robert Bullard (2000) studied five southern communities and found that they were deliberately targeted as sites for waste dumps. Since the origination of the environmental justice movement, the discourse has expanded to include areas of injustice such as indigenous rights, food security, and land use (Schlosberg, 2013).

Many states use diversity thresholds to demarcate communities that are impacted by environmental justice from those that are not. Lewis and Bennett (2013) argue that a

more comprehensive approach to environmental justice is needed to reach all communities at risk. A comprehensive assessment would include consideration of the role of equity in the distribution of environmental hazards, enhanced participation of those at risk in the political and policy process, and acknowledgement of the diversity of those at risk.

Environmental justice issues related to poor environmental quality disproportionately affect low income and minority neighborhoods. In addition to creating poor living conditions, contaminated soil and poor water quality can negatively impact the value of residential property. Native plants can play an important role in mitigating some of these impacts by improving soil retention and soil quality. Buffers of native plant vegetation, such as native meadows and hedgerows, can reduce soil sediment runoff by up to 97% before it reaches streams (Lee, Isenhart, & Schultz, 2003; Lowrance, Dabney, & Schultz, 2002; Wratten, Gillespie, Decourtye, Mader, & Desneux, 2012).

Certain native plant species have the potential to be effective at phytoremediation and are able to remove toxic organic compounds and metals from contaminated soil (Yoon, Cao, Zhou, & Ma, 2006). Several tree species native to Charlotte, such as poplar and oak, can be used for phytoremediation (Evangelou, Papazoglou, Robinson, & Schulin, 2015). Agricultural crops such as tobacco, rapeseed, wheat, sunflower, corn, and soybean have also been found to have bioremediation properties.

Numerous studies have identified racial and income disparities in green space location and amenities (J. Byrne & Wolch, 2009; Jason Byrne, 2012; Jason Byrne, Wolch, & Zhang, 2009; J. W. Smith & Floyd, 2013). These issues have been brought

under the environmental justice paradigm and have been taken even further into the framework of the "Just Sustainability Paradigm" brought forth by Agyeman (2007). Agyeman argues that environmental quality and human equity are inextricably linked and wherever there are great occurrences of environmental degradation there will also be environmental injustice (Agyeman, 2008). In addition, he says that urban ecology should focus on creating equitable habitat in urban spaces for all, including humans and wildlife.

Ecosystem service mitigation can be used to as a way to address environmental justice issues as they can have a direct impact on individual health and quality of life (Marshall & Gonzalez-Meler, 2016). Urban trees can sequester carbon and be used for air pollution abatement that can decrease cardiovascular and respiratory health issues (Hoek et al., 2013). Trees are beneficial to all urban residents however, they have been shown to have an uneven distribution in cities based on socio-demographics, with higher educated and wealthier communities having a significantly higher number of trees (Pham, Apparicio, Landry, Séguin, & Gagnon, 2013; Pham, Apparicio, Séguin, Landry, & Gagnon, 2012; Watkins, Mincey, Vogt, & Sweeney, 2016).

Connection to nature

Urban parks play an important role in creating sustainability (Chiesura, 2004). They provide important environmental benefits but also provide cultural, social, and psychological benefits. Natural environments can have a restorative effect on medical patients and exposure to nature has been found to reduce recovery time after surgery (Ulrich, 1984). Frequent visitors to parks are more likely to report good health and parks

with more vegetation have been found to be better at reducing stress than those with no vegetation (Chiesura, 2004).

The term “extinction of experience” is often used to describe a reduction in how people experience and interact with nature (Soga & Gaston, 2016). This not only impacts health and well-being but can impact behavior towards the environment effectively creating a disaffection towards nature. When people are exposed to nature, they have a stronger desire to protect it (Dunn et al., 2006). This highlights a critical need for reconnecting people with nature through education and experiential learning opportunities.

For urban dwellers, experiences and interactions with nature seems to be the exception and not the norm (Cox, Hudson, Shanahan, Fuller, & Gaston, 2017). Cox et al. believe that opportunity and orientation are both contributing factors to a decline in experiences with nature. They argue that while increasing the amount of green space will help, public health interventions are needed to drive people to become oriented more to nature. A majority of those engaged in nature conservation activities cite nature experiences as a child as a motivating factor (Chawla, 1998).

When the majority of the world’s population lives in high-density urban centers, how can we reverse the extinction of experience? One way is to better integrate biodiversity conservation in the places where we live and work (Miller, 2005). This can provide opportunities for meaningful interactions with nature that will help people become more oriented to nature as well as opportunities for increased well-being. Nature

in urban parks can also provide important social and psychological benefits (Chiesura, 2004).

Garden spaces can serve as learning environments for both adults and youth (Krasny & Tidball, 2009). The Garden Mosaics program is a National Science Foundation funded program that uses community gardens to engage youth from 9-18 in science and environmental education, community youth action, employment, and gardening. The curriculum for the program includes cultural learning about "traditional" gardening practices, as many of the community gardens in the program are located in immigrant communities. The program also includes youth led neighborhood exploration through mapping, interviews and observations. It is suggested that the outcomes of participation in programs such as Garden Mosaics can provide opportunities for cross cultural and inter-generational learning in low income, immigrant communities that will strengthen communities and enrich the lives of participants.

Informal environmental education is cited as an outcome of participation in a community garden (Martin et al., 2014). Participants often exchange information based on their own knowledge and expertise. It creates opportunities for social learning, which reinforce social and ecological sustainability that in turn builds social capital within a community.

Connection to place

Research has shown, those who express "rootedness" or a connection to place have been found to be more likely to participate in community organizations than those that don't (P. Florin et al., 1986). Rootedness can refer to the length of time someone has

been connected to place, for example through homeownership, or a psychological connection of positive feelings about their neighborhood (Unger & Wandersman, 1982).

Place attachment is the extent to which people put value on a particular environmental place (Brehm, Eisenhauer, & Krannich, 2012). It creates a sense of belonging to place based on how that space contributes meaning to the person's life. Place attachment can take many forms. For example, the state of an environmental landscape can create place attachment if it supports a person's aesthetic values. Community attachment is the amount of emotional investment a person has in a place. This type of attachment is usually related to residence in the community and the feeling of belonging. Kasarda & Janowitz (1974) presented community attachment as a system of friendship, kinship, and associational networks that are part of the community life cycle. And the longer someone is a resident of a community, the stronger their attachment. Neighboring and friendship density are also important to community attachment (Sundblad & Sapp, 2011).

Environmental education studies have found that pro-environmental behaviors are stronger for those who have a connection to the place that is trying to be conserved than those who don't (Duerden & Witt, 2010; Kudryavtsev, Krasny, & Stedman, 2012). An example of this is students who have visited the Peruvian rainforest are more likely to have pro-environmental behaviors towards saving the rainforest than those who have only read about the rainforest in a story. This physical connection can create a sense of care and concern for a particular place (Kudryavtsev et al., 2012). People want to care for places they love.

2.5 Ecological Wisdom – constraints

The success of Ecological Wisdom as a management practice can be constrained by legal, political, and socioeconomic conditions (Patten, 2016). These constraints could be driven from the top down such as zoning ordinances or other regulations. They could also come from the bottom up and be restricted by community capacity or resources. Social capital has not been presented as a constraint in the Ecological Wisdom framework but I believe it is important to include. Particularly in the context of the African American community in Charlotte.

Social capital

Social capital is broadly defined as a way to bring people together to work towards common goals through creating social connections and networks among people (Putnam, 2000). Social capital can be viewed as an individual oriented approach or a collective approach. One mechanism to generate social capital in communities is resident participation in neighborhood and civic organizations. Individual social capital is based on resources available to an individual that can become available to another through a social relationship between the two (Rostila, 2011). If community development projects aim to increase individual social capital, then they should focus on promoting development of individual networks through getting neighbors to participate in activities to increase networking, norms, and trust (Alaimo, Reischl, & Allen, 2010). From a survey of low-income neighborhoods, residents participation in the community was a strong predictor of individual level social capital (Brisson & Usher, 2005).

Collective social capital is created by citizens actively participating in organizations and groups (Putnam, 2000). Trust between group members is central to building social capital and groups that lack trust are not able to accomplish as much as those that have strong trusting relationships. If the goal of a community is to build social capacity at the neighborhood level, then it is suggested that having at least some of the neighbors participate in neighborhood organizations or events should be enough to create a spillover effect to non-participating neighbors (Alaimo et al., 2010).

Building social capital in natural resource management is viewed as important to creating best management practices (Alaimo et al., 2010; Leahy & Anderson, 2010; Rydin & Pennington, 2000). Leahy and Anderson (2010) studied the development of social capital between community groups and the US Army Corps of Engineers in a watershed management program. They found that initially groups were working independently on programs and individually coming to the Corps, which became overwhelming and was not a productive way to work and engage with organizations. The Corps took a strong role in building a single community-based coalition and provided capacity for the new organization by offering technical advice and meeting space. They conclude that natural resource management organizations will be more successful in accomplishing their goals by focusing on community collaboration and engagement as opposed to multiple groups attempting to address single problems.

Most of the studies I found reflect on building social capital through partnerships with communities and top down organizations such as government organizations. While these studies are useful for understanding the role and relationships between the two groups, the perspective is framed based on how it benefits the government entities and

the management practices. There is little to no reflection on building social capital within the grassroots community itself. Further, studies have mostly been conducted at the community level and not at the neighborhood level. This study can contribute to this understanding of building social capital at the neighborhood level through participation in the Butterfly Highway.

2.6 Ecological Wisdom – adaptive co-management

Ecological Wisdom includes adaptive management as a way to drive decisions about actions involving the CHANS social-ecological system (Patten, 2016). For systems that involve multiple stakeholders, adaptive co-management is an appropriate management model to use.

Adaptive co-management is method of natural resource management that is rooted in the idea of learning by doing. It is a flexible social-ecological framework for resource management that can be adapted to fit a variety of locations, situations, and management organizations (Armitage et al., 2009; Olsson, Folke, & Berkes, 2004; Rodríguez-Izquierdo et al., 2010). The foundation of adaptive co-management is based on theories from geography and ecology. The traits of adaptive co-management are rooted in dynamic learning from adaptive management and linkage from cooperative management. It relies on stakeholder collaboration at all levels from the individual, to regional, and up to international groups. A central theme of adaptive co-management is the focus on creating community resilience to change and uncertainty in social-ecological systems. Governance, learning, and power relationships are all factors that must be considered for adaptive co-management to be a successful framework.

Learning from doing is the first step in adaptive co-management but the complex nature of stakeholder relationships requires it to go beyond the first step. Armitage et al. (2009) highlight four specific issues that must be addressed in learning. First, social interaction and trust are required to learn from local and traditional knowledge. It can be difficult for outsiders to learn if they have not gained the trust of the community. Second, intentional learning is important but often some of the most important knowledge is gained from experiential learning. Third, learning theories must account for social context and be able to adapt to power imbalances and a diversity of approaches to adaptation. Finally, one must be considerate of who the learner is and ensure that the learning can be facilitated effectively through all scales of institutions and organization.

Governance is an important concept in adaptive co-management (Armitage et al., 2009). Social-ecological feedback is non-linear and requires multiple levels of governance to link each of the stakeholders. Without strong links the network will not have a sufficient flow of information and understanding and cooperation will be difficult to achieve at best. These networks will take time to nurture and will not evolve overnight. Special attention must also be paid to each individual member's rights, responsibilities and benefits to ensure the organization benefits all equally.

Power relationships within adaptive co-management are something to be mindful of. Olsson, Folke and Berkes (2004) found that leadership was significant in the self-organizing process. Leaders are often the ones who are stewards with specialized skills that can provide vision and ecological knowledge. However, careful attention must be paid to the power role that these leaders take as it can influence the direction of outcomes without being representative of the organization (Armitage et al., 2009). The fact that

adaptive co-management even considers potential power asymmetries is a strength of the framework as this can help to mediate conflict through the linked network.

2.6 Ecological Wisdom – ecosystem services

Ecosystem services, are biophysical processes that benefit humans by providing essential life-support services such as food, air, and water (Daily & Matson, 2008). In the ecological wisdom discourse, the ability to produce, instead of consume ecosystem services is an important concept (Ernstson, 2013; Ernstson & Sörlin, 2013). Frederick Steiner (2016) explains why the production of ecosystem services is important to creating sustainable cities, " The challenge is to make cities fairer, more sustainable, more resilient, and more productive ecosystems; to create regenerative cities, in which sources of energy and materials are restored, renewed, and revitalized" (Steiner, 2016).

Ecosystem services can be divided into several categories based on what their services provide but broadly they fit into two main groups; environmental ecosystem services and cultural ecosystem services. Figure 8 illustrates the relationships between the different categories of service types and how they impact well-being. Food, water, and resources that are in the provisioning category of environmental services have the strongest relationship with the materials needed for a basic quality of life. Cultural ecosystem services are at the other end of the spectrum and have the weakest relationship with the basic needs of well-being. This does not diminish the importance of cultural ecosystem services to well-being but illustrates why they are only attended to after all basic needs are met.

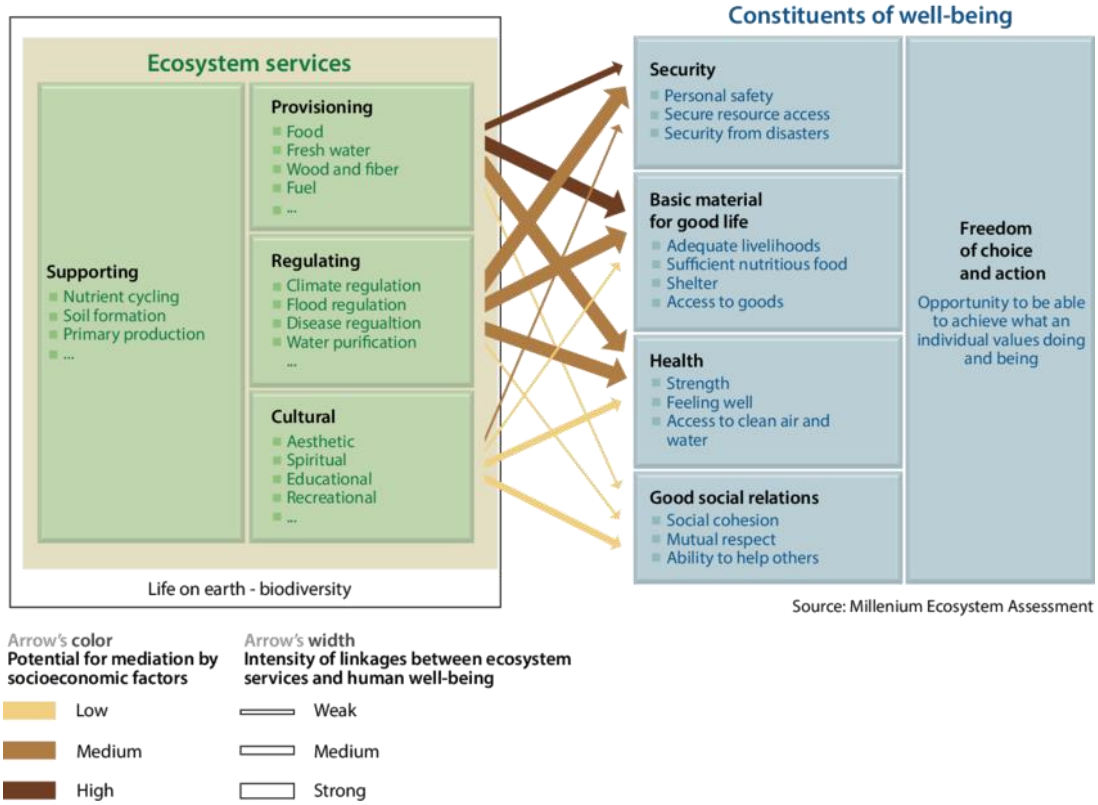

Figure 8. Relationships between ecosystem services and human well-being (Millennium Ecosystem Assessment, 2005).

Ecosystem services in urban spaces are often in the form of green infrastructure such as storm water mitigation projects and parks and green space for recreation (Bolund & Hunhammar, 1999). Exotic plants, turf grass, and other urban structures do not greatly contribute to the production of ecosystem services and can often have a negative impact on conserved areas (Hostetler, Allen, & Meurk, 2011). Parks can serve a dual role in ecosystem service production as they can provide environmental services through green infrastructure and cultural services through recreation opportunities (de la Barrera, Reyes-Paecke, Harris, Bascunan, & Farias, 2016).

Cultural ecosystem services include benefits that people receive from the environment that do not have a material form. This includes recreation, health, and spirituality (Chan, Satterfield, & Goldstein, 2012; de la Barrera et al., 2016). Despite their importance to society, ecosystem services assessments rarely account for cultural services outside of recreation. It is believed that to best manage our ecosystem services, we must find ways to evaluate and value cultural services. Creating direct connections between environmental and cultural systems will better enable us to comprehensively manage land and conservation (Plieninger, Dijks, Oteros-Rozas, & Bieling, 2013).

One barrier to urban creation of ecosystems services is the conflict between manicured and wild landscapes (Im, 1984). Manicured landscapes are often preferred by people, but they are also the landscape types that contribute the most to environmental degradation because of the need for mowing, trimming, fertilizers, and pesticides. Non-native and often invasive plants are also primary components in these types of landscapes. “Wild” landscapes require little or no maintenance and can provide a safe habitat for native plants and wildlife. However, these wild landscapes can invoke negative responses such as fear and safety issues (Bixler & Floyd, 1997). A way to address this conflict is to use “framing” around wild landscapes to provide a more culturally acceptable boundary (Tzoulas et al., 2007). For example, wildflowers in a raised bed are viewed as intentional landscaping which is more acceptable than flowers left to go wild in a section of the yard.

Pollination is the most widely known ecosystem service provided by insects (Losey & Vaughan, 2006). It has been conservatively estimated that insects provide $60 billion worth of ecosystem services annually on a global scale. These services include

pollination, pest control, and opportunities for recreation through fishing and bird watching. Because of this, it is recommended that greater attention be paid to the habitat needs of insects. Land management practices such as grazing, burning, and pesticide use should be managed to best protect insect biodiversity. Conservation of pollinator habitat can provide additional ecosystem services such as enhancement of overall biodiversity, increased water quality, pest control, and aesthetic value to a community (Wratten et al., 2012).

Pollination ecosystem services are environmental services that help pollen transfer from one plant to another by birds, insects, and other pollinators. In food systems, managed honeybees and native bees are critical to maintaining biological diversity as well as agriculture services necessary for our food systems (Wratten et al., 2012). Increasing floral resources by enhancing native flowering plant diversity not only benefits pollinators but it also can reduce soil erosion, surface water runoff, increase land value, improve water quality, and support wildlife conservation. Much attention has been focused on conserving pollinator habitat in rural areas to support agriculture but there is a great need to conserve habitat in urban ecosystems as well. Urban sprawl consumes valuable forest and meadow habitat and replaces it with weed free lawns and impervious surfaces such as roads and rooftops (Peterson et al., 2012).

Residential yards can provide important habitats for birds and other wildlife (Belaire, Whelan, & Minor, 2014; Cameron et al., 2012; Goddard, Dougill, & Benton, 2013; Rudd et al., 2002). Even the smallest garden can provide an ecological connection between larger tracts of habitat (Niemelä et al., 2010). Lack of access to diverse flowering plants that provide essential pollen and nectar resources has contributed to a

decline in bee populations (Goulson et al., 2015). Residential yards can help fill this gap, especially in urban and suburban areas. Flowering weeds such as dandelions and clover can also provide valuable resources for pollinators (Larson, Kesheimer, & Potter, 2014).

Global food crops are dependent on pollinators and more than 70% crops either require pollination to produce fruit or have a higher yield because of pollinator insect visits (Holzschuh, Dudenhöffer, & Tscharntke, 2012). Losey and Vaughan estimate that native pollinators (mostly bees) are responsible for pollinating almost $3.07 billion of US produced fruits and vegetables.

Agriculture relies heavily on pollinators but is also a primary driver of landscape change that has greatly contributed to the loss of habitat for pollinators (Tscharntke, Klein, Kruess, Steffan-Dewenter, & Thies, 2005). It has been shown that conservation based agriculture management can increase ecosystem function even though it is not a "pristine" natural environment. This type of management requires a landscape scale approach and intense cooperation between farmers and land managers.

The production of ecosystem services through the protection of nature provides many benefits, which also leads to the opportunity for these benefits to be unevenly distributed (Ernstson, 2013). Ernstson argues that it is social and political processes that determine who in society benefits from the distribution of ecosystem services. The role of human agency as stewards of ecosystem services is not often included in ecosystem management models. Those with the most income (and influence) have access to the highest valued land such as highly diverse parks and other urban natural spaces. This

limits access and contributes to the unequal distribution of land that produces the most ecosystem services.

CHAPTER 3: METHODS

This chapter is comprised of several sections that provide the details and justification for the methods used in this study. The first section presents methods used for neighborhood and participant recruitment. The following sections outline the qualitative methods used to collect data including participant observations, semi-structured interviews, and a focus group. The analysis section highlights coding and theme analysis. Figure 9 outlines a summary of the methods used in this study. The research IRB is in the appendix.

A Participatory Action Research (PAR) approach is used throughout this study. From initial study design to actionable outcomes, the community was involved in almost every aspect of the Butterfly Highway. With the strong focus on community engagement and outcomes, the PAR approach is the most appropriate method to answer the research questions put forth in this dissertation. Participants were co-researchers in this study. Their local knowledge of the community provided critical insight to the success of the Butterfly Highway.

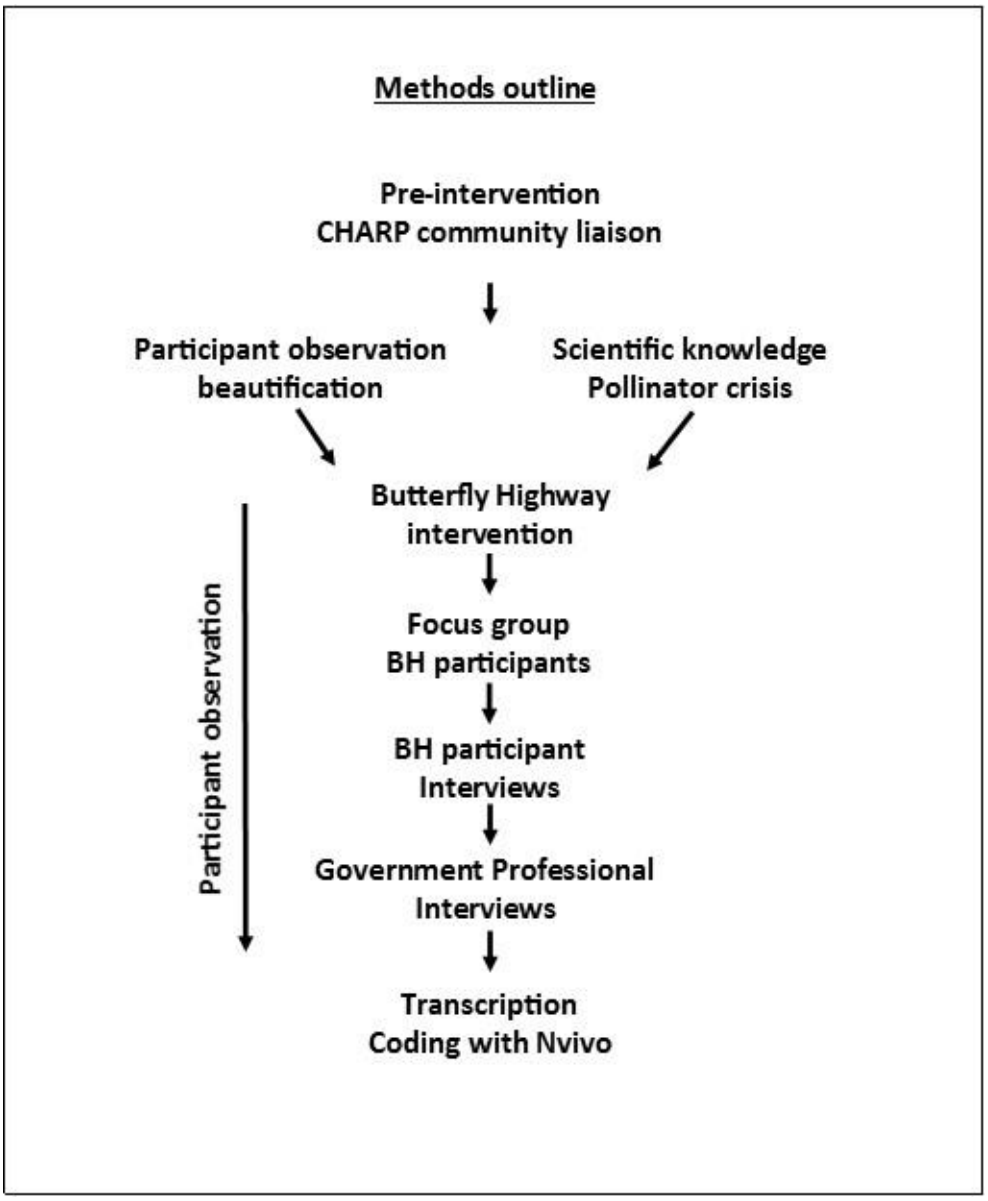

Figure 9. Qualitative methods used in this study.

Methods timeline summary:

- Winter 2015. Neighborhoods that participated in the Butterfly Highway had a connection to CHARP or are neighborhoods that contacted me about participation. Individual participants were recruited through presentations at neighborhood meetings or recommended by other participants.
- Spring 2015. Participants assisted with plant selection and garden design as well as installation of Butterfly Highway gardens. Participant observations were recorded after each installation event.
- Summer 2015. All Butterfly Highway gardens were visited 2-3 times over a three-month period. The goal was to check in with participants and observe how well their gardens were growing. Participant observations were collected during each visit.
- May 2016. Focus group with 13 neighborhood leaders held at a neighborhood church. Purpose of the focus group was to assess and revise Butterfly Highway participant interview guide.
- Summer 2016. Semi-structured interviews conducted with 19 Butterfly Highway participants. Most interviews were conducted at the participant's homes. Purpose of interviews was to identify motivations and barriers to participation and outcomes of participation in the Butterfly Highway. Participant observations were also recorded.
- Fall 2016. Transcription and analysis of Butterfly Highway participant interviews. Deductive coding based on literature was the primary method of content analysis. Additional codes were included based on inductive, organic themes that emerged.

- November-December 2016. Conducted semi-structured interviews with 17 Government Professionals. Purpose of interviews was to identify how top down organizations interacted with the Butterfly Highway. Interview guide was based on the one used with Butterfly Highway participants.
- January 2017. Transcription and analysis of Government Professionals interviews. Deductive coding based on literature was the primary method of content analysis. Additional codes were included based on inductive, organic themes that emerged.

Restatement of research purpose and research questions

The purpose of this study is to add empirical knowledge to the Ecological Wisdom theoretical framework including lessons on the importance of participation and constraints/barriers to participation in projects at the intersection of social and ecological systems. Empirical research is also needed to explore the role of ethics and values as we engage in participatory, practice based research. Equally important are contributions to the conversations about ecosystem services and adaptive management from the perspective that evolves as neighborhood residents and academics establish a partnership to learn about these issues by engaging in an intervention established to intervene in both the social and environmental challenges discussed in the introduction to this dissertation. Additionally, the findings of this work will contribute to our understanding of participation in social-ecological interventions. The research questions specifically inquire about empirical contributions of the Butterfly Highway to the Ecological Wisdom framework.

1. What is learned from practice while implementing an intervention at the intersections of social and ecological systems about the motivations and barriers to participation in a social ecological intervention for participants at multiple governance levels ranging from participants in the intervention to government employees interacting with the project? And,
2. What are the outcomes of participation in a social-ecological intervention for participants at multiple governance levels? And, finally,
3. How can a social-environmental intervention contribute to our understanding of an adaptive management planning framework *within the theoretical framework of* Ecological Wisdom?

3.1 Butterfly Highway neighborhoods and participants

This section describes how neighborhoods and participants were selected for participation in the Butterfly Highway. A total of six neighborhoods hosted Butterfly Highway gardens: Northwood Estates, University Park, Oaklawn Park, Greater Enderly Park, Graham Heights, and Druid Hills. Within those neighborhoods, there were 51 Butterfly Highway gardens located at single family and multifamily residences. For the qualitative research, there were 13 Butterfly Highway neighborhood leader participants in the focus group, and 19 Butterfly Highway neighborhood participants in the semi-structured interviews. A follow up set of interviews included 17 Government Professionals. This group was comprised of past and present employees of county and city government agencies.

Neighborhood selection

Sustain Charlotte (http://www.sustaincharlotte.org) is an environmental organization in Charlotte, NC, dedicated to increasing awareness of sustainability in the community. Through my previous work with CHARP, I had been introduced to the Sustain Charlotte community sustainable vision plans that many of our CHARP partner neighborhoods had participated in. (http://www.sustaincharlotte.org/initiatives)

Neighborhoods participated in a one-day Sustain Charlotte workshop where they learned about the concept of sustainability and then discussed what aspects of sustainability they would like to work on in their neighborhood. Two neighborhoods that have worked closely with CHARP participated in this program, Enderly Park and Graham Heights. Upon reviewing the sustainability plans there were several initiatives that many of the neighborhoods identified: beautification, increased consumption of local food, and a local farmers market in their neighborhood. These initiatives fit within the scope of the Butterfly Highway, which made both neighborhoods good candidates for participation.

Neighborhoods were initially recruited to participate in the Butterfly Highway from those where CHARP has established trusting relationships. These relationships were created through previous PAR projects and working together to address other neighborhood concerns such as housing, safety, and air quality. Through my role as a research assistant for CHARP and as a neighborhood liaison, I attended neighborhood meetings for Graham Heights, Northwood Estates, Druid Hills, Enderly Park, and University Park. At each of the meetings, neighborhood beautification was brought up either as a committee report or in general discussion. The general observation for each

neighborhood was how frustrating it was to address beautification because residents felt it was expensive or there are too many short-term renters who don't care about making their yards look nice. Neighborhoods that identified beautification as a neighborhood priority were invited to participate in the Butterfly Highway. The Oaklawn Park neighborhood joined the Butterfly Highway because two of their leaders read about the project in the Charlotte Post newspaper and wanted to bring the initiative to their neighborhood.

Neighborhoods recruited to be a part of the Butterfly Highway have a majority African American/Black residents (Race Black), a median household income (HHI) below the county median, and a low median home value. All of these demographics are considered to be indicators of communities that face issues of environmental and social injustice (Chakraborty, Maantay, & Brender, 2011; Kim, Campbell, & Eckerd, 2014; Mohai & Saha, 2006). Table 1 includes values for all neighborhoods and the county for comparison. The demographics are also represented geographically in Figures 10-13. These figures show race, median household income, median home sales price, and percentage of resident registered voters that voted in the 2016 election.

	County	Northwood	University Park	Oaklawn Park
NPA		123	70	311
Race Black	30.2	86.5	95.8	92.6
HHI	$56,854.00	$31,551.00	$24,875.00	$29,219.00
Home Value	$273,064.00	$63,400.00	$42,286.00	$88,500.00
Vote	74.7	76.6	70.8	72.2
Median Age	35	32	51	46
Historic Race		Black	Black	Black
	Enderly Park	Graham Heights	Druid Hills	
NPA	6	369	363	
Race Black	78.6	90.3	85.9	
HHI	$24,092.00	$25,798.00	$20,748.00	
Home Value	$41,056.00	$50,750.00	$40,344.00	
Vote	55.3	61	60.7	
Median Age	42	29	34	
Historic Race	White	White	White	

Table 1. Demographics for participant neighborhoods in the Butterfly Highway. Data from the Charlotte Quality of Life Study. NPA = neighborhood profile area, Race Black = % black residents in the NPA, HHI = Median Household Income, Home Value – Median Home Sales Price, Vote = % registered voters that voted in the 2016 election, Median Age = Median Age of Residents, Historic Race = Racial demographics of neighborhoods at origin.

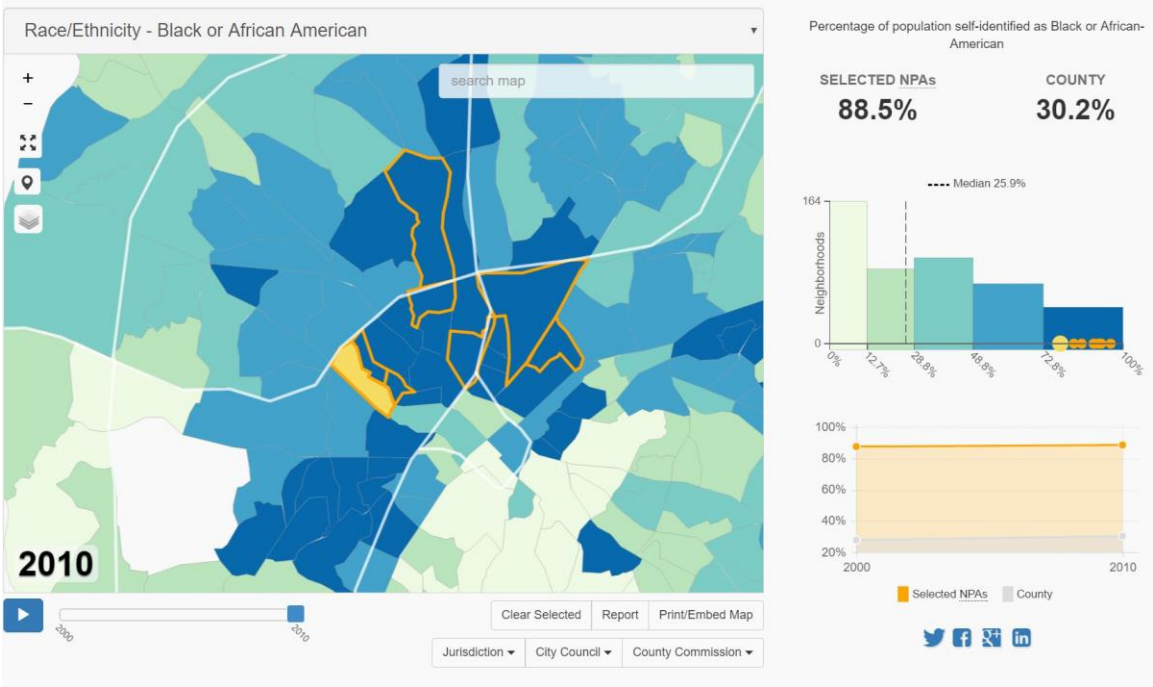

Figure 10. Percentage resident population that is Black or African American. Butterfly Highway neighborhood NPAs are highlighted yellow.

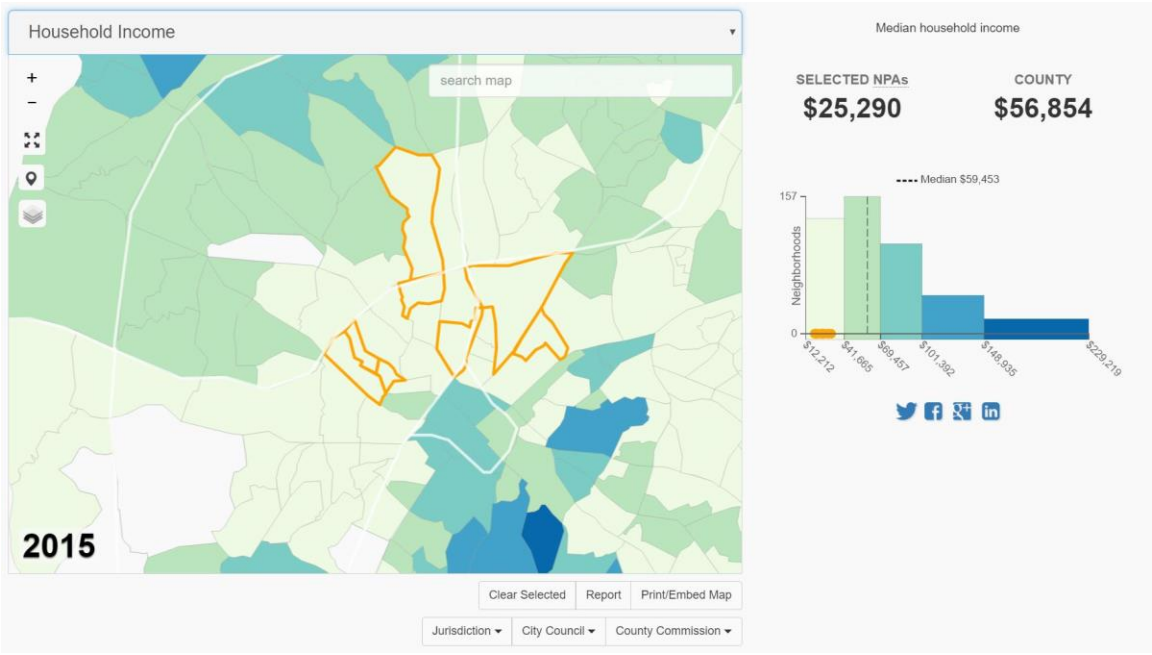

Figure 11. Median Household income. Butterfly Highway neighborhood NPAs are highlighted yellow.

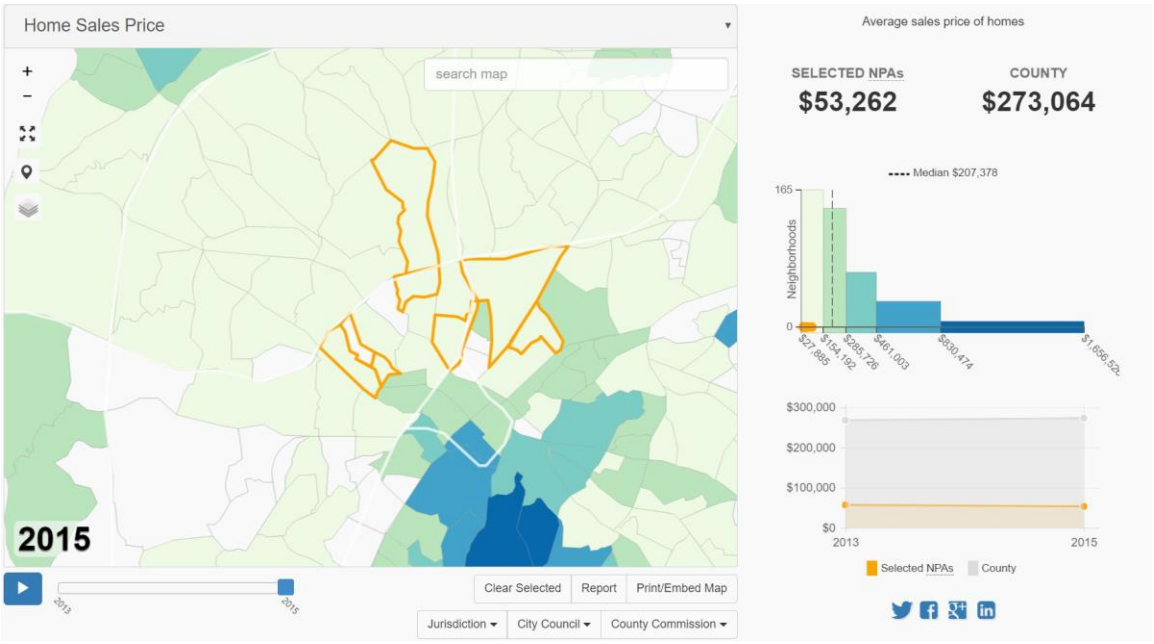

Figure 12. Median home sales price. Butterfly Highway neighborhood NPAs are highlighted yellow.

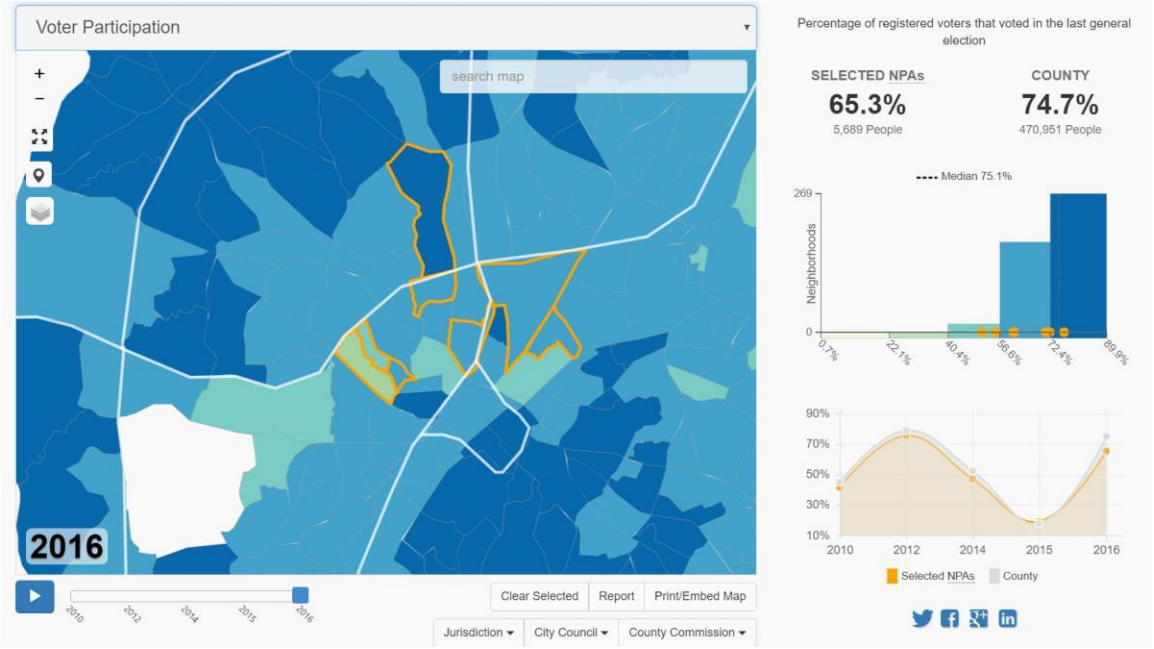

Figure 13. Percent of registered voters that participated in the 2016 election. Butterfly Highway neighborhood NPAs are highlighted yellow.

Neighborhood participants

Participants were eligible to participate if they lived in the Druid Hills, Graham Heights, Greater Enderly Park, Oaklawn Park, University Park, or Northwood Estates neighborhoods. Participants were recruited at neighborhood association meetings and through word of mouth. Eligibility was not based on homeownership, both renters and home owners were invited to participate. Participation was also not limited to single family homes. Two gardens were placed in common space in apartment complexes with the landowner's permission. A total of 49 gardens were installed at single family homes.

Criterion sampling method was used for interview participant selection, as it is the most commonly used method in the literature I reviewed. Criterion sampling is a method in which participants are selected based on a predefined set of criteria. The use of a standardized method to select participants has been identified as one way increase rigor in qualitative studies (Baxter & Eyles, 1997). Interview participants were required to have hosted a Butterfly Highway garden during 2015. There were 50 participants consented to participate in the research aspect of the Butterfly Highway, 19 of the consented participants were recruited for interviews and 13 were recruited for a focus group. The IRB and informed consent letter is a part of the appendix.

Government Professionals

The original research design of this study limited interviews to residents of neighborhoods who participated in the Butterfly Highway. During the interviews with Butterfly Highway participants, discussions emerged around the distribution of parks and amenities that could only be answered by professionals that worked for the county or

city. Participants felt that government agencies controlled the resources they needed to help their neighborhoods address issues such as beautification and community development. Participants said that they do not feel they have the same access to these resources that other communities and neighborhoods in Charlotte do. The interviews and participant observations identified a disconnect between the community and government agencies. A lack of capacity for neighborhoods to access resources became apparent.

Through my work with NCWF, I have relationships with professionals in Mecklenburg County Park and Recreation (MCPR), Mecklenburg County, City of Charlotte, City of Concord, and Cabarrus County. All of these government agencies have participated in the Butterfly Highway through partnering with UNC Charlotte or NCWF to host Butterfly Highway gardens. I expected that the experiences professionals from these agencies had with the Butterfly Highway would be very different than the experiences of neighborhood participants. Bringing this additional layer of participation perspective would help to add depth and breadth to this study.

The participatory focus of PAR supports bringing additional stakeholders into the research process and I felt that this group of government professionals needed to have a voice in the process as well. The insight that those working on the Butterfly Highway from a top-down perspective in government agencies would give a balanced look at how the Butterfly Highway could impact multiple layers of community and natural resource governance. Collecting data from two different levels and perspectives of governance brought a much deeper insight into the motivations, barriers, and outcomes of participation.

I recruited participants from my network and tried to include a range of participants from different organizations and departments including planning, natural resources, environmental education, horticulture, and recreation. There were a total of 17 participants in the Government Professionals interview group. The IRB amendment to include the Government Professionals group and the associated informed consent form is in the appendix.

Participants as co-researchers

In keeping with the PAR focus, Butterfly Highway participants also served as co-researchers in the study. Their contributed knowledge of the local environment made numerous contributions to this study. Some of these contributions are listed below:

- The community preferred the name “Butterfly Highway” over “Bee Highway”. I was told that everyone liked butterflies but no one wanted2 a bee highway in their neighborhood.
- Residential plant selection was determined by the participant from a list of pre-selected pollinator friendly native plants.
- Through participant observations, community members identified the community research priority of beautification which helped to shape the Butterfly Highway.
- Participants requested signs for their yards to identify that they were a part of an organized project.
- Participants helped determine the design of the Butterfly Highway installation. Because the plants may look “wild” I was told that they needed a frame or box

around them so community members would understand this was supposed to be something special.

- Butterfly Highway neighborhood leaders provided local knowledge to shape the participant interview guides.
- Butterfly Highway interview participants helped identify a need to include a different perspective of governance in the study. This resulted in adding the government professionals interview group.
- Participants determined and were a part of the implementation of the action outcomes of the Butterfly Highway.
- Several Butterfly Highway participants were part of a grant writing team to fund action outcomes of the Butterfly Highway. The grant was successful and the team received $50,000 for additional pollinator and wildlife habitat projects in the community.

3.2 Data Collection

Qualitative data collection methods were used in this study. The aim of qualitative research is to gain an in-depth perspective to human behaviors. Qualitative methods include those methods used to recruit participants, collect, and analyze data. Participatory Action Research Methods were used to ensure that community members were engaged in the process of the Butterfly Highway from beginning to end. A focus group of neighborhood participants vetted the interview guide that was used for the semi-structured interviews. Responses from neighborhood participants suggested an additional set of interviews was needed to explore the interactions between neighborhoods, government professionals, and the Butterfly Highway. Participant observations were

collected as a part of a research journal. Participant observations included visits to participants, garden observations, interactions with community members, and neighborhood meetings.

Participant Observations

Participatory Action Research (PAR) methods were used to engage participants in the Butterfly Highway project through garden design, citizen science participation, and participant interview guide design. One way in which PAR methods were operationalized was through a focus group with community leaders involved in the Butterfly Highway. The primary outcome of the focus group was to evaluate the interview guide that would be used in the interviews with Butterfly Highway participants. Even though participants did not conduct the interviews, this gave them an opportunity to review and identify additional questions they felt were important to learn about the community. These results will be presented back to the community during a community event and celebration of the Butterfly Highway during Summer 2017.

Summary of PAR methods specifically used in the Butterfly Highway:

1. Participants recruited from urban residential neighborhoods that identified neighborhood beautification as important to the neighborhood but something that has been a challenge to achieve. Recruitment was done based on cues from the community to address a community identified need.
2. Participants decided where and how the Butterfly Highway was a part of their residential landscape. Participants were also engaged in building the garden and maintaining it through watering and weed control. Participants had a voice and

were vested in the project because they made decisions regarding how they interacted with the Butterfly Highway.

3. Participant observations. A research journal was kept to record all participant observations during interviews as well as during garden site visits. This information was used as an additional data collection source to validate findings as well as another way to bring participant knowledge to the study.
4. Focus group of community leaders vetted the interview guide so it reflected the voice of the community and not just that of the researcher.
5. Interview participants selected the location of the interviews. This allowed for the interviews to be conducted in a space that they felt safe. Interviews conducted in a space chosen by the researcher could have shifted the balance of power and biased the results.
6. Prior to the interviews, I had met with all of the participants on several occasions and had developed a trusting relationship with them. By investing time to develop relationships with the participants, I feel it created a safer space for them to reflect and provide honest answers during the interviews.

Participant observations took place at meetings, during phone calls, or at community events. Table 2 shows observation locations and typical data collected at each site. Participant observations influenced numerous aspects of the study including the intervention name, interview guide, and plant selection. Participant observations were an important part of the reflection and evaluation of the study from inception to execution.

Participant observation location	Observation types	Number of observations
Neighborhood/community meetings	Attendees, discussions, conflicts, events	20
Garden builds	Preferences, science literacy, neighborhood background, connection to place	51
Site visits	Garden performance, neighborhood background, community information, science literacy, participation feedback	255
Phone calls	Participation feedback, garden performance, community information	50

Table 2. Participant observation locations, observation types, and recordings.

The Butterfly Highway gardens were checked monthly for growth and establishment. During June 2015, we had several weeks of 100+ temperatures and little to no rain that occurred within weeks after most gardens were planted. *Asclepias tuberosa* (Butterflyweed milkweed) had either died or gone dormant in most gardens. The remaining plants seem to have a >50% survival rate. Growth and establishment of the gardens was assessed through in person visits in the Fall of 2015 and April-June 2016. At

each visit, participant observations were recorded about the status of the garden and interactions with participants if they were home. See appendix for copy of the form.

Research Journal

A research journal was used during the course of this study to record participant observations. Reflections and observations about the interviews or other relevant information observed during site visits to the gardens were recorded. I recorded my observations within 24 hours of the interaction. Participant observations were also recorded after neighborhood and community meetings, phone calls with participants, and any other opportunities where the Butterfly Highway was discussed with participants or other members of the community. Research assistants also recorded journal entries using participant observation forms during their visits to gardens in the summers of 2015 and 2016. These notes have been used in the analysis. A copy of the participant observation template used by the research assistants during site visits is in the appendix.

Focus group

Community leaders who were participants in the Butterfly Highway were invited to join in a focus group as a part of the PAR process. The purpose of the focus group was to assess and revise the interview guide that would be used for Butterfly Highway participant interviews. The guide included questions on topics related to community involvement and engagement, neighborhood beautification, gardening, and participation in citizen science. A focus group guide was used and is in the appendix.

The focus group session was held May 4, 2016. Participants were invited to the focus group by phone. One week prior to the event, information about the focus group was

mailed to each participant. This information packet included directions to the location of the focus group, an update on the Butterfly Highway, and summary of the project goals. This packet was mailed to all neighborhood leaders regardless of their ability to attend the focus group.

The focus group meeting was held at Smallwood Presbyterian Church. Dinner was provided for all participants. There were two facilitators (myself and Dr. Sorensen) and 13 participants representing six neighborhoods. The session lasted two hours and was recorded using audio recorders only. The focus group audio was transcribed and was used as a part of the analysis.

Within one week following the focus group, participants were mailed a copy of the revised interview guide based on input from the focus group. Participants were given one week to respond with additional revisions. No revisions were requested.

Semi-structured interviews

The primary data collection method used in this study was semi-structured interviews. Semi-structured interviews are interviews that have an open structure where the interviewer uses a guide to explore predetermined themes. The semi-structured format allows the interviewer to follow any new themes the interviewee may bring into the conversation. These have been demonstrated to be an effective tool to identify motivators and barriers to participation in community organizations (Clarke & Agyeman, 2010; Dyer et al., 2014). In-depth interviews are more flexible and unstructured than semi-structured interviews, which allows the participant to explore ideas, and are not bounded by a structured guide. For this study, the semi-structured interview model was the best fit.

Each interview participant was given a copy of the interview guide to direct the interview responses. The semi-structured interview model allowed the addition of questions and responses as needed.

Interviews were conducted using an interview guide, which is a set of questions and themes used to direct an interview towards the issues under investigation in a study. The guide was revised and amended through a focus group of Butterfly Highway participants. Both preliminary and final interview guides are in the appendix. The preliminary guide is based on deductive codes developed through a review of the relevant literature.

A total of 19 Butterfly Highway participants were interviewed in July and August 2016. There were 17 Government Professional interviews conducted in November and December 2016. All interviews were recorded using a digital recorder and I transcribed all of the interviews.

Citizen science monitoring

In addition to hosting gardens, participants were asked to record butterflies, bees and bumblebees that visited their gardens. Participants were asked to observes butterflies and bees in their home gardens for 10 minutes, once a week on a sunny day where the temperature was at least 70 degrees F. Some participants recorded observations more frequently than once a week, some didn't record observations at all. Recording observations was not a requirement of participation. Participants were provided sheets to record their observations.

Participants were not expected to identify all of the species in a specific area. Instead they were asked to identify and document 7 common species that are easy to

identify. I used the most commonly reported butterflies in Mecklenburg County along with my own observations in the neighborhoods during the summer of 2014 to create a list of 7 common and easily identifiable native butterflies. Each participant was given a notebook with participation instructions, a set of laminated identification sheets, and printed sheets to record their observations. In addition to the common butterflies, there was a space to record "unknown butterflies", bumblebees and "other" insects that resembles bees.

3.3 Data analysis

According to Guest (2006) codebook development in grounded theory should be done during the course of processing data. Ryan and Bernard (2003) state that themes in grounded theory should be discovered through open coding. Philip Burnard (1991) describes three stages of coding in grounded theory: codes derived from interview notes, those taken from the first reading of an interview text, and those that have been filtered through a second reading and deemed as important to the topic. I created a preliminary codebook based on a priori and inductive themes identified in the literature new codes were added as they were identified over the course of data analysis.

The concepts of rigor, reach, and relevance are important factors to consider when conducting qualitative research. In this section I discuss each of these concepts and how I address them in this study. Baxter and Eyles (1997) authored a seminal paper on establishing rigor in qualitative interview methods. They defined rigor as, "the satisfaction of the conventional criteria of validity, reliability, and objectivity within quantitative research".

Baxter and Eyles (1997) state that one of the important principles to consider in qualitative research is establishing credibility. They define credibility as the degree to which someone who has had a similar experience can recognize it immediately and those who have not had are able to gain a clear understanding of the experience. They also introduce the idea that credibility is based on the assumption that there is more than one reality and that researchers should not be looking for confirmation of respondent's perspectives but instead that the interpretation of their intentions is plausible.

Creating dependability in research methods is another way to ensure rigor. Baxter and Eyles (1997) define dependability as the amount of consistency between interpretations of the same phenomenon over space and time. They cite several ways to create dependability in a study. These include the use of mechanically recorded data, peer examination and participant researchers. In this study, the interviews will be recorded on audio to reduce the chance of misinterpretation and increase dependability.

Transferability of the results should also be addressed. I will acknowledge that the results presented from the interviews are based on case studies. If the results support those from similar case studies, they can be used to build up the body of knowledge on community based project participation.

Qualitative research can be used to reach a new understanding of areas that can't be unfolded through quantitative methods (Pope & Mays, 1995). The concept of reach can also be used to ensure inclusiveness of populations that can be difficult to engage in the research process. I aim to reach a diverse group of interview participants by using a purposeful sampling method.

There is no established number for the ideal sample size of interviews in qualitative research. Recommended numbers vary based on study type and area of research and range from 15 to 60 participants (Francis et al., 2010; Guest, 2006). According to Guest, the number of participants required for a study should be determined by the factors that influence saturation. Saturation is the point when enough interviews have been conducted that primary themes do not change and no new significant information is revealed when more participants are added. Based on a literature review by Guest, most studies cited "saturation" as the gold standard on which to base sample size but none of them were able to effectively operationalize it.

One issue that often arises for researchers is that they are required to state how many participants will be involved in a study before it occurs. However, saturation can only be determined once the interviews have been conducted and evaluated. Therefor it is difficult to determine the ideal number of participants before a study takes place.

Digital data files and interview transcripts were de-identified as a means to maintain confidentiality. All files are stored on a secure cloud storage space managed by UNC Charlotte IT. For the Butterfly Highway participant group, there were 17 transcripts with 19 interview participants. Two groups of participants did their interviews together. For the Government Professionals group, there were 17 transcripts and 17 interview participants.

Grounded theory is a method of discovering theory through the process of data analysis. Findings will be interpreted using grounded theory, as I feel this study fits most

of the procedures and canons of grounded theory as outlined by Corbin and Strauss (1990).

To analyze the interview transcripts, I used coding to reduce the data into groups of key themes. I also used a combination of manifest and latent content analysis methods. Manifest content analysis is a descriptive analytical method in which a text is assessed for visible themes that are described by particular words or phrases. Latent analysis is an analytical method that identifies themes that the interview participant may not have explicitly mentioned but are identified through interpretation of the context. These themes can include ideologies, beliefs or personal stereotypes (Hay, 2010). Coding themes are presented in next section.

To operationalize thematic coding, I used several methods. First I read each transcript and used a spreadsheet to record the themes. Ryan & Bernard (2003) outline many excellent methods to identify coding themes in texts. I looked for topics that were repeated regularly both within and across interview texts, metaphors and analogies to established themes, conversation transitions to identify a potential new theme, and I compared similarities and differences between statements and topics in individual interviews. In addition to manually coding the themes, I used the qualitative research software, NVivo http://www.qsrinternational.com to analyze the interview texts. NVivo can be used to query text for predefined themes and can also be used to identify additional themes across one or multiple text sources.

Evaluation

Evaluation of qualitative research methods and findings is important to establishing the rigor and reliability of the findings. Baxter and Eyles (1997), established a set of criteria to evaluate qualitative research. Criteria include credibility, transferability, dependability, and confirmability. Table 3 identifies how this study addresses each criterion for evaluation.

Credibility	Long term engagement with the community Participants reviewed transcripts Triangulation-multiple sources of data Purposeful sampling
Transferability	Methods are repeatable Findings are applicable to other studies
Dependability	Participatory research methods Interviews and focus group were audio recorded Multiple researchers (research assistants)
Confirmability	Research journal – field notes

Table 3. Evaluation of this study using criteria from Baxter & Eyles (1997) criteria for evaluating qualitative research.

Themes

The tables below highlight the connection of themes with the research questions, expected response themes based on the literature, and the corresponding source in the literature.

Research Question 1.

What are the motivations and barriers to participation in a social-ecological intervention for participants at multiple governance levels?

In Chapter 2, the section on Ecological Wisdom and participation (2.3) presented the motivations and barriers to participation in a social-environmental initiative such as the Butterfly Highway as identified in the literature. Table 4 summarizes the themes identified with the relevant literature cited. Motivations and barriers can contribute to our understanding of knowledge, participation, ethics, values, and constraints in the Ecological Wisdom conceptual model. These themes framed the coding used to analyze the data collected from Butterfly Highway participants and government professionals. These themes form the framework for answering research question 1 about motivations and barriers to participation.

Variable	Themes Identified Through Literature Review	Literature Cited
Participation Motivation	Civic Duty Community Pride Expectation of Influence Institution and researcher involvement Preference for action	(Donovan & Mills, 2014; Evans et al., 2005; P. Florin et al., 1986; Paul Florin & Wandersman, 1990; Miller-Rushing, Primack, & Bonney, 2012; Perkins et al., 1996; Prestby et al., 1990; Singh et al., 2014)
Participation Barriers	Don't fit in Cost of participation Trust Engagement practices Cultural preferences Perception of wildlife Landscape preferences	(Bruyere et al., 2009; Clarke & Agyeman, 2010; Dietsch et al., 2016; Gambetta, 1990; Gibson-Wood & Wakefield, 2013; Madden, 2004; Nassauer, 1995; Pandya, 2012; Parisi et al., 2004; Prestby et al., 1990; Van Velsor & Nilon, 2006)

Table 4. Motivation and barriers to participation themes.

Research Question 2.

What are the outcomes of participation in a social-ecological intervention for participants at multiple governance levels?

In Chapter 2, the section on Ecological Wisdom and Participation (2.3) presented the outcomes of participation in social-environmental initiative such as the Butterfly Highway as identified in the literature. Table 5 summarizes the themes identified with the relevant literature cited. Outcomes of participation contribute to our understanding of knowledge, participation, ethics, values, ecosystem services, and constraints in the Ecological Wisdom conceptual model. These themes framed the coding used to analyze the data collected from Butterfly Highway participants and government professionals. These themes form the framework for answering research question 2 about outcomes of participation.

Variable	Themes Identified Through Literature Review	Literature Cited
Participation outcomes for neighborhood participants	Beautification Connection to nature Connection to place Empowerment Trust building Scientific Literacy Environmentalism Sense of accomplishment Place based conservation	(Fernandez-Gimenez et al., 2008; Paul Florin & Wandersman, 1990; Fraser et al., 2006; Krasny & Tidball, 2012; Prestby et al., 1990)
Participation outcomes for government professionals	Public engagement Ecosystem services Trust Adaptive management Recreation opportunities	(Abercrombie et al., 2008; Agyeman & Angus, 2003; Bolund & Hunhammar, 1999; de la Barrera et al., 2016; Fraser et al., 2006; Gobster, 1998; Light, 2003; Miller, 2008; Miller & Hobbs, 2002; Peterson et al., 2012; Wratten et al., 2012)

Table 5. Participation outcomes themes.

Research Question 3.

How can a social-environmental intervention contribute to our understanding of an adaptive management planning framework such as Ecological Wisdom?

In Chapter 2, I presented the framework for the Ecological Wisdom conceptual model. There is a need for empirical knowledge of Ecological Wisdom in practice. Question 3 aims to fill this gap in the knowledge. Table 6 identifies the themes used to frame the coding specific to adaptive co-management in the Butterfly Highway intervention. These coding themes were used to analyze data collected from interviews and participant observations of Butterfly Highway participants and government professionals. These themes will frame the responses to Research Questions 1 and 2 and how they build upon the Ecological Wisdom model.

Variable	Themes Identified Through Literature Review	Literature Cited
Adaptive co-management	Learning by doing Collaboration Resiliency Governance Power relationships	(Armitage et al., 2009; Berkes, 2009; Olsson et al., 2004; Plummer & Armitage, 2007; Rodríguez-Izquierdo et al., 2010)

Table 6. Adaptive co-management themes.

CHAPTER 4: FINDINGS

The purpose of this study is to add empirical knowledge to the Ecological Wisdom theoretical framework. The first three chapters of this dissertation offered an introduction to the social and environmental issues facing African American communities in Charlotte, a literature review to situate this dissertation within the framework of Ecological Wisdom, and the methodological design used for this study. This chapter presents the collected data and findings that emerged. Data collection methods included participant observations, a focus group, and semi-structured interviews. The template for participant observations, focus group guide, and the interview guides are included in the appendix. The IRB documents for this research are also included in the Appendix.

Interviews with Butterfly Highway participants were conducted in July and August of 2016. Participant observations were collected from April 2015-December 2016. Interviews with government professionals were done in November-December 2016. Interview participants have been deidentified and will be referred to using the below abbreviations.

- Butterfly Highway participant interviews = BH1, BH2 …
- Government professional interviews = GP1, GP2 …

Restatement of research purpose and research questions

The purpose of this study is to add empirical knowledge to the Ecological Wisdom theoretical framework including lessons on the importance of participation and constraints/barriers to participation in projects at the intersection of social and ecological eco-systems. Empirical research is also needed to explore the role of ethics and values as we engage in participatory, practice based research. Equally important is contributions to the conversations about ecosystem services and adaptive management from the perspective that evolves as neighborhood residents and academics establish a partnership to learn about these issues by engaging in an intervention established to intervene in both the social and environmental challenges discussed in the introduction to this dissertation. Additionally, the findings of this work will contribute to our understanding of participation in social-ecological interventions. The research questions specifically inquire about empirical contributions of the Butterfly Highway to the Ecological Wisdom framework.

Research questions:

1. What is learned from practice while implementing an intervention at the intersections of social and ecological systems about the motivations and barriers to participation in a social ecological intervention for participants at multiple governance levels ranging from participants in the intervention to government employees interacting with the project? And,
2. What are the outcomes of participation in a social-ecological intervention for participants at multiple governance levels? And, finally,

3. How can a social-environmental intervention contribute to our understanding of an adaptive management planning framework *within the theoretical framework of* Ecological Wisdom?

4.1 Research question 1. Participation motivation and barriers

What is learned from practice while implementing an intervention at the intersections of social and ecological systems about the motivations and barriers to participation in a social ecological intervention for participants at multiple governance levels ranging from participants in the intervention to government employees interacting with the project?

Themes of participation motivations and barriers used to analyze the participant observations and interview data were identified using the literature on Ecological Wisdom, with particular focus on contributions around participation in citizen science and community-based environmental organizations. It was expected that motivations and barriers to participation in the Butterfly Highway would be similar to those identified in the literature. All the transcribed data was integrated in NVivo and both participant observation data and interview data have been reviewed multiple times to code for the themes in the literature and to identify organic themes. Table 7 summarizes response numbers for themes in my interviews. I have chosen not to quantify the participant observation because review of my data illustrates that data in my observations is repetitive and that it is more meaningful to point out if/when different observations contradict.

Response theme	Number of responses
Social capital	12 responses
Social contagion	2 responses
Community involvement	17 responses
Connection to place	17 responses
Connection to nature	19 responses

Table 7. Motivation to participate response theme and number of responses.

Motivation to participate

Motivation for participation in the Butterfly Highway was identified through participant observations and interviews. Themes that emerged from the data support the themes that were identified in the literature. Literature themes and participant response themes are listed in Table 8. This section presents the major findings on participant motivation. Quotes from interviews have been selected that best represent the responses. Additional supporting observation and response data is in Appendix C.

Primary Theme	Sub themes Identified Through Literature Review	Additional organic themes	Literature Cited
Participation Motivation	Social capital Civic Duty Community Pride Expectation of Influence Institution and researcher involvement Preference for action Connection to nature Help the environment	Likes flowers, Likes butterflies (particular interest in the topic of the project)	(Donovan & Mills, 2014; Evans et al., 2005; P. Florin et al., 1986; Paul Florin & Wandersman, 1990; Miller-Rushing et al., 2012; Perkins et al., 1996; Prestby et al., 1990; Singh et al., 2014)

Table 8. Participation motivation theme, sub themes, and responses themes.

The following discuss each of the themes in participant motivation. First those consistent with the literature and then the additional organic themes that emerged in my data analysis.

Social capital

Social capital is defined as the connections between individuals and the social networks and norms of reciprocity and trustworthiness that result from these connections (Putnam, 2000). The ability to build and sustain social capital within neighborhoods and the community is an important motivation for participation. Many participants feel that there is a generational disconnect in their neighborhoods between older and younger generations and between renters and homeowners. The Butterfly Highway is seen as a way for participants to strengthen existing relationships and bridge new connections with each other. A current neighborhood leader explained it this way: “My initial (motivation) was to try to get more action amongst the neighbors. I know again most of the residents

are ladies and most like flowers and most have a nice little area set up for some flowers. So, I thought that would be something to get them involved and to create that conversation. We could talk about the butterflies and the gardens. As well as open up the door for other conversations that affect the neighborhood and the city." (BH7)

Building social capital within the community is also important to other participants. Because the Butterfly Highway included six neighborhoods there was an opportunity to work together as a group in a larger coalition capacity. In a conversation about what the participant would change about community organizations: "What I would suggest changing is the collaborativeness of community leaders and organizations in totality. I think that they are so segmented in the way that they carry out different goals and initiatives. Instead of there being 15 people here, 15 people there. We could be 150 here doing the same thing and not duplicating efforts. Getting more done. Getting more time, and having a greater impact. And a singular voice….. So instead of each individually hammering at city council or county commission or sitting amongst their groups, hammering together. Forming a coalition to work." (BH3) This initial conversation led follow up conversations on how the community could come together to address environmental justice and wildlife concerns. The outcome was the participant became a founding member of a new grassroots environment and wildlife coalition, Community Alliance for Wildlife.

Prestby et al. (1990) identified social/communal benefits of participation in community organizations. One benefit is getting to know your neighbors better. Participation in beautification projects can increase social capital on an individual and

neighborhood level (Unger & Wandersman, 1982). One participant said that the Butterfly Highway helped her connect with a neighbor she previously felt she had nothing in common with: “I think that is what I like about it so much because ‘Ms. Jones’ we talk more now because I went over and planted all of hers. And she is older and she helped a little bit but I pretty much planted everything. But now we have something to talk about and we talk about other things now life and stuff like that.” (BH2)

Neighboring is another form of social capital (Alaimo et al., 2010). Neighboring activities are associated with an individual’s attachment to place, including psychological investment and rootedness (Unger & Wandersman, 1982). Community togetherness and informal neighboring was an important motivating factor for participation in the Butterfly Highway. In the interviews, 12 participants mentioned that informal neighboring or in their words, being “neighborly” was important an important neighborhood characteristic. The Butterfly Highway provided new opportunities for participants to be neighborly. Neighbors came together to help each other build Butterfly Highway gardens and assist older neighbors with pulling weeds. These are two examples of how the Butterfly Highway increased neighborliness that were observed and recorded in the participant observations.

Civic Duty

Participation in grassroots organizations is strongly correlated to civic duty, informal neighboring, and involvement in religious or other community organizations (Perkins, Brown, & Taylor, 1996). According to Putnam (2000), churches and faith communities where people worship together are the most important form of social capital in America. Those who are active with their church are more likely to be active in their

community. Ten participants mentioned that they were involved in activities with their church and two participants are either active or retired ministers. This quote from one of the retired ministers supports the connection between participation in church and community: “I did 7 or 8 years as a preacher building a church back up and called as a full-time minister. Though I was ready to hang it up, I ended up going to a little small country church. I was still doing plumbing and preaching on the side. Then I got involved with the neighborhood leadership. So from that to becoming leaders in the neighborhood, I got hooked up with the community relations board with the city of Charlotte and I am involved with that and a lot of different community outreach programs.” (BH11) This participant was very active with the Butterfly Highway and was responsible for recruiting several additional participants.

Community pride and connection to place

Research has shown, those who express “rootedness” or a connection to place have been found to be more likely to participate in community organizations than those that don’t (P. Florin et al., 1986). Rootedness can refer to the length of time someone has been connected to place, for example through homeownership, or a psychological connection of positive feelings about their neighborhood (Unger & Wandersman, 1982). Connection to place is also strong driver for participation in the Butterfly Highway. A majority of participants grew up in Charlotte, and many of them have returned to the neighborhood where they grew up. Some even live in the house they were raised in. This creates a strong connection to place for the participants which motivates the desire to give back and improve their neighborhood and community. As one participant explains: “Well this was my parent's home and I am attached to them more than anything else. That's why

I am here. And they left me the house. So, I am the caretaker of this place until I leave it. I would like to do what they did and do the best you can to make it at least livable. Now this is an old dwelling. It was built in 1947. So, it's my job to be a caretaker of this property. And that is what I am doing now." (BH1) When I went to do the interview, this participant proudly showed off how well their Butterfly Highway garden was blooming and how it made their end of the street more beautiful. There was obviously a sense of pride in how well they had taken care of the garden and the enhancement it made to their personal property.

Pride and showing that you care for your yard was brought up often in discussions about beautification. One participant shared: "Just trying to show that you care about your community. And when people drive through that don't necessarily live in your neighborhood they recognize that people care about the neighborhood. There isn't run down stuff in the yard or broken down cars, those types of things make a neighborhood look like the people have no interest in where they live. Pride in your community." (BH16) It was mentioned during participant observations that joining the Butterfly Highway and having boxes of flowers out front was one way for a neighbor to show that they cared about where they lived.

Community pride and the ability of the Butterfly Highway to beautify and increase pride was a motivating factor for participation. Participants expressed a strong connection to their neighborhoods and are proud of the history and what the neighborhood once was. Many saw the Butterfly Highway as a way to help revive that beauty or to enhance what is already there. When asked why they decided to participate in the Butterfly Highway, one participant said: "I decided to participate because I live in a

corridor where there are not so many beautiful things to see. As a result of that, I felt that if I could partner with the Butterfly Highway initiative that that would help to bring something beautiful to the Statesville Avenue and Graham Street Corridors. As well as the urban inner city neighborhoods." (BH17)

Connection to nature

Participation in environmental conservation initiatives is often motivated by an interest in conservation, nature, or protecting a particular species or group of species such as butterflies or birds (Cerra, 2017). Even just identifying a connection to nature is can be a motivation to participate in citizen science. A connection to nature is something that all Butterfly Highway participants had in common. This section shares examples from Butterfly Highway participants that show their connection to nature, which supports the literature on connection to nature and participation. All participants shared that they participated in the Butterfly Highway because they like butterflies, flowers, and/or protecting nature. Participants either brought it up in their interviews or mentioned it during a participant observation. When asked why they decided to participate in the Butterfly Highway, one participant said: "Because first of all I like nature and I understood that what we planted would bring back the monarch butterflies which I have only seen two this entire summer." (BH10)

Many participants talked about what they liked to do in nature. Some said they just enjoyed sitting outside and watching birds and wildlife, while others said they enjoyed hiking and photographing nature. One participant's response supports to the connection to nature theme: "Occasionally I will go up to South Mountain State Park to

go hiking. They have a waterfall and I'll go look at that. Just walk around. I can appreciate walking around in the woods. Take pictures." (BH18)

Participation in conservation can also be motivated by an opportunity for action to protect environmental resources (Foster, 2011). Six participants responded that they wanted to participate in the Butterfly Highway because it helped to protect natural resources. The following quote is an example of one of their responses: "Being able to see butterflies. I had never seen as many butterflies and just a variety of different birds, just within the last 6 or 7 months than before. Like what happened to the butterflies? We would never see that. And the creeks would just be filthy. Again, so trying to take care of the creeks and that type of thing as well to me represent some environmental issues and concerns. And hopefully we can get back to where the creeks and so forth are in good shape where we can have kids walk through them. Walk alongside the creek and throw rocks and enjoy it." (BH7)

Social contagion

Social contagion can be a motivator for hosting urban garden spaces (Hunter & Brown, 2012). Yards can exemplify people's personal values and can provide a sense of pride and connection to community (Clayton, 2007). The sense of belonging or fitting in with your neighbors can influence personal gardening practices. Yards can also be an expression of conforming to social norms (Nassauer, 1988). For example, neighbors often ask each other for advice and want to mimic what others are doing (Goddard et al., 2013). This was found to be true in the Butterfly Highway. Several neighborhood leaders that hosted gardens asked for theirs to be installed first so that it would inspire their neighbors

to participate. One neighborhood leader said: “You know our neighbors are funny. When they see something going on they are suspicious. I guess we are you can say the pattern setters. When they see me doing something they try to do it as well.” (BH11)

While installing a garden, a Butterfly Highway participant called her neighbor to come and see what we were doing. The neighbor had been on the fence about participation but she decided to join in once she saw her neighbor’s box. In another neighborhood, the neighborhood leader asked to have his box installed first because he said neighbors would be more likely to say yes if they could see that he had one. His street had five gardens, which was the most gardens on one street in the study. He further explains: “There were individuals that I asked to be a part of it and they politely declined but after they saw the beautiful gardens throughout the corridor and the city of Charlotte then they were most definitely talking about I wish I had, I should have.” (BH17)

The Butterfly Highway has received lots of positive media exposure, both in print and online. This included an article in the Charlotte Post, a print newspaper for the African American community in Charlotte. One participant read the article and concluded that this was a program that could greatly benefit their neighborhood as well. When asked where they heard about the Butterfly Highway they responded: “Yes, the Charlotte Post. That's what it was. And I saw it online. And I said. O.M.G. this is an awesome program. And they talked about the neighborhoods and that they were doing it.” (BH2)

Likes Butterflies and flowers

An additional organic theme to participation motivation emerged. Participants identified a strong motivation to participate because they liked either butterflies and/or flowers and wanted to attract more to their yard. There were 18 out of 19 participant responses that supported this. An example of this type of response, “I like butterflies, I like flowers and I love to garden.” (BH4). These responses support beautification but they were specific to the topic of the project.

Barriers to participation

Barriers to participation in community-based organizations include cost of participation, trust, engagement practices, and cultural preferences (Clarke & Agyeman, 2010; Donovan & Mills, 2014; J F Dwyer & Gobster, 1991; John F. Dwyer & Barro, n.d.; Fernandez-Gimenez et al., 2008; Prestby et al., 1990). The results in this section support and expand on previously identified barriers to participation. Participants talked about barriers to participation in the Butterfly Highway as well as barriers to participation in other projects in the community. Few barriers to participation in the Butterfly Highway were identified as all interviews were with those who participated in the Butterfly Highway by hosting a garden. Barriers to participation include trust, cost of participation, and fear of nature. Connections to relevant literature that supports these findings are cited. Table 9 summarizes the number of responses to each theme. Barriers themes identified in the literature and themes identified through this study are listed in Table 10.

Response theme	Number of responses
Cost of participation	10 responses
Awareness	5 responses
Methods of Engagement	6 responses
Trust	13 responses

Table 9. Barriers to participation responses theme and number of responses.

Primary Theme	Sub themes Identified Through Literature Review	additional organic themes	Literature Cited
Participation Barriers	Cost of participation Trust Engagement practices Cultural preferences Fear of nature	Awareness	(Clarke & Agyeman, 2010; Donovan & Mills, 2014; J F Dwyer & Gobster, 1991; John F. Dwyer & Barro, n.d.; Fernandez-Gimenez et al., 2008; Prestby et al., 1990)

Table 10. Barriers to participation theme, sub themes, and responses themes.

The following section discuss each of the themes related to barriers to participation in the Butterfly Highway. First are those consistent with the literature and then the additional organic themes that emerged in my data analysis.

Cost of participation

The age of participants in environmental community-based organizations has been found to impact their participation and power in organizations (Reed, 2008). Age of neighborhood residents was the most cited barrier to participation in the Butterfly

Highway. Age did not impact the power balance in the Butterfly Highway, as most of the participants were seniors and over the age of 70. In this case, age was a limiter because of physical ability. One participant was unable to bend down to weed her garden and said she had her yardman take it out. In response to this barrier one participant said: "I think if we could get more of the residents involved. I know some of the issues that happen in my neighborhood are kind of the age of the residents as far as maintaining the gardens and that type of thing." (BH19)

Other participants who were not physically able to weed their gardens had friends or family that were not a part of the Butterfly Highway help them with maintenance. Their "helpers" were not trained to know what plants were a part of the Butterfly Highway box, so they removed the "dead"/dormant flowers and replaced other non-native plants in the garden. A participant shared about another incident where this happened: "She let one of her friends who became very interested in the butterfly garden, well she felt like she had to maintain that one. And when I went up there, there was absolutely nothing in the garden. I asked what happened. And she said well they died. And I said what did you do? And this Beth, Beth is a busy body, Beth I think she had dug it up. I think she had put something else in there." (BH19)

Another participant said that older people in her neighborhood don't like change. So, an initiative like the Butterfly Highway may not be appealing to them. I asked participants if they had talked to their neighbors about the Butterfly Highway. One participant responded: "This is an older neighborhood. Older people don't like change. So, you leave them alone. And if they are interested, they will come to you. And if not,

they won't. So, I don't push anything or say anything. I let them do their thing and they let me do mine." (BH8)

Personal cost of time or having to choose other obligations can also be a barrier to participation (Prestby et al., 1990). One community leader asked her neighbor to participate and she responded that she was too busy and didn't have time. She said: "The lady across the street. She said she work every day and on the weekend, at that time they were going to Durham to see about her grandbaby was sick and that was for about a year. So, I understood why she couldn't do it." (BH14)

Trust

Trust is needed for successful collective action. It takes time to build trust but it is also easily broken when promises aren't met (Gambetta, 1990). Bringing communities into a process without fully engaging them can make community members feel that they are being instructed as to what to do from a top down manner (Rodríguez-Izquierdo et al., 2010). Often this results in the feeling that their opinions are just tokens in the process and they are not really valued. These feelings could be avoided if community members are brought in at the beginning of a project.

Almost every neighborhood leader mentioned a time when an organization from outside their community has broken their trust and it has made them hesitant to engage in work with other outsider organizations. In one particular situation, a neighborhood had agreed to participate in supporting a project that could help secure a significant financial resource for an outside organization. A community member had asked questions about the process and found out that they had been lied to regarding the input and voice the

community had. The organization did what they wanted to even though it was against what the community said they wanted. The community member now feels that they are in the position of having to fight for what the community wants instead of working in partnership as it had been originally intended. The outcome of this situation is that the community will approach new partnerships and opportunities with a sense of distrust based on previous actions by organizations (BH17).

A similar trust breaking situation was brought up during another interview. The community had placed trust in an organization to help bring a tool to educate them, but it didn't work out quite as promised. The community put a lot of effort into planning an educational program for the organization but afterwards there was no follow up or further engagement. The neighborhood leader said about the situation: "In a way if affected my trust. I mean it's not like the end of the world or anything like that. It's just like look, we had a conversation about this and this is supposed to be our understanding and for it to fizzle in this way. It didn't bode well for you to be trusted moving forward. So now you have damaged a level of trust. Not that I don't trust anybody because it's not, I don't trust you as much anymore. The things I see damped trust, not necessarily that experience but I just know I need to watch this situation a little bit closer if I am going to engage again. So, it's not that big of a deal." (BH3)

Trust is a fragile component of community building and why I felt it important to share these two stories even though the circumstances did not happen with the Butterfly Highway or me. Lack of trust did not impact these neighborhoods participation in the Butterfly Highway because I had gained the trust of the neighborhood leaders through my association with CHARP and my reputation within the community. However, there were

several neighborhoods I approached about being a part of the Butterfly Highway that chose not to participate. The lack of trust is a probable reason why.

Methods of engagement

Clarke and Agyeman (2010) identified that participation can be impacted by cultural differences in how groups are engaged. Some participants felt that the project could have been more successful if there was increased engagement from the organization. Participants were engaged individually and as a community several times through the Butterfly Highway initiative. In June and July of 2015, a research assistant visited each garden at least once a month. If the participant was at home, they engaged them in a conversation about the garden. These interactions were recorded as a part of the participant observations. Additional visits were made during the summer of 2016. Despite these additional visits with participants, several participants commented during the interviews that they felt the project would have been more successful if there was more regular engagement with participants. A participant commented about the impact that in person visits made to the project: “I was hearing at first different things, they would tell me "the young lady came by my house" but I do think it had an impact.” (BH19)

Another participant said that the project could be improved with more contact from the project staff: “I think maybe you should call us more often that's about it. To see if our stuff is dead. To me sometimes hearing from the organization maybe just having a little calling team. Say we are just calling to see if you have seen any birds. That might keep the interest because it makes it seem like you are interested” (BH13)

Cultural barriers

There are also ways in which nature itself can be a barrier to participation. One barrier to participation in a wildlife conservation project is the perception of human wildlife conflict, particularly in urban spaces. Many Participants identified a fear of snakes, birds, bees, and other insects. Insects especially have an extreme negative perception in society (Lemelin, 2013). A fear of nature or things occurring in nature such as insects or snakes could impact a participant's willingness to go outdoors into "wild" spaces or their willingness to bring things into their yards or homes that will attract wildlife. The project name, the Butterfly Highway, even reflects this. Early discussions with participants revealed that a "Bee Highway" would not be welcome in their neighborhood, while a Butterfly Highway was exciting and welcome.

During a participant observation at a community recreation center, I witnessed an example of the misconception about bees in the community. When attempting to find a suitable location for a Butterfly Highway garden at a community recreation center, there were concerns over attracting bees to an area located near the tennis courts. During this conversation, it was observed that there was a trash can in the same area that was attracting yellow jackets. A lack of knowledge about the different between bee and yellow jacket behaviors resulted in a bias against bees and made them not wanted in a high traffic space.

One barrier to the creation of ecosystems services in urban spaces is the conflict between manicured and wild landscapes (Im, 1984). People often prefer manicured landscapes, but they are also the landscape types that are the least beneficial to wildlife.

A way to address this conflict is to use "framing" around wild landscapes to provide a more culturally acceptable boundary (Tzoulas et al., 2007). The framing in the case of the Butterfly Highway was to build a box around the wild native flowers, to make them appear intentional instead of unkempt. This conflict is reflected in the numerous participants that associated beautification with manicured, well-tended yards. There were 11 participants that mentioned that an ideal yard had grass, most of which said they should been edged as well as cut.

Fear of nature

A fear of nature was identified through the participant observation data. Community members were afraid to participate in the Butterfly Highway because they were afraid of bees, snakes, birds, and other wildlife that the garden might attract. One non-participant said that they were really afraid of caterpillars and that they didn't want them in their yard. Since all of the interview participants hosted Butterfly Highway gardens, there was not data in the interviews directly related that I could quote.

Awareness

An organic theme that developed during data analysis was awareness of opportunities to participate in projects like the Butterfly Highway. Lack of knowing about opportunities to participate in environmentalism could be a sub theme of cultural barrier (Bruyere et al., 2009). When asked about participation in conservation projects or involvement with environmental organizations, when participants responded no they did not or have not participated, I followed up with the question, "Why not?" The most

common answers were either “no one asked me” or “I didn’t know anyone engaged in these kinds of programs”.

A participant provided insight to the theme of opportunities for participation: “I think also something you said in one of the meetings we had you were talking about lack of participation in minority communities in like wildlife associations, I think that is because people aren't asked or the assumption is that people in this community don't want to do flowers, or they don't want to do a Butterfly Highway. They aren't interested in science. But you don't have to sell it as science so much as you sell it as, you can have some nice flowers and you can do a good thing for the bees and the butterflies. And oh yea by the way we are going to collect some data. It doesn't have to be sold as a science thing. A science project.” (BH18)

Participation findings summary:

This section presents data collected through interviews and participant observations that relate to motivations and barriers to participation in the Butterfly Highway. Major findings include:

- Motivations to participate in the Butterfly Highway
    - Build social capital. Opportunity to build social networks in neighborhood and community, nurture existing relationships, bridge age and socio-economic barriers in neighborhoods.
    - Connection to place/rootedness. Most participants are Charlotte natives; a majority lives in their family home or has lived in the home for more than 50 years.

    - Community involvement. All participants are involved in the community either through church or other organizations.
    - Environmental conservation. Participants like nature, butterflies, flowers.
    - Self-interest. Participants wanted to make their own yard nicer.
    - Social contagion. More likely to participate if neighbors or trusted neighborhood leaders participated first.
- Barriers to participation in the Butterfly Highway
    - Cost of participation. Participants responded that they are over committed and have limited time for new activities, they don't know anyone else involved in environmental activities, and some participants felt they were too old to participate.
    - Trust. Outside organizations have not followed through on promises to neighborhoods, which resulted in broken trust.
    - Methods of engagement. Community member expectations should be established up front, organizations should be more intentional about engagement practices, and participants had not previously been asked to join an environmental conservation project.
    - Cultural barriers. Fear of nature such as snakes or insects, extinction of experience with nature.

4.2 Research question 2. Outcomes of participation

What are the outcomes of participation in a social-ecological intervention for participants at multiple governance levels?

Butterfly Highway neighborhood participants

This section brings together data from the Butterfly Highway participants interview group about the personal, neighborhood, and community outcomes of participation in the Butterfly Highway. This data was collected from Butterfly Highway participant interviews conducted during July and August 2016. Data from Butterfly Highway participant observations collected during the period from April 2015 to January 2017 are also included. All the transcribed data was integrated in NVivo and both participant observation data and interview data has been reviewed multiple times to code for the themes in the literature and to identify organize themes.

Several questions in the interview guide were intended to identify outcomes of participation in the Butterfly Highway. Literature on participation in citizen science and community-based environmental organizations was used to code the outcomes of participation. This study presents results that support and expand on these. Table 11 is a summary of themes identified in the literature that were used to code these results. Table 12 presents a quantitative summary of key results.

Primary Theme	Sub themes Identified Through Literature Review	Additional organic themes	Literature Cited
Participation outcomes for neighborhood participants	Social capital-neighborliness Capacity Empowerment Trust Beautification Pride Connection to nature Environmental literacy Connection to place	Continued university engagement after BH Behavior change Native plant habitats	(Alaimo et al., 2010; Fernandez-Gimenez et al., 2008; Paul Florin & Wandersman, 1990; Fraser, Dougill, Mabee, Reed, & McAlpine, 200(Brooks, 2002; Freire, 1970; Putnam, 2000; Rostila, 2011; Rydin & Pennington, 2000; Westphal, 2003)6; Krasny & Tidball, 2012; Prestby et al., 1990)

Table 11. Participant, neighborhood, and community outcomes theme, sub themes, and responses themes, literature cited.

Outcome	Responses
Neighborliness	15
Environmental literacy	11
Pride	9
Connection to nature	9
Beautification	8
Behavior change	4
Connection to place	4

Table 12. Neighborhood participant and community outcomes and responses from participant interviews.

Social capital

Social capital is broadly defined as a way to bring people together to work towards common goals through creating social connections and networks among people (Putnam, 2000). Social capital can be viewed as an individual oriented approach or a collective approach. The Butterfly Highway has been successful in providing opportunities for neighborhood residents to increase individual and collective social capital by creating new connections and strengthening existing connections with one another. Themes within social capital include coalitions, participation, neighboring, and individual and collective outcomes. Connections to relevant literature that supports these findings are cited.

Individual social capital

Participants reported that they had numerous opportunities to share knowledge with others about their participation in and the importance of the Butterfly Highway. Each participating residence had a small sign to place in their front yard with the logo and website. Many of the participants said that the signs created opportunities for conversation with neighbors. One participant said that the sign motivated people walking down the street stop and ask her about the Butterfly Highway when they saw her sitting on the front porch. Most of the time these were people she knew lived in the neighborhood but she had never spoken to before. Others had friends and family that visited their homes ask how they could join the Butterfly Highway. These conversations provided a platform for peer education on the importance of pollinators and sharing on how they could join the Butterfly Highway.

One neighborhood participant said: “People who would just come through the neighborhood it (the Butterfly Highway box and sign) would pique their curiosity. They would want to know what this was about. Oh the plants look good. It spurred conversation among the neighborhood. I went by your garden and yours looks better than mine. What are you doing?” (BH7)

Butterfly Highway t-shirts were also important as a way for participants to engage others in knowledge sharing about the program. One participant said that he wears his Butterfly Highway shirt a lot when he is out at other community events: “I have had people that are out because I wear my shirt they say what is that and I say well the Butterfly Highway means that this thing is big. Way bigger than this shirt. This thing is going to go across the United States and they say oh I want to be a part! and there were black people, mainly women who asked me about and wanted to know how to be a part of it.” (BH16)

In a conversation about how the Butterfly Highway impacts their community one participant said: “It gets community members involved and together and talking and that spreads up and down through generations. Maybe one person in the family participates and they go and tell their grandparents and their children about it. Spreading and creeping in to people's minds slowly and getting people thinking about and trying something new.” (BH5)

The Butterfly Highway has given participants new tools to engage their community with. One neighborhood leader explained how the Butterfly Highway has impacted the community: “It’s given me another avenue to engage in our community.

Another avenue to beautify our community. It has attached us and aligned us with different resources that may be able to further than effort. I think it has done a great deal in that regard to opening other doors and potential positive change." (BH3)

The Butterfly Highway has helped to build relationships between seniors and younger members of the community. A younger participant in the project said: "I think that is what I like about it so much. because 'Jane' we talk more now. Because I went over and planted all of hers (flowers). And she is older and she helped a little bit but I pretty much planted everything. But now we have something to talk about and we talk about other things now life and stuff like that." (BH2)

Another participant became engaged in wildlife habitat conservation through his experience with the Butterfly Highway. He felt that it gave him knowledge to share with his neighbors. He said: "One particular experience is centered around education that helped me to become a Certified Wildlife Habitat Steward. And it equipped me with tools to help other people to identify with things on their particular properties that would serve wildlife from a positive stand point of view. It also helped me to understand about invasive plantings that are negative and beneficial to properties and to the community." (BH17)

Neighborhood social capital

Many Butterfly Highway participants saw participation in the initiative as a positive way to bring their community together by building a coalition of people that had similar interests. A neighborhood leader shared his expectations of participating in the Butterfly Highway: "My expectations were that I would be part of a community of other

people that were like minded in this way. That saw the benefits that saw potential impact of bringing the community together. Having something in common." (BH3)

During the garden installation phase in 2015, Dr. Sorensen accompanied me to install four gardens in one of the participant neighborhoods. All of the gardens were located on the same street, three of which were in close proximity to each other. We invited each of the participants to join us in helping to install their neighbor's gardens. This led to an impromptu street party that brought together neighbors that admitted they do not socialize with each other on a regular basis. I interviewed two participants that were a part of the planting that day and both talked about how they now check in with their other neighbors and help with their gardens. This created new opportunities for neighborliness between neighbors. One participant said about her new interactions with her neighbors: "Yea 'Sam' mostly, and occasionally the lady up the street. Sometimes I talk to the youngest sister that lives here." (BH16)

The other participant that was a part of the planting shared this reflection about that day: "I enjoyed that every opportunity that I was a part of in implementing and establishing the Butterfly Highway was kind of like a family reunion where we had so many people coming together. And sometimes it wasn't that many people but if it was just 2 or 3 people it brought about a sense of family a sense of love a sense of care." (BH17)

The Butterfly Highway provided an opportunity for neighborhood residents to participate in a project that was non-confrontational and was not based on power dynamics in the community. Power imbalance and avoidance of confrontation are reasons

that keep some participants from getting more involved in their neighborhood or community. One participant shared this reflection about power and why he got involved in the Butterfly Highway but stays away from other types of activities: “I don't go to a whole lot of meetings, because some leaders are here and they are untouchable. And I feel like if you are untouchable, you don't have any business trying to be in a leading position that represents a neighborhood or people.” (BH16)

When discussing neighborhood participation, neighborhood leaders are frustrated at the lack of participation from renters in their community. These observations were recorded during visits to neighborhood meetings and other community events. When asked during an interview if renters were welcome at neighborhood meetings and if they were made to feel a part of the community one participant responded: “our neighborhood, we leave it open if they are willing to join. If you stay here you are part of the neighborhood. We want you to take care of the property just as much as the homeowner.” (BH7)

The Butterfly Highway can be a way to bridge the social capital gap between renters and homeowners in communities. One participant said: “I actually own a rental property here in the Druid Hills community and live in a property here. And the person that I rent my home to is very happy to have a butterfly garden in their yard and I am working with them to understand the meaning and overall purpose of that garden.” (BH17)

Capacity

The Butterfly Highway provided opportunities to create and build capacity within neighborhoods, the community, and between Butterfly Highway Participants and Government Professionals. This section explores capacity outcomes of the Butterfly Highway through the sub themes of empowerment, trust, local knowledge, and sense of place.

Empowerment is a mechanism that enables communities to gain control over their affairs (Paul Florin & Wandersman, 1990). It is expected that participation in citizen science can empower participants because they are able to contribute to resource management decisions and the data is collected by the people that are most likely to be affected by those decisions (Dickinson et al., 2012). Participants said that the Butterfly Highway made them feel empowered to make changes and take action. One participant said she felt empowered by being a part of the Butterfly Highway: “Meeting good people who are genuinely interested in my neighborhood. The fact that it brought my attention to the fact that in a lot of the meetings about the neighborhood we talk about crime, but let's talk about beautification. But to actually do it. You brought that to my attention too. We need to do all of it.” (BH19)

One neighborhood leader said that participation in the Butterfly Highway has changed how he feels about his neighborhood’s capacity for change. “We have potential and we can do a lot more. we can make it better than it is.” (BH7) Another neighborhood leader said they feel empowered by the PAR process: “The way you do things is

empowering. You know that is what I said when I talked to Dr. Sorensen initially." (BH17)

I asked another neighborhood leader about how he thought the Butterfly Highway has impacted his neighborhood: "I think it is a positive thing and it is a beautification thing and I think it is going back to that conversation about layers. It's a small thing that just helps to add something positive as opposed to something negative or something that takes away or brings a bad reputation to the neighborhood. This is something positive, this is something good. Who doesn't like butterflies?" (BH18)

Two Butterfly Highway participants told stories during their interviews about bad experiences with organizations from outside the community. While this may hinder them from engaging with those organizations in the future, it also empowered them to be able to say, thanks but no thanks to future opportunities that don't fit with the needs of the neighborhood (BH3, BH17). Another participant had a similar experience writing a grant with an outside organization. Their experience with working with the Butterfly Highway and the use of engagement through PAR methods, empowered them to question if the grant opportunity was a good fit for their neighborhood or if they should pass on it. Previously they felt they should say yes even if the opportunity wasn't a good fit because they didn't want to lose out on future opportunities.

Butterfly Highway participants were empowered by university involvement in their neighborhoods. One participant said: "If the university felt that this neighborhood would have those things that would be beneficial to their study, obviously, it would make you feel a sense of pride in the betterment of your neighborhood." Personal contact and

engagement with a scientist or expert is cited as a motivation for participants to join an environmental education program (Evans et al., 2005). This can empower citizens to feel like important partners in the research process. It can also impact the power differential between researcher and scientist. One participant mentioned that the involvement of the university in his neighborhood for a project meant that it increased their status and was something worth being a part of: “One of the things is people would ask, what is it all about. So, it made you feel like you were a little scientific. well in conjunction with the college. It gave you a little bit of a statue that, are you a retired scientist?”

Urban greening can create a sense of accomplishment for participants who actively engaged in the process. This can also result in a feeling of personal empowerment and connection to others (Westphal, 2003). Butterfly Highway Participants said that being a part of the project helped to increase pride in their neighborhood. One participant expressed how being a participant made them feel: “It does make you feel proud because you keep your garden up, and keep your little sign posted so it makes you feel proud to be a member of the Butterfly Highway”. (BH14)

Participants were empowered by being called citizen scientists. When asked to reflect on the name “citizen scientist” one participant said: “I think being a citizen scientist is pretty cool. It embodies being a participant of what's going on around you in your community and your neighborhood. Really paying attention to understand some of the opportunities and challenges of how to make it better. So, that's a good thing.” (BH3)

Sense of place and beautification

Beautification can impact both social and environmental sustainability. From a social perspective, it can provide opportunities for community members to come together over a joint project. This project can also bring about increased pride in the neighborhood and strengthen a participant's sense of place. When asked about the Butterfly Highway and beautification one participant responded: "I think it is a positive thing and it is a beautification thing and I think it is going back to that conversation about layers. It's a small thing that just helps to add something positive as opposed to something negative or something that takes away or brings a bad reputation to the neighborhood. This is something positive, this is something good. Who doesn't like butterflies?"

Putting a "frame" around wild areas can improve community perception of the space and show it as being something done intentionally instead of being perceived as a wild area that is uncared for (Nassauer, 1995). Orderly frames can provide cultural and social cues of care and pride instead of disorder and lack of respect. Butterfly Highway participants said things such as edging, trimming, and neatness provide cues that a person cares for their yard. Based on this feedback from the community, the concept of framing was used in the Butterfly Highway. A box was used of to frame the native wildflowers and participants were given a sign to place in or near the box to identify the space as something that was intentional instead of neglected.

Participation in the Butterfly Highway has also influenced the way one participant looks at beautification regarding their residential yard: "Let me tell you what it used to be. To have a nice green grass. I didn't care what kind of grass it was but nice green

grass. Cut and it might have some flowers but neatly cut grass. Nicely trimmed trees. but now I kind of look at, and I am still kind of going through this learning process, reacclimating process trying to get the native plants in the yard and again the Butterfly Highway garden has been a real eye opener with that. I am leaning towards now doing away with grass and put some native plants out and let them do their thing. That will save me some work. And save the environment without all of the gas from cutting lawns."

Beautification by outside organizations can also jeopardize sustainability in a neighborhood. There was an opportunity to bring a Butterfly Highway and a public art project to a neighborhood park located within one of the partner neighborhoods. Neighborhood residents were invited to an informational meeting about the project. The project was well received and all 10 participants in the meeting left in support of the project. Unfortunately, the neighborhood president was unable to attend the meeting and decided that the association would not support the project without a vote that they were involved in. The first meeting to vote was snowed out and subsequent meetings have not been convenient for a vote to happen. There was quite a bit of back and forth between the residents who supported the project and the president, some of which was a bit confrontational at times. The project still has not been given support by the association and is now on hold as it cannot go forward without it. Since the proposed project would be on MCPR property, they will not support it without neighborhood support. It would be difficult to drop the project as significant amounts of time and money had been invested in the process. But as has been discussed earlier regarding neighborhood trust of outside organizations, if we move forward without neighborhood support, we will risk breaking the trust of that neighborhood and its residents for future projects.

Connection to nature

The term “extinction of experience” is often used to describe the reduction in the ways people experience and interact with nature (Soga & Gaston, 2016). This not only impacts health and well-being but can impact behavior towards the environment effectively creating a disaffection towards nature. When people are exposed to nature, they have a stronger desire to protect it (Dunn et al., 2006). This highlights a critical need for reconnecting people with nature through education and experiential learning opportunities.

There were also opportunities for participants to share knowledge with each other. One participant shared how he shared knowledge with his neighbors: “I had some individuals who were participants in the Butterfly Highway initiative that talked about well my flowers when they were put in they were dying. And everything in my garden has died. And I had to reassure them that when spring comes again and summer comes again that your Butterfly Highway will be in full bloom and springing forth with beauty and will be plentiful in terms of butterflies and other pollinators. And that became a reality and a truth. And I think people, that for me to share that with them gave them a measure of hope and to know that I wasn't just blowing smoke. And I was intentional about going to some yards and pulling weeds with people to help them understand that this is a flower, this is not a weed. This is going to bloom so do not pull that up.” (BH17)

Cultural heritage is deeply connected with ecosystems and landscapes that remind us of our roots (de Groot & Ramakrishnan, 2005). These connections help provide a sense of place within the natural world. A majority of the Butterfly Highway participants

that were interviewed said that they grew up with a connection to gardening or farming. As more and more children are raised in urban environments, this connection to the land is being lost. One participant reflected on growing up as a cotton sharecropper and how her children didn't know what cotton was so she had to take them out to a farm and teach them (BH13).

Participants said that the Butterfly Highway gave them a new reason to go outside and observe nature. One participant said about their experience with the Butterfly Highway: "This was totally new to me. And it was a new experience to see which plants the butterflies liked most. I just enjoyed it." (BH1) When asked what he enjoyed most about participation in the Butterfly Highway, one participant responded, "And just in the end, interacting with individuals that are involved in preserving nature and saving the species of birds. Learning about different snakes. It has been real eye opening and something I want to be a part of going forward." (BH7)

Environmental literacy

Participants said that being a part of the Butterfly Highway helped them better understand the connection between pollinators and plants. One participant described what they learned through being a part of the Butterfly Highway: "Just meeting you and learning a whole lot more. I mean before I met you, I didn't know about native plants. And pollinators. I had heard about pollination because even in our garden some of the gardeners that come in say, you need to put a sunflower there. So it will attract the bees and help pollinate. But I didn't understand the reason behind getting native plants." (BH2)

Participation in the Butterfly Highway has opened the door to more learning opportunities for participants. A participant said: “I think that my engagement and working with the butterfly highway has been instrumental in increasing my awareness and layering that and I have been afforded the opportunity to continue education as it relates to certain pollinators and soil types and testing soils and creating certain wildlife habitats.” (BH17)

Native plant habitats

Prior to the Butterfly Highway, native plants were present in only three out of the 51 locations where Butterfly Highway gardens were installed. While participants were not specifically asked about their opinion of native plants during the interviews, observations and interactions with participants during follow up visits to their garden yielded numerous positive comments regarding the color, bloom, and ease of care of the native plants.

A participant said about the impact of native plants in her neighborhood: “It’s bringing butterflies back to the neighborhood. Because they don't just stay in my yard even though some of the older people up further they don't have the Butterfly Highway but now they are saying, you know I saw that white butterfly in my yard because they have other kinds of flowers so now they are relating to the flower and the butterfly because we talk about it.” (BH1)

Behavior change

Gardening is one of the principal ways Americans experience nature, yet gardening also has a significant negative impact on the environment (Clayton, 2007).

Participants were motivated to join the Butterfly Highway by a desire to beautify their personal yard as well as their neighborhood. Several participants admitted to using negative environmental practices such as using pre-emergent “weed and feed” on the lawns which prohibits growth of broad leafed plants such as clover while at the same time providing fertilizer for grass. One participant said that knowledge gained through participation in the Butterfly Highway has influenced him to discontinue this practice and that he will look for more environmental and pollinator friendly ways to manage his grass. “I did that last year in the back. I had almost a field of clover. So I went back and sprayed it. that was just lack of knowledge. If I wasn't sitting here talking to you and you hadn't said that I would have looked out there and said, oh need to go get some weed and feed. I think we are having some of the problems now because as man we try and change the environment that we thought would suit our purposes better and we found out down the road that it doesn't.” (BH9)

Participants have also changed their behavior towards pollinators. One participant said he would always try and kill bees when he saw them but that has changed: “I look at it now and I see the Bumblebee, the bees. I used to just like, WHAP. But then I think about man, they are going extinct so I am going to let them live. and fly from this flower to that flower. To that flower. So it's learning.” (BH15)

Summary of community outcomes findings:

- Participation in the Butterfly Highway increased social capital on an individual, neighborhood, and community scale. Drivers of increased social capacity were new opportunities to connect with neighbors and others in the community that shared a similar interest.

- Participation in the Butterfly Highway increased capacity at the personal, neighborhood, and community scale. Pride, sense of accomplishment, and partnerships were the major contributors to increased capacity.
- The Butterfly Highway produced environmental outcomes at the personal, neighborhood, and community scale. Individuals experienced a reconnection with nature and increased environmental literacy. Neighborhoods and the community increased habitat for wildlife and pollinators.

Government Professional Participants

Government agencies in the Charlotte metropolitan area participated in the Butterfly Highway through hosting Butterfly Highway gardens in parks, recreation centers, and other public spaces. Recreation and nature centers also offered programming around the Butterfly Highway.

The Butterfly Highway is an initiative that was designed to have a social impact for communities as well as an environmental impact for pollinators and wildlife. When I decided to interview Government professionals as a part of my dissertation, the original intention was to explore the environmental impact of the Butterfly Highway through their programs. During the interviews, I learned that the Butterfly Highway provided a strong social impact to the programs run by municipalities through recreation and community engagement. In addition to collecting data about programming and engagement, interviews with Butterfly Highway neighborhood participants brought to light questions that only Government Professionals could answer.

This section describes the results collected to answer how Government Professionals interacted with the social and environmental systems impacted by the Butterfly Highway. Interview questions from Butterfly Highway participants as well as their responses guided the development of the Government Professional interview questions. Data was collected in 17 interviews with government employees during November and December 2016. Government professionals interviewed work for city and county governments as well as park and recreation departments. Interview questions are located in the Appendix. The Government Professionals interviewed broadly work in two categories. Those involved in education and engagement, and those who work in facilities and operations.

Table 13 is a summary of themes identified in the literature that were used to code these results. Table 14 presents a quantitative summary of key results.

Variable	Themes Identified Through Literature Review	Additional Organic themes	Literature cited
Participation outcomes for government professionals	Public engagement Ecosystem services Trust Adaptive management	Connection to nature Recreation opportunities	(Abercrombie et al., 2008; Agyeman & Angus, 2003; Bolund & Hunhammar, 1999; de la Barrera et al., 2016; Fraser et al., 2006; Gobster, 1998; Light, 2003; Miller, 2008; Miller & Hobbs, 2002; Peterson et al., 2012; Wratten et al., 2012)

Table 13. Government professional outcomes theme, sub themes, responses themes, literature cited.

Government Professional outcome theme	Responses
Break organizational silos	16
Program opportunities	12
Build community trust	6
Increase urban ecosystem services	5

Table 14. Government professional outcome theme and responses.

Ecosystem Services

Government Professionals that work in natural resources and operations perform work that directly or indirectly impacts ecosystem services. Departments in these groups include nature preserves, horticulture, and planning. The interview questions did not specifically address how their work with the Butterfly Highway impacted ecosystem services, in part because concepts around ecosystem services are not still not widely used outside of academic circles. However, several questions about the impacts of the Butterfly Highway led to discussions about ecosystem services. The primary research methods in this study are qualitative in nature therefore, data on ecosystem service impacts is based on perception and has not been quantitatively measured.

Ecosystem services can be managed through multiple organizations within a city or county government. Government stakeholders in this may be Soil and Water Conservation districts, Storm Water Services, Natural Resources, or facilities and operations. Planners can also serve a role in this when planning green infrastructure such as new parks or facilities to include more native plants (Bolund & Hunhammar, 1999).

When new parks and recreation facilities are built, natural landscapes are often destroyed and require mitigation plantings after grading and infrastructure are completed. A new recreation facility that was built in Charlotte required that more trees be removed than was desired to accommodate a baseball field. A pilot project with MCPR, TreesCharlotte, and the Butterfly Highway was launched to create a no mow area for reforestation and pollinator habitat along the edges of the park to mitigate the tree loss. A 5-acre area of the site was identified for reforestation and the area was seeded with a mix of native grasses and flowering plants that would be beneficial to pollinators. This area would have normally been planted with a mix of fescue grass, Bermuda grass, and lespedeza which is the industry standard for reestablishing vegetation after construction. This mix has no value to wildlife and does not provide the same root structure to hold soil in place that the native grass and flowers do. The trees will be planted this spring after the project is completed. This pilot is an example of the long term impact that the Butterfly Highway can have on projects and if successful will serve as a model for future projects.

I interviewed a member of the Southview Project team about why they wanted to involve the Butterfly Highway in the project. “It was when I went out there and they started clearing and grubbing everything and I got visions of working on a subdivision again basically back in the private sector. And I was just like, I am not on that side anymore. There was a beautiful oak out there and it needed to come down. What that (the community recreation park) is doing is so much better than what that oak was doing for that community. But I was still sad for the hawk that kept circling over me. When I learned about this (Butterfly Highway) I was already talking to TreesCharlotte and it just seemed like a good fit for something. An amenity that masqueraded so much.” (GP7)

In addition to the Southview Park project, there are Butterfly Highway gardens in MCPR spaces across the county including the formal gardens at Romare Bearden and First Ward Parks in uptown Charlotte. These more formal spaces serve as demonstration gardens and include most of the same plants used in the residential Butterfly Highway gardens. While these gardens serve as an important bridge to the community part of the Butterfly Highway initiative, they also serve to mitigate urban pressures on ecosystem services. “We have butterfly highway gardens all through the park system now. And specifically, in Romare Bearden Park and now at First Ward Park as of today, and they are doing really well. At Romare we have four different areas that have butterfly gardens in them. And the plants are growing and doing well and spreading.” (GP1)

One way to create ecosystem services is through increasing the plant diversity by the addition of native pollinator supporting plants. “So, it creates a really diverse space because you have got all of these different layers between the trees and the shrubs and now we are adding the herbaceous layer with the butterfly plants that are mostly perennials. So, we are adding a whole new layer for the ecology in the environment.” (GP1)

There is a strong conflict in urban spaces between manicured and wild landscapes (Im, 1984). Manicured landscapes are often preferred by people, but they are also the landscape types that contribute the most to environmental degradation because of the need for mowing, trimming, fertilizers, and pesticides. Non-native and often invasive plants are also primary components in these types of landscapes. In parks, turf grass is treated with a “weed and feed” and other pre-emergent chemicals to keep the lawns green and weed free. In MCPR parks. all planted areas that are not grass are 98% organic. This

practice can help mitigate the impact of turf grass treatment. Pollinators benefit from the reduction of chemical pesticides. The Butterfly Highway has supported this by helping to provide the right plants for the right place in parks. “Having the time and the resources to get things going organically it really is a better method I think and more economic in the long run. Once you have the systems in place, the beneficial insects and the good soil and all of those things. If you use the right kind of plants in the right places, then the ecosystem takes care of itself.” (GP1)

Several interview participants worked in the private sector prior to becoming government employees. They offered a unique perspective on the differences between how each entity operates. “The private industry is for profit so they want to get in and out as quickly as possible for the least amount money. And usually that includes chemicals whether that is insecticides, fungicides, herbicides, all of those things are used a lot. There are some companies that do try to do things organically. But on the commercial side I didn't see anybody. I think they were focused mostly on residential. And commercial is pretty much the landscape companies across this area pretty much do the same thing because they are competing with each other. If that's the cheapest way and the way that they know, it is hard to change.” (GP1)

Conservation plans are ways for municipalities to prioritize conservation and include biodiversity conservation and ecosystem service remediation in a working document. The Butterfly Highway has been included in conservations plans and can also serve as model for municipalities that don’t have one in place to get started. “The Butterfly Highway gives a good model for others who don't have a conservation plan like

I was doing but might get them jump started. But maybe we don't have one but we want to do something smaller. (GP5)

"We just had an ordinance change that was actually part of the mayor's monarch pledge which all goes hand-in-hand with the Butterfly Highway where we've increased the percent native plants have to be planted as part of our landscape ordinance We didn't even have one. In all categories. 50 percent of the trees you plant 50 percent of the shrubs 50 percent of the groundcover have to be native plants." (GP4)

I have also worked with several members of the Keep Charlotte Beautiful program on Butterfly Highway garden installations. Because of engagement with the Butterfly Highway, a board member for the Keep Charlotte Beautiful program told me that they are now investigating ways to include native plants in their grant requirements.

Neighborhoods that partner with the Butterfly Highway on projects may be perceived as being more credible than others when applying for grants. "I think there being a name and a brand and even a website gives those review team members, that's other resources for them to really see the legitimacy of the project and the idea." (GP13)

Pollination ecosystem services provided by managed honeybees and native bumblebees and butterflies are critical to maintaining biological diversity as well as agriculture services necessary for our food systems (Wratten et al., 2012). Increasing flowering plant diversity not only benefits pollinators but it also can reduce soil erosion and surface water runoff, increase land value, improve water quality, and support wildlife conservation. "I know the city is looking at changing some best management practices and things like that with building and grounds and parks. If we do build other city

facilities, how do we help and plant the plants and the gardens and have better uses of space. Butterfly gardens and native species would allow for more pollinators and butterflies. Generally, the government is how fast and how cheap we can do it as to not negatively impact the taxes. And not always think about the green side of it. What are the other impacts of things we can do or incorporate since we are already there and going to spend that money is there other ways and better opportunities to use it?" (GP6)

The Butterfly Highway also had an impact on beautification in public parks. "Well the plants have really pretty flowers on them. They mostly have a longer flowering time and a wider range so pollinator plants that are used in the butterfly highway start flowering in the spring and then the asters and the goldenrod are flowering all through the fall up until the frost. So we create a space where we have flowers all the time and them being native and things that you see growing in fields and other places I think that when people see them they recognize that and it is a little therapeutic and it reminds them of a plant they saw in a field as a little kid. So it's not just all cultivated plants that have been hand selected and cloned to have the biggest impact. They are more natural looking and they don't look like mutants with gigantic flowers and things like that. I think that definitely has a positive impact on the beauty of the spaces."

Through the Partnerships for Stronger Neighborhoods program, the City of Concord has awarded grants to five neighborhoods for Butterfly Highway garden installations through their neighborhood block grant program. The Concord Wildlife Alliance (a chapter of NCWF) has worked with one neighborhood to help them plan the garden space to best support wildlife. These partnerships have helped neighborhoods with

capacity to get beautification grants as well as longer term support and education from the city and a local environmental organization.

Public engagement

Public participation and engagement was discussed in every Government Professionals interview. Most feel that they do an adequate job of public engagement and providing volunteer opportunities for community members. One of the most effective methods of engagement is a Neighborhood Leadership Council. Most municipal departments use social media and email to recruit participants and volunteers. Several professionals still feel that they struggle with reaching their intended audience and that more could be done to reach out to the community. The two sub-themes addressed in this section are civic environmentalism and public engagement.

Government Professionals were asked to state the mission of their organization in their own words. Almost every response included that their mission was to serve the public. While I found that is indeed the case, there are limited ways for the public to be fully engaged in the process from plan conception to completion. Most of the barriers to participation are a result of professional bias based on their own knowledge of process.

Both the cities of Charlotte and Concord have programs to engage city staff directly with neighborhoods and communities. In Charlotte, the program is part of Neighborhood and Business services, with staff members assigned as liaisons to different zones within the city. In Concord, the model is slightly different and city staff volunteer to be neighborhood liaisons through a program called Partnerships for Stronger neighborhoods. This program helps to break down barriers between the city and neighborhoods that may

need additional capacity support. Concord neighborhood leaders are also invited to be a part of a Neighborhood Leadership Council that is facilitated by the city. “I think the neighborhood leadership council is incredible because it's a really good way to connect those communities with each other and to keep them connected to us.” (GP4)

Municipal support for environmental programs can help inspire social contagion in neighborhoods. “I feel like that if the community is engaged then they can help educate and inspire even other communities. So, you get one going and you inspire them and they do something beautiful and cool that unites their community and they can help spread that information and help others.” (GP4)

It can also bridge a connection between the work they are doing from a top down level to what communities do from the grassroots level. “It connects home with your government. It's a beautiful bridge. I mean it's like we have something in common, it's not just us and them. It's another way to connect the dots”. (GP4)

Programs such as the Neighborhood Leadership Council are ways for community members to have a voice in policy making. “We have citizens who are now coming up to our elected officials and saying hey these are some of the things that we want. We care about wildlife we want and we want to see this that happen. What's important to citizens is important to us.” (GP4)

Civic environmentalism is a policy framework to support local collaborative decision-making process to address environmental concerns. These results provide support to the civic environmentalism framework (Agyeman & Angus, 2003; Light, 2003; Svendsen & Campbell, 2008). When the top-down organizations such as city governments

intentionally engage communities at a local level to provide more opportunities for citizens to become engaged in the environmental decision making process.

I was invited to give a presentation on the Butterfly Highway initiative to Charlotte Neighborhood and Business Services staff. They contacted me because leaders from the Butterfly Highway neighborhoods are also active in advocacy for their neighborhoods with the city and the initiative had come up several times in conversation. Neighborhood and Business Services has discussed offering a program for neighborhoods on beautification with native plants. The idea for this program was a direct result of my presentation.

The Partnerships for Stronger Neighborhoods program in Concord, was put in place to help underserved neighborhoods build capacity and have a direct line to the City of Concord to connect with opportunities and services. Staff serve the program as volunteers and many have worked with the same neighborhood for 10 or more years. Government Professionals that participate in the program feel that the program has helped to create equity within neighborhoods that were facing increasing stresses such as crime and poverty. Through this program, five neighborhoods have written grants to the city of Concord to install Butterfly Highway gardens in their neighborhoods.

“The original intent of the program was to build community and reduce crime in neighborhoods that didn't already have an HOA way. So, some of our older inner city type neighborhoods that weren't already formally organized. the program helps establish leadership in those neighborhoods. The president and a board. And it's pretty big and it's a very successful program and we have a grant program for those neighborhoods as an

incentive. We also have each one of the neighborhoods that is participating gets a city staff person that is a liaison for that person for that neighborhood. sometimes people feel that government can be red tapey to kind of you know even if they have to report that their garbage got missed. They don't always know who to call. How to handle it. Even if the issue is bigger like how to address this. And so they have one person that they call that helps them figure out where to go to as part of this program and through this program we have been able we have a regular newsletter that goes out we have leadership meetings among the leadership. It's a Leadership Council they all come together." (GP6)

How municipalities communicate opportunities for engagement can either promote or be a barrier to participation. Cities have used online resources to inform community members about opportunities to participate in city programs that include social media platforms such as Facebook and Instagram. Both Concord and Charlotte use www.nextdoor.com. "And it's really caught on. people seem to really be plugged in to what's going on Next Door. Even folks who are not into Facebook we found are really using Next Noor. What's also really great is that people can communicate with us." (GP4) Neighborwoods and Keep Charlotte Beautiful opportunities are regularly posted on Next Door by staff. It was suggested that this could be another avenue for communicating Butterfly Highway opportunities.

Volunteers

MCPR has numerous opportunities to engage the public as volunteers but most of the opportunities are centered around recreation centers. All of the sports program coaches are volunteer positions. Within the parks and natural resources, opportunities are

more limited. People can volunteer to be park ambassadors, or a neighborhood group can support a neighborhood park. MCPR also offers the Master Naturalist program to train volunteers to become certified naturalists.

Master Naturalist volunteers have supported the Butterfly Highway in a number of ways. “We've gathered milkweed seeds together with volunteers, we've had volunteers building the actual (Butterfly Highway) boxes, we have had volunteers weeding along the Butterfly Highway and serving as spokes people and garden hosts. That liaison between the butterflies and the people. They have served as that bridge so I do think the Butterfly Highway is a way to get people more engaged. They are going places in our community they have never been and that highway has opened that door for them. I had maybe been to two rec centers before the project. So, for myself after 11 years with park and rec my eyes were opened. I think I went to every one. And the senior centers, I drove by them but never went in. I never engaged with the seniors themselves. And it brought volunteers out and they then had that connection and reason to go to the senior center and give a presentation.” (GP9)

In addition to creating a pool of trained volunteers, MCPR pays for staff to attend the Master Naturalist training. This is a large commitment of time for a department, but it also provides access to new resources and knowledge that can be used on the job. Especially for those who do programing at recreation centers. The Butterfly Highway is a partner program for the Master Naturalist program. I serve as an instructor and train participants on creating and using Butterfly Highway pollinator habitats.

Community members help manage and maintain habitat through volunteering in the parks and recreation centers. This is something the park staff wants to encourage to help bring a sense of public ownership. Volunteering in the parks "gives them a sense of ownership to some of the parks. So they will be more apt to say something to somebody if they see someone disrespecting the property. I think that's the key. And it can be a win win. Park and Rec Horticulture team get the benefit of having people out there that help protect the space and the community members that do come out and volunteer with us have a sense of ownership of the space. So, we get more cooperation and help in keeping the places safe." (GP2)

Butterfly Highway signs placed in public spaces have created opportunities for staff to engage with the public about wildlife and pollinators. "We do put signs up in the parks in the gardens so I have had people ask me about it. What is this butterfly highway that you have a sign for down there? That is helping spread the word." (GP1)

There were 17 MCPR Senior and Recreation centers that hosted Butterfly Highway gardens. This was done in partnership with the MCPR leadership program and raised beds were installed during summer 2015. The gardens had mixed success and several centers removed the native plants and used the beds for vegetable gardens instead. Installation was done with Master Naturalists and members of the leadership project team. Minimal to no education was done with center staff about the plants or how to care for the gardens. I feel this is the main reason that the gardens were not successful.

"Their opinion is the rec centers really don't take care of them like they promised they would have. There I think is the next move on this somehow. I did see another last

week, I saw a pollinator garden at one of the rec centers and everything seemed to have drooped over. And the place it is, I didn't think that was appropriate. So I think we got to be a little careful. It doesn't mean we shouldn't do them but where are we going to site them so it doesn't look so unsightly as it did that day I saw it." (GP2)

Connecting with volunteers for programs can be a challenge. It is often a matter of knowing the network of people in the community who are interested in environmental programs. "It is mostly posting volunteer days as a part of our programs. Come do this and let's talk more. Just interconnected networking. Knowing 'Jane' and the pollinator group. And then CWA. And just talking with them and saying if you want to participate, you are welcome to come out, these are our designated volunteer days. If you want to do something more, I Can do something more for you. we have Eagle Scouts, and American Heritage girls and Girl Scouts that come out to do special projects on their monthly meeting. And that is mostly just removing invasive species but so I try and offer. I have structured ones for people that need structured, I have ones for ok you want to come do something special I am here for you just give me the word." (GP5)

Recreation centers that host Butterfly Highway gardens connect to neighborhood participants because of a shared interest. "I think it shows them that we are also part of the community. So, if someone from the neighborhood is like oh I am part of the butterfly highway and they see the sign, oh you are part of the butterfly highway too. That's great. I think it shows there is a commonality, an interest, it shows hey they are doing something other than just basketball. They are doing something more." (GP3)

“It connects home with your government. It's a beautiful bridge. I mean it's like we have something in common and it's not now it's not just us and them. It's another way to connect the dots.” (GP4)

The Butterfly Highway project has created new opportunities for change at all levels of county and city government. One of the most recent opportunities is the Mayor of Charlotte, Jennifer Roberts, took the NWF Mayor’s Monarch Pledge. As a part of this pledge, a Butterfly Highway garden will be planted at City Hall and Mayor Roberts will issue a public proclamation regarding the pledge. The city has agreed to work towards implementing other opportunities to protect pollinators such as ordinances about native plants and pesticide use. These outcomes are not realized yet but prior to the Butterfly Highway, they were not even under consideration.

Adaptive management and organizational capacity

Organizations that partner with the Butterfly Highway see it as a way to give them additional capacity and credibility with organizations and within the community. “By partnering with organizations, you are looked at as an expert in this particular area. So, we can say hey we have worked with the experts and look at what we have done. It gives some credibility to what we are doing and hopefully gives us some pull in a lot of different ways. Maybe future labor, maybe future nature preserves. Even maybe an extra $2000 in the budget.” (GP5)

Having designations such as being on the Butterfly Highway or a Certified Wildlife Habitat can increase the prestige of a park. “So, I look at a park and say it is a certified nature and wildlife park. That's good but I don't think a lot of people put a whole

lot of credit to that sometimes because they are looking at a such a big space. But now this is designated butterfly, pollinator, wildflowers. More of a specific niche where people trust that this is good habitat. Instead of just this is a good park." (GP5)

With the Butterfly Highway project being based in North Carolina, it is seen as a resource and an asset to help organizations get going with a project in the right way. "With the Butterfly Highway project, you are a local commodity and resource for us. With yours you are here. You are local. We can come to you. That in itself is invaluable. A national program is not really going to worry about what is specific to NC or our geographic portion of NC. With you doing your work here it is more important than the national because it is specifically geared for us here." (GP6)

"I think if the city helps celebrate what we do it will help spur the private sector to do it (The Butterfly Highway) on their own sites. but also, residents will then see that it does provide a benefit and there is a commonality between you seeing landscapes at certain projects or buildings and when people see it, it can create that trend of I would like to do that in my yard. I think the city can get that out there I think residents will pick up on it. The education piece will be there." (GP6)

MCPR recreation and senior centers hosted 17 Butterfly Highway gardens. If a more intentional education component is integrated into the gardens, then staff believe they could serve as a demonstration garden. This could bring more people to centers that might not normally go there and provide an example of what people could do in their home gardens.

"I have seen where people are going to tour butterfly gardens. They have become this educational tourist attraction. I said I would like a tour of recreation center gardens. Like how people tour homes, so how wonderful would it be to have so many tours open to the public where they could come see it. Kind of like what cooperative extension does with the demonstration gardens. You come see how you could do it at your home. They could come to different recreation centers. Maybe one has a larger or a smaller and see what they can adapt and take home to them plant. I think there is a lot of potential that we are not doing. the gardening that is existing in certain recreation centers, people don't know about it unless you are in our programs because they are all program based stuff. During National Pollinator week, we should have a tour of pollinator gardens!" (GP8)

Can the Butterfly Highway serve as a model for other organizations to use in engaging the public with the environment? "The Butterfly Highway, just as all successful projects, takes into account stakeholder groups. When you come in and you do what you want because you think it is the right thing even though you are on the exterior of the community, you walk away and those projects walk away with you. As much as you want to think, oh yay this is going to work it is going to be so great and people are going to benefit. As soon as you leave no one cares what you did or why you did it because you did it for you and your own self-worth. But the Butterfly Highway actually engages all the stakeholders and asks them what they want and involves them in the decision making. Therefore, then they are a part of the team and not just being told what is going to happen." (GP7)

City Council or County Commission support for environmental programs is important to their implementation and success. "Honestly at this current moment I don't feel like I

could be more supported. And personally, as an environmentalist I think it's been really great. And there's also been some real support on council's end. and we have citizens who are now coming up to our elected officials and saying hey these are some of the things that we want. We care about wildlife we want and we want to see this that happen. What's important to citizens is important to us." (GP4)

Involvement with the Butterfly Highway helped government professionals be able to understand better how some community members interact, or don't interact well with nature. "Being in my silo of the nature preserves, people came to the nature centers because they love nature and they wanted to be surrounded by nature. I was bringing nature to the people, and the people don't necessarily like nature. Not all people think that pollinators are beneficial they don't see the benefit of bees. They see them as stinging harmful, painful animals. I was quickly awakened to that. Not only at Sugaw Creek but at Berewick Academy and many others. It was more an educational experience for me than them." (GP9)

The Butterfly Highway also helped build capacity within organizations, such as bridging silos between departments in the same organization. "It's proved to be a a way of breaking down those silos between the division of nature preserves and natural resources and the recreation centers to get that foot in the door and the conversation started about environmental ed and improving nature based programming at recreation centers which for some as you know is completely outside the box. Where it really shouldn't be. it falls into one of those programs that helps to connect children to nature in parts of the organization in the city where you don't traditionally think of as you can have that connection. It has done that."

The Butterfly Highway also helped organizations increase their capacity to help community members reconnect with nature. “It is a chance to expand the education around using that garden as a center piece and creating new curriculum that nature center staff and recreation staff can work together on to facilitate programs from Pre-K all the way to senior citizen programming. Using the butterflies and the garden as a way to get the public excited, schools excited. having those gardens at the recreation centers and using the knowledge that the nature center staff have to increase that comfort level with the natural history and the outdoors I think can be, it has shown and I am hoping it will continue to be a very powerful tool help that partnership grow.” (GP11)

“There was another project that was done here in our office and it was a Knight Cities Project it was called the No Barriers project. I know that one of the things that they did and while it wasn't specific around planting and pollinators is still it still touches it in some way. It was you know lower income communities and they installed bird houses in a park and they got together as a community and they painted them and they put like a glow in the dark roof on them and I don't know if that's probably the best thing to do when you're thinking about birdhouses but you know it was something community building and fun. And they installed them in this park which the park became this area of really breaking down the literal physical barrier between the two communities. But those birds that are going to live there are going to need. The insects that are going to be attracted by the plants that provide the pollen and the nectar. So, I think that there's a lot of places where this fits into.” (GP12)

Several organizations commented on how they wish they could get the same buy in from communities for their programs that the Butterfly Highway does. We talked about

the PAR model of engagement and I asked if this is something their organizations would be willing to invest in. “It's an approach I would have the time and the patience for but I don't know if the higher and highest ups if they can't see that result from the time that is going towards it, is it them deemed worth it? or are they going to say no, you need to go back to whatever aspect of it. because you and I know with educational it can't always be quantified. It draws things out but to be able to reach the people, if you only do it in one or two meetings you didn't really reach everyone.” (GP15)

Connection to nature

Some recreation centers that have Butterfly Highway gardens have used them to creating programming to connect patrons with nature. When asked about how the Butterfly Highway impacts their organization. “The opportunity for education. I think being able to take the kids outside during the summer or any blooming time and them be able to look at all of the butterfly activity has been amazing. Whereas before that garden (Butterfly Highway garden) we did no flowers at all besides what little seasonal flowers I might put in the pots out front. So, that has added a whole habitat that we never had before that because we never grew flowers. And so, it has given the kids an opportunity because we were solely growing vegetables. It has changed what they could see, how we could program and what we could expose them to.” (GP8)

People that are more aware of the environment, are more likely to take actions to protect it. If people are not aware of plants and their function in our ecosystem, it can be challenging to motivate them to protect them. It has been observed that people do not notice plants and that the Butterfly Highway is a way to increase awareness of their

importance. One government professional said: “That's one thing I notice in the park the most is that most people don't notice plants. Walking through the park sometimes it seems like the plants are something that are more in the way than something to appreciate. So, anything we can do to draw attention to them will be good. So, the butterfly highway does that and so in communities where plants are under appreciated.” (GP1)

There are acknowledged barriers to accessing nature in parks. One Government Professional was tasked with creating nature programming for seniors: “We just started Feeder Watch at the Senior centers. They weren't coming out here, they don't come to parks. They go to their senior center. That’s their senior center. And they have a really cool area behind the Concord Senior Center that has all sorts of wildlife. It's like a wooded lot with a trail around it. There is a ton of stuff back there. Foxes, raccoons, mammals. there is a trail cam back there. I asked Theresa, I said give me $200. I will put this really awesome feeder watch system up, it is something they can do without coming to the parks.” (GP5)

Summary of findings

This section presented the findings of the interviews with government professionals. Figure 14 illustrates identified government organization needs (box) and the outcomes for organizations after participation in the Butterfly Highway.

Major findings include:

- The Butterfly Highway provided opportunities to train and educate staff on pollinators, native plants, and sustainable environmental outcomes.

- The Butterfly Highway created new opportunities for staff to engage with the public.
- The Butterfly Highway created opportunities for municipalities to support environmental ecosystem services by creating new habitats for pollinators in urban parks, recreation centers, and natural resource spaces.
- Government Professionals mostly operate in their own silo and do not have opportunities to work and interact with colleagues in the same organization but in different departments. The Butterfly Highway helped to break these silos through inter-department cooperation on projects.

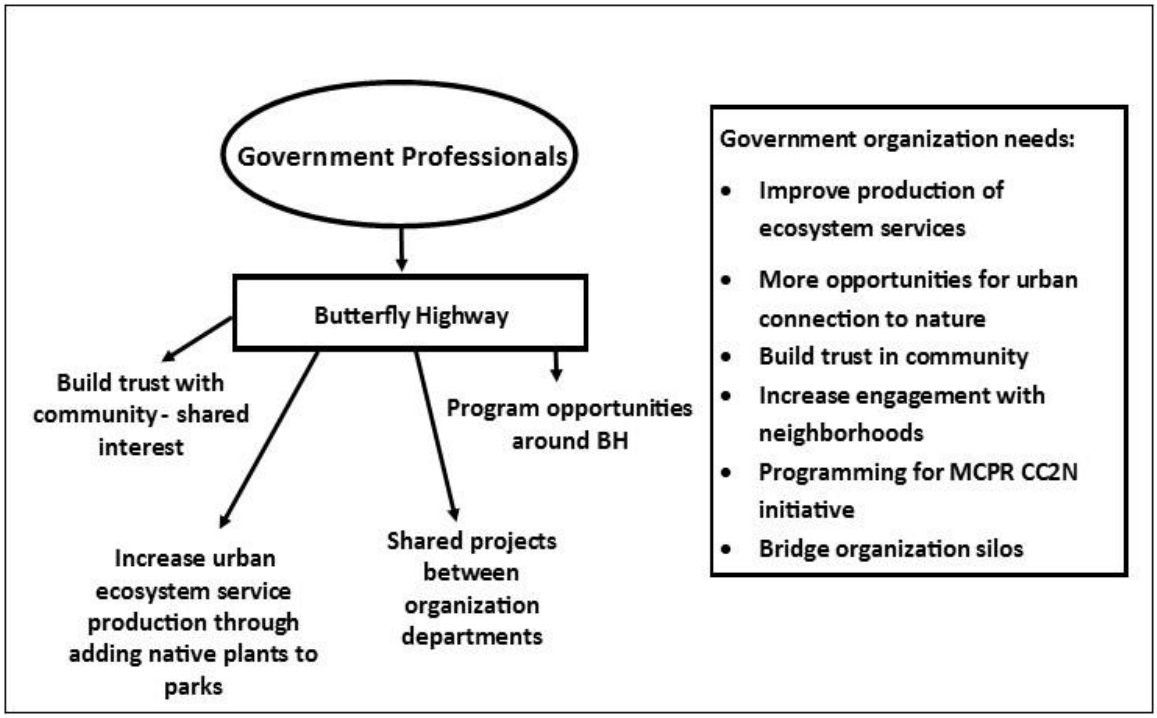

Figure 14. Government organization needs and outcomes after participation in the Butterfly Highway.

4.3 Research question 3. Adaptive Management and Ecological Wisdom

How can a social-environmental intervention contribute to our understanding of an adaptive management planning framework within the theoretical framework of Ecological Wisdom?

Adaptive co-management

Ecological Wisdom includes adaptive management as a way to drive decisions about actions involving the CHANS social-ecological system (Patten, 2016). For systems that involve multiple stakeholders, adaptive co-management is an appropriate management model to use. Adaptive co-management is method of natural resource management that is rooted in the idea of learning by doing. The Butterfly Highway is made of a network of community members, government agencies and professionals, wildlife organizations, and university partners. This network is one of the strengths of the Butterfly Highway and each partner contributes something to the success. The PAR influence creates a perfect opportunity for learning from doing so that the model can adapt and shift as needed.

Figure 16 illustrates the partners in the adaptive co-management network that supports the Butterfly Highway. The Butterfly Highway brings together a diverse set of partners ranging from university departments to government organizations to nonprofit partners. Each partner brings a strength to the partnership that helps to make this a more sustainable model. This network of partners is an important outcome for the community as it can provide support and resources that the community does not have on its own.

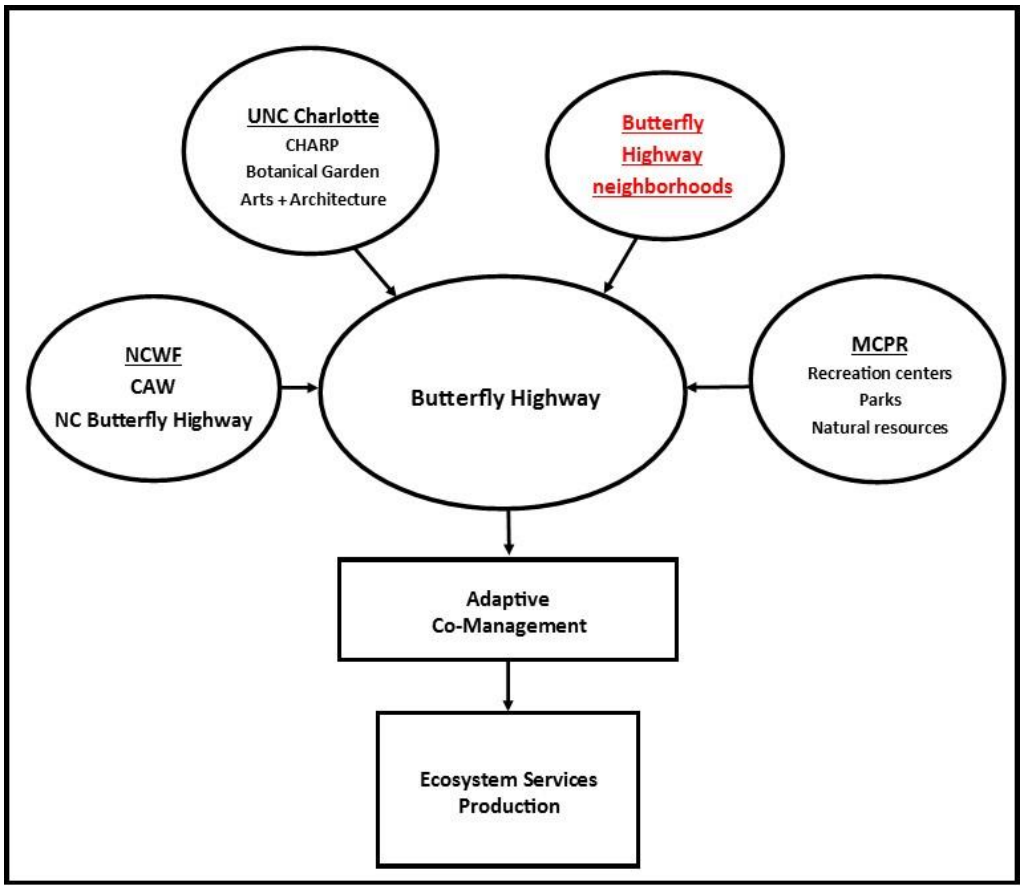

Figure 15. Butterfly Highway adaptive co-management network.

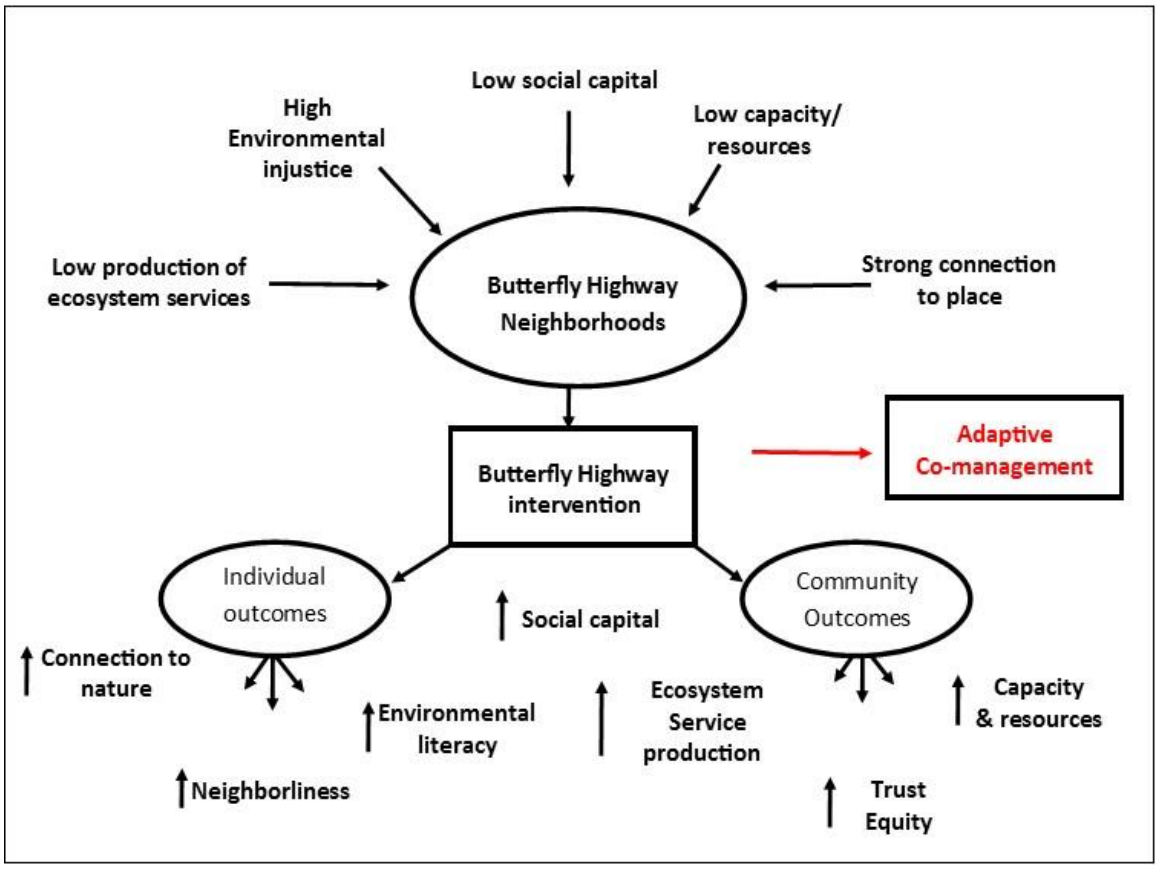

Figure 16. Community inputs before and outcomes after the Butterfly Highway intervention.

Figure 17 shows a summary model of neighborhood inputs and outcomes through their interaction with the Butterfly Highway. Inputs are either internal from within the neighborhood (social capital, connection to place) or external from outside (ecosystem services, environmental justice). Outcomes included those that directly benefited the individual participant and those that benefited the community. Social capital outcomes benefited both the individual and community. Collectively, these outcomes create the community-based input into the adaptive co-management model.

The Butterfly Highway has been successful in creating opportunities for government professionals to interact with social and environmental systems in the community and within their own organizations. These include increased opportunities for environmental education, building organizational social capital, trust building with the community, and increased production of ecosystem services. This relationship is illustrated in Figure 18.

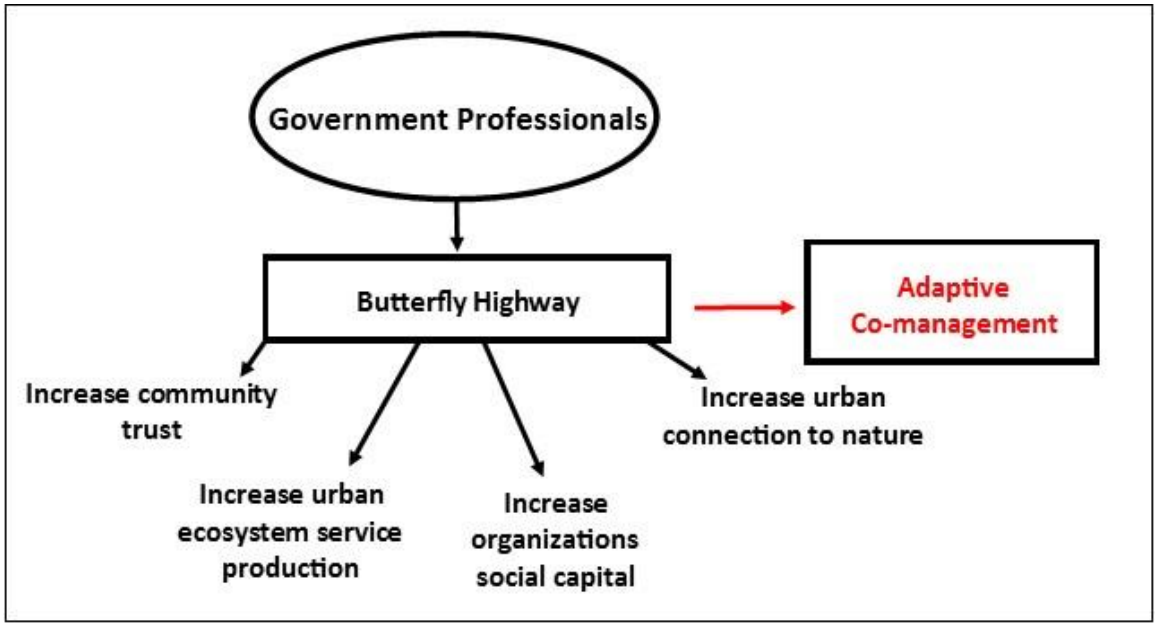

Figure 17. Organizational outcomes from participation in the Butterfly Highway.

CHAPTER 5: DISCUSSION AND FUTURE RESEARCH

The Butterfly Highway has made a significant contribution to Ecological Wisdom research by providing an empirical example of Ecological Wisdom in practice. This is one of the first empirical studies to focus on using the Ecological Wisdom framework which addresses a much needed gap in this developing field. This chapter highlights some of the most significant outcomes of the intervention as well as opportunities for additional research and the future of the Butterfly Highway.

Xiang (2016) believes the challenge comes when human self-interest is in conflict with the natural world. The hope is that ecophronesis can help bridge the gap between scientific theory and ecological practice by inspiring people to act with a wisdom focused approach to ecological practice. The combination of a beautification project with a pollinator garden project is an example of this.

5.1 Ecological Wisdom conceptual model

Patten (2016) presents that ecological wisdom is a way to integrate the processes of human and natural systems to allow both systems to be sustainable over time. Patten's conceptual diagram of ecological wisdom (figure 19) was used to inform the design of this study. Knowledge gained in this study has been used to expand on Patten's conceptual model of Ecological Wisdom. Each of the sections below discusses the

expanded model inputs in Figure 20 and specifically how the Butterfly Highway informed each of these inputs.

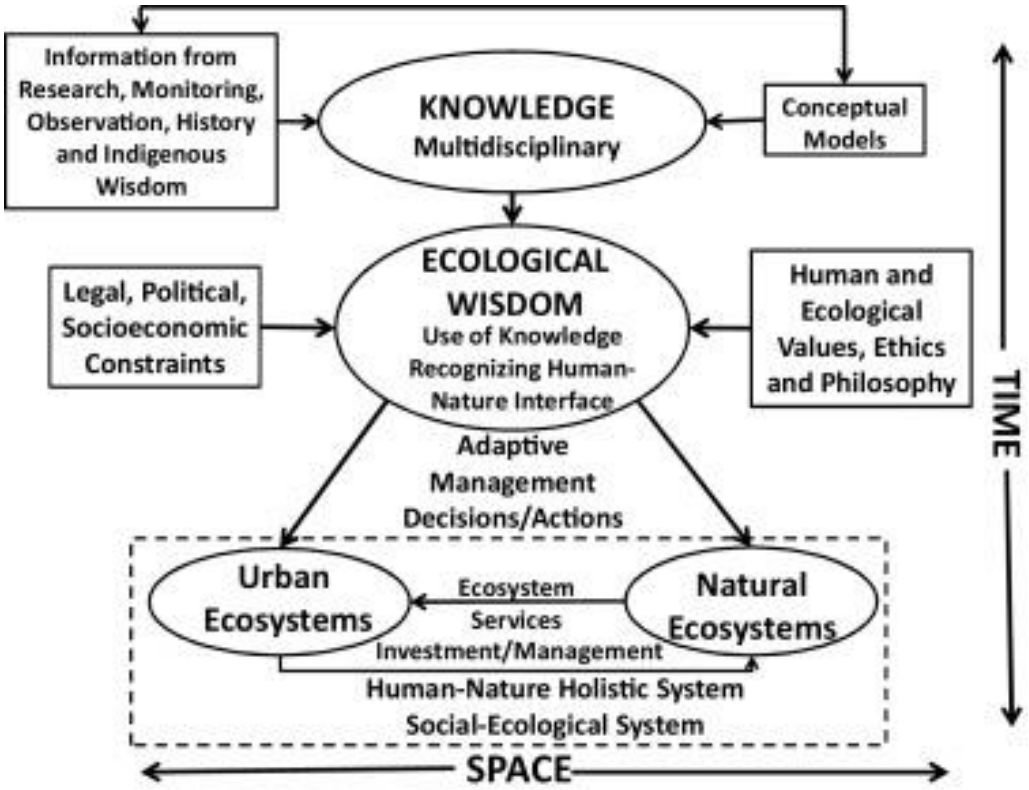

Figure 18. Ecological Wisdom conceptual diagram. (Patten, 2016).

Proposed model after the Butterfly Highway inputs

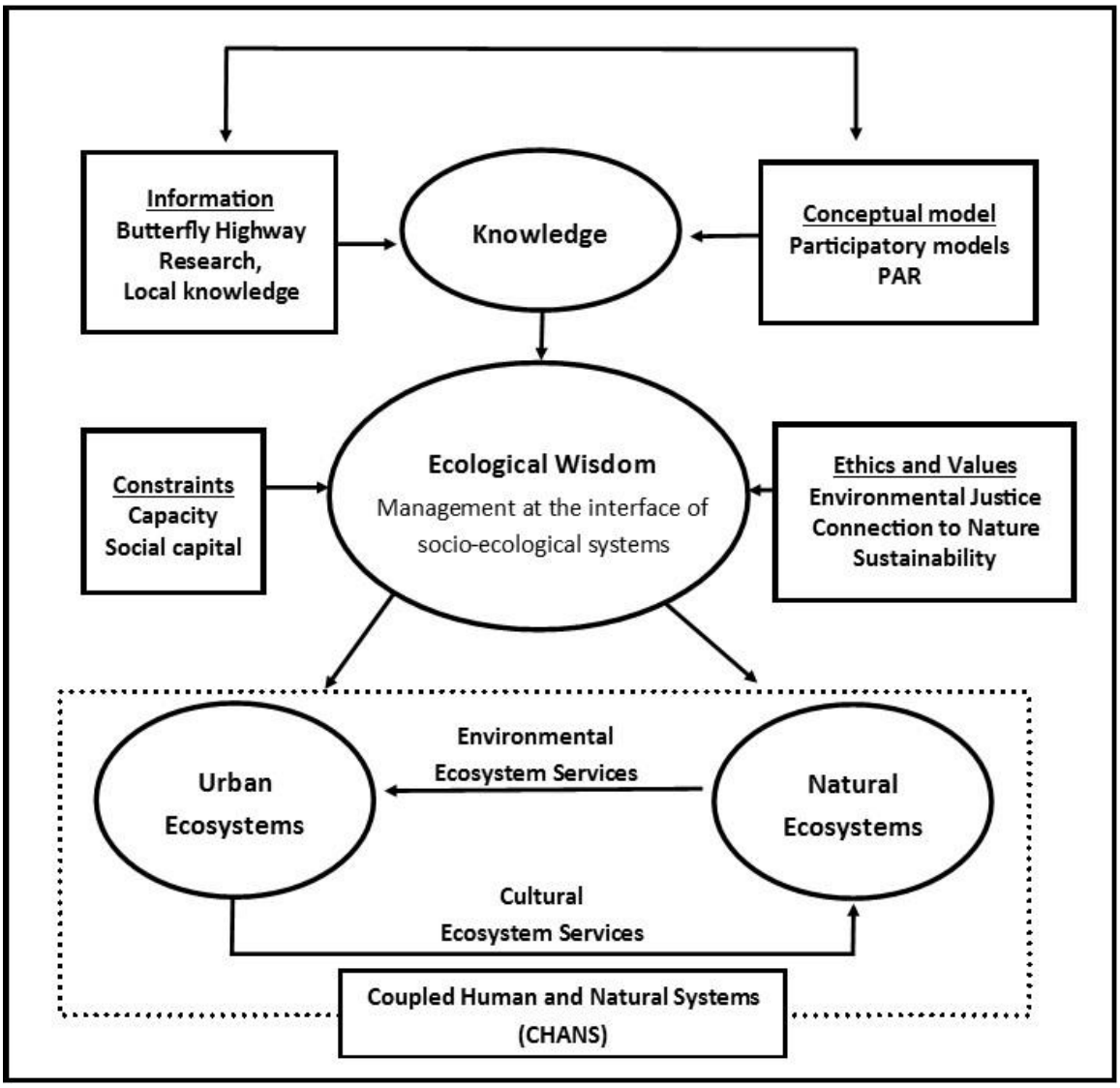

Figure 19. Revised version of the Ecological Wisdom conceptual model from Patten (2016).

Information – Knowledge

Knowledge took several forms in this study. There was knowledge gained through the literature review such as the history of African American neighborhoods in Charlotte, urban ecosystem services, and the natural history of NC pollinators and native plants. This knowledge shaped my perspective as a researcher and influenced how I designed and implemented the project. There was knowledge gained from conversations with community members, government professionals, and community partners that helped me with garden design, plant vendors, and how to get through some of the government hoops. Local community knowledge in the Butterfly Highway was gathered as a part of the pre-intervention process during visits to neighborhood association meetings and through discussions with community leaders and residents. Without this knowledge, the Butterfly Highway would not exist.

In this study, local knowledge represents both group and individual knowledge in the framework of Ecological Wisdom. Local knowledge can be defined as information in a local context that includes circumstances, relationships, and community characteristics (Corburn, 2003). To distinguish this from professional knowledge, it is the knowledge that is held by the local community in both a geographic and contextual sense.

In the Butterfly Highway neighborhoods, access to local knowledge was key to the success of the intervention. Having insiders that knew and understand the context of the neighborhood was knowledge that I would never possess on my own. An example of this is neighborhood leaders assisted with recruiting participants in their own neighborhoods. They knew who enjoyed gardening, and who needed a little extra help and encouragement. Even when it came to the garden design, early discussions with

participants revealed that they didn't want anything that looked "wild" in their yards. This was confirmed in the interviews when participants described their ideal yards as manicured, neat, and green.

The Butterfly Highway also served as a learning experience about the context of the neighborhood for a young family that was new and still considered outsiders to most of the residents. Having the Butterfly Highway in their neighborhood helped to build a bridge to the seniors that they had not previously been able to connect with.

Ecological wisdom and sense of place in the context of this study are expressed the most strongly through beautification. Almost half of the participants defined beautification as a way to show pride in their neighborhood. An ecologically wise solution for one place is not always the wise solution for another. Ecological Wisdom is place and context dependent and requires input and guidance from local knowledge. My role in this as the practitioner is to be able to identify when the standard rules of engagement should be followed and when they should be bent to follow the lead of the local community. In the case of the Butterfly Highway, I had to follow the lead of what the community would accept regarding aesthetics of "wild" plants in their yards. From early discussions, I knew that grass and lawns were important components of yards, which conformed to the social norms of the community.

In Patten's model, the 'information' input includes information from research, monitoring, observation, history, and indigenous wisdom. I propose to expand 'information' to include local knowledge as an information input. In the case of the Butterfly Highway, information from qualitative research that includes local knowledge

is the input for this model. I propose that in urban settings, the idea of local knowledge be a surrogate for ecological knowledge. However, it can be difficult to engage underserved communities in conversations about local knowledge because of prior community experiences with outsiders and trust. PAR is one solution for intentionally engaging people in real and honest dialog about their local knowledge of their community. Bringing community members into the earliest stages of research allows for a level of trust to be built by giving them a voice in what is done within their community.

Conceptual model - PAR

Patten's diagram only shows "conceptual model" as an input and the narrative only provides a vague description of what that "conceptual model" might be. I propose that PAR or other participatory models be used in place of the generic conceptual model. Top down models may not take into consideration the community perspective at all and may only reflect that of the researcher. PAR provides opportunities to intentionally contribute community input based on community needs and wants. It situates generation of knowledge in a framework in which the community has a participatory voice regarding what is ecologically wise in the sense of their community.

Constraints – Social capital, capacity

Social capital and capacity contributed to the constraints inputs of the ecological wisdom model. The lack of social capital in neighborhoods is reflected throughout all of the interviews. Social capital can impact the extent of influence ecological wisdom can have on a community. If communities have sufficient social capital, they are more likely to have capacity to engage in Ecological Wisdom, without social capital, they don't.

Ethics and values - Environmental justice, connection to nature

Environmental justice contributes to the ethics and human and ecological values inputs in the revised Ecological Wisdom model. (Figure 16). The Butterfly Highway and the newly formed community coalition, Community Alliance for Wildlife, provide a platform to begin to address issues of environmental injustice. The Butterfly Highway project improved ecosystem services in urban communities. The use of phytoremediation plants in creating native plant habitats can help address environmental justice issues in communities that may be affected. Many of the neighborhoods participating in the Butterfly Highway project are potentially at risk of being affected by environmental justice issues. One participant is actively engaged in a grassroots community group that is investigating pollution and environmental justice in their neighborhood.

Connection to nature is essential for humans to place value on nature. The Butterfly Highway is helping people and communities connect to nature through experiential environmental education by addressing a community need of beautification. The Butterfly Highway helped participants find new ways to connect with nature and establish a new set of values in regards to the natural environment. Sustainability can be viewed as a values based construct that places values on the social, economic, and environmental needs of society. These values can help to establish benchmarks for creating sustainability and resilience in communities.

Constraints – social capital

Neighborhoods that do not have sufficient social capital struggle to access resources to address community needs. These resources could include neighborhood matching grants, knowledge sharing between neighbors, or neighborliness which fosters

communication and cooperation. Neighborhood participants and Government Professionals felt that participation in the Butterfly Highway helped to build social capital in neighborhoods.

Ecosystem Services – CHANS

For the Butterfly Highway, pollinator ecosystem services are an important justification for planting native pollinator gardens in residential communities. The Butterfly Highway gardens not only attract butterflies but they attract all pollinators including bumblebees and other wild bees. Replacing mown grass with native plants improves the root structure in the soil to help reduce soil erosion. Native pollinator plants provide habitat for native wild pollinators that can increase productivity in urban agriculture (Potter & Lebuhn, 2015).

Government professionals have also improved their impact on ecosystem services. This includes the use of native meadowscapes in facility plans and being more intentional about choosing native plants over nonnative grasses for landscaping in parks. These professionals are now making choices to benefit the environment and enhance it, instead of simply choosing the easy option of using an outdated industry standard that has no benefit to wildlife.

Cultural ecosystem services include green spaces that are used for relaxation, connection with nature, and recreation (de la Barrera et al., 2016). The Butterfly Highway provides new opportunities for recreation in parks, greenways, and recreation centers. These activities include butterfly walks or opportunities to just relax and enjoy

nature. MCPR and other organizations are now offering programs centered around the Butterfly Highway and as a way to provide new ways to connect with nature.

In Patten's model, ecosystem services are treated as a singular entity and not considered as separate cultural and environmental services. I propose that environmental and cultural ecosystem services be regarded as independent inputs to the model. The reason for evaluating them independently is they do not feedback into the system in the same ways. Urban cultural ecosystems services are produced when residents spend time in nature and gain recreation or spiritual outcomes. Cultural service outcomes can be manifested as personal well-being, an improved quality of life, and the desire to care for and preserve the natural environment. Urban residents that experience these outcomes will want to protect them and will be motivated to participate in activities that will feed into and support the natural ecosystems. This could be in the form of environmental activism or protectionism through laws, regulations, or restoration.

The ecological wisdom model can provide community-based guidance for the management of the CHANS framework of ecosystem service provision. The CHANS framework encompasses the feedback loop driven by environmental and cultural ecosystem services. In this case, when natural systems are cared for and protected they produce environmental ecosystem services that provide provisioning, supporting, and regulating services that are necessary to provide a basic quality of life for urban residents. If these residents have basic needs met, then they are more likely to benefit from cultural ecosystem services and care for the natural ecosystem which feeds back environmental ecosystem services and completes the ecosystem service provision loop.

5.2 Participation

Beautification was expected to be the primary motivation for participation in the Butterfly Highway. A majority of participants said that they participated because the flowers that were offered through the Butterfly Highway would help to beautify their yards and neighborhood. My findings support that beautification was the primary motivation for participation.

In addition, I believe that a strong motivation for many participants was the feeling that the Butterfly Highway could help them return a little to the old days. None of the participants specifically stated this but it was evident from the numerous conversations that were had about how things used to be. A majority of the participants in the Butterfly Highway are over the age of 60 and several are in the 75 years or older range. During garden installation and follow up visits, participants often talked about the old days. Many times, it was sharing a remembered connection to the native plants. Participants would tell me that the last time they had seen these types of flowers were in their aunts or grandmother's gardens and bringing these same plants into their own gardens gave them a warm and positive feeling. Several participants said that once they started looking for butterflies, it made them realize that there weren't as many around as there had been during their childhood. Some participants were motivated to participate because the Butterfly Highway could help to bring back the butterflies of their childhood.

It was expected that the primary barrier to participation in the Butterfly Highway would be a lack of time as this is cited in the literature as a major barrier to participation

in community and environmental activities (Hutton, Adams, & Murombedzi, 2005; Parisi et al., 2004; Rodríguez-Izquierdo et al., 2010). The lack of access to environmental activities for some communities has also been identified (Bruyere et al., 2009). While participants did mention time as a barrier to participation, the most common response was that participants simply weren't aware of opportunities to engage in environmental activities in their community. Participants said they didn't know anyone in their social circles with similar interests in the environment or that they had never been asked by anyone to participate. The findings of this study support lack of access and awareness of opportunities as a primary barrier to participation in environmental activities.

In the interviews, Butterfly Highway participants were asked if they participated in the city recycling program. All participants responded that they did participate and several said that they were very involved in recycling. Participants were also asked about their previous participation in environmental conservation activities before joining the Butterfly Highway. Only two participants said that they had previously participated in other conservation activities. One participant had attended an Audubon meeting and the other was involved in a community effort to improve their local watershed. I find it interesting that a direct connection between environmental conservation and recycling was not made by any of the participants. Without additional research I can't create a direct causality connection between recycling and participation in the Butterfly Highway, however there is a strong correlation between the two.

5.3 Social capital

Literature on social capital in natural resources management primarily focuses on how public engagement can help protect natural resources and support recreational

activities (Alaimo et al., 2010; Leahy & Anderson, 2010; Rydin & Pennington, 2000). These studies are done at a community scale and look at how networks across a community bring together a diverse group of stakeholders to benefit a particular natural resource. There is little evidence on what benefits the community gains from participation. The Butterfly Highway study area is at the neighborhood and community scale. The findings presented in this dissertation build on the knowledge of how natural resource management can contribute to building social capital at the neighborhood scale. Specifically, this study brings attention to how neighborhoods benefit from participation in a conservation initiative versus how the initiative benefits from local community involvement.

Participants said that the Butterfly Highway built a social network of neighbors that were interested in beautification. This new network provided an opportunity to engage residents that are not currently engaged in their neighborhood. The Butterfly Highway helped to bridge the generation gap in neighborhoods by providing common ground around a topic that all residents could agree on. The Butterfly Highway also planted the seed for the development of a new community-based environmental coalition.

Many participants mentioned a decline in the neighborliness they used to have in their neighborhoods. They said it was common for neighbors to help each other out with yardwork, they would watch each other's children, and generally knew each other better than they know their neighbors now. They said this aspect of their community is missing and they hoped that the Butterfly Highway would help bring this back. There is not sufficient evidence to claim that the Butterfly Highway reversed the decline in

neighborliness in the community, however there is substantial evidence that it helped neighbors find new ways to connect with one another.

The disconnect between renters and homeowners in neighborhoods is one that is often discussed in neighborhood meetings but few solutions have been presented to resolve it. One of the initial aims of the Butterfly Highway was for the intervention to create a bridge between renters and homeowners in a neighborhood. The majority of participants were homeowners, only four out of 51 gardens were planted at sites where the residents were not the homeowners. Two of these sites were located in the common areas of multi-family housing. One of the struggles to recruit renters as participants is few of them attend neighborhood meetings which is where most of the participant recruitment occurred. All non-homeowner participants are active in their community and either learned about participation at a neighborhood meeting or through a personal connection. Almost all of the participants in each neighborhood knew each other or were connected in some way as most had been neighbors for five years or more. I think the tight network of social capital in neighborhoods was the biggest barrier to new residents or renters participating.

While the Butterfly Highway was not able to fully build social capital between homeowners and renters, I believe with additional community investment this is a reasonable outcome to expect based on responses from current Butterfly Highway participants. Two of the participants hosted a garden in an apartment community where they live. One of them walks a lot in the neighborhood and mentioned seeing other Butterfly Highway signs on his walks. He said that made him feel like he was more a part of the community by having something in common with other residents. To expand the

Butterfly Highway to renters in these neighborhoods, a more intentional effort should be made to include renters through a neighborhood outreach initiative.

Another aim of the Butterfly Highway was that it could be used to help bridge the generational gap in neighborhoods. Most of the homeowners in participant neighborhoods are senior citizens. One participant who is 60 said that they are considered a youngster in the neighborhood. Participants mentioned conflicts between younger residents and older residents in the neighborhood. Through conversations with participants, we believe many of the older residents want to keep the neighborhood the same and are afraid of change, while younger residents want to bring in amenities to attract young families to the neighborhood. This can create tension and further increase the generational gap that already exists. One participant was successful in using the Butterfly Highway as an opportunity to connect with her elderly neighbor because it gave them a positive way to connect through a shared interest. This has led to additional learning and sharing about each other which has created a new bond between neighbors.

5.4 Environmental justice

Environmental justice issues equally impact people and wildlife in communities. The impacts to people are most often brought to light but they can be difficult to address. This can occur because of the imbalance of power between those who created the environmental issues and those affected by them. This power imbalance leads to communities of color and low income often not having capacity or a voice to fight back with. These fights can become political which can create additional challenges. Initiatives to address wildlife conservation are typically less controversial and rarely face pushback unless the initiative impacts a group's ability to make money. Most people want to save

butterflies, birds, and flowers as these are things considered to be an asset to a community.

Community organizations with a mission to protect wildlife and the environment out number organizations that have a mission to fight for environmental justice. Framing environmental justice as a wildlife conservation issue could help to create new opportunities to address these issues. The mission of CAW is to address both of these issues by working to create safe environmental spaces in the community for people and wildlife. The impact of this perspective shift is something that should be explored further.

Butterfly Highway Participants recognize that there is an inequality in beautification in their neighborhoods in both residential and public spaces. The Butterfly Highway helped to address these inequalities by providing residential households with the materials to host native plant gardens. Through the project, I was also able to advocate for more native flowering plants in community and neighborhood parks. This will improve beautification as well as help mitigate environmental justice issues in the surrounding community by replacing grass with native plants that will improve soil quality and reduce run off into local creeks and streams.

Government Professional interviews did not specifically include questions related to justice or how their organization or department may address justice issues through the Butterfly Highway. However, during the course of the interviews, several professionals discussed issues of justice and inequality in Charlotte, specifically in neighborhoods where the Butterfly Highway Participants live. They shared examples of programs their

organization does to help create equity, some of which will now include providing Butterfly Highway gardens to neighborhoods.

5.5 Capacity and Adaptive co-management

Collaborative partnerships to achieve a common goal, such as beautification or conservation, have been identified as a way to build trust between stakeholders (Fernandez-Gimenez et al., 2008). The Butterfly Highway has created a sense of trust between stakeholders and community partners through building trust at multiples levels in the process. Trust is important to the development of adaptive co-management strategies (Armitage et al., 2009).

If neighborhoods apply for a beautification matching grant, including the Butterfly Highway as a part of the project can help give credibility to their proposal over those that just say that they want to build a flower garden. Partnering with a known and trusted project like the Butterfly Highway can increase a neighborhood's capacity and access to resources. The Butterfly Highway lends credibility as it is a known project that is affiliated with UNC Charlotte and NCWF. Having outside support has been shown to help give neighborhoods capacity to complete projects successfully.

This initiative has also been a vehicle to build trust between the community and UNC Charlotte. CHARP's existing relationship and trust with neighborhoods influenced the initial success and buy in for the Butterfly Highway. Neighborhood leaders that had previously worked with CHARP trusted that we would work in a participatory manner to benefit the community. The Butterfly Highway was able to add another layer to that trust and bring new neighborhoods into CHARP.

This trust has extended to other departments at UNC Charlotte that are partners with the Butterfly Highway. I have been working with the Keeping Watch on Habitat program through the College of Arts + Architecture and they were interested in doing a community art piece. I approached neighborhood leaders that were participants in the Butterfly Highway about the project and the initial trust for the project was established because of our existing relationship. The project is still under consideration with the neighborhood but without the affiliation with the Butterfly Highway, the project would likely not have made it to this stage.

The Butterfly Highway, CAW, and the work done through other NCWF chapters can be used as a case study of how adaptive co-management can be a model for creating collaboration, social learning, and institutional development (Armitage et al., 2009). Learning from doing is a central tenant of adaptive co-management. The Butterfly Highway is built on the idea that participants learn about the environment through stewardship of their own residential Butterfly Highway garden that can then be transferred to other stewardship opportunities within their neighborhood or the larger community. An upcoming stewardship opportunity for participants is an opportunity to attend a NWF Habitat Steward Training course in the community. This training will equip participants to be able to train and assist community members in creating 100 Certified Wildlife Habitats in their neighborhoods in September and October 2017.

5.6 Government agencies

The Butterfly Highway has been successful in creating opportunities for government professionals to interact with social and environmental systems in the community and within their own organizations. These include increased opportunities for

environmental education, building organizational social capital, trust building with the community, and increased production of ecosystem services.

Professionals in the government sector are often viewed as being disconnected from the community that they serve. This attitude became apparent during the interviews with Butterfly Highway participants. Trust is a major issue for community members, especially with outsiders. This can create an unbalanced power dynamic where the community is left feeling that they are being told what to do or what will be done to them by those at the top. Leaving them to feel as if they have no voice in what happens within their community.

Government professionals identified ways that the Butterfly Highway has helped them increase social capital in their organizations. Participation in the Butterfly Highway provided opportunities for different departments to work together on a joint project. For some organizations, this was the first time these departments had worked together within their organization. Staff that participated in the NWF Habitat Stewards workshop said that they really enjoyed the opportunity to networking and train with other county staff that they had not previously worked with. This training has created new ways that county organizations and departments can work together.

In the interviews, Butterfly Highway participants and government professionals discussed trust and trust building between organizations and the community. Several neighborhoods identified issues of trust with outside organizations, including government organizations. In the government professionals' interviews, they felt their organizations were doing a good job of getting community input on projects. The goal of this study was

not to evaluate the effectiveness of community engagement between government agencies and neighborhoods, however there are ways that the Butterfly Highway can be used help build trust and engagement between them. The Butterfly Highway is viewed as a positive project in the community which can transfer to projects done by outside organizations. Showing that organizations are participating in a known project in the neighborhood can help to build trust with the residents. One way is through hosting Butterfly Highway gardens and pollinator pitstops in public spaces such as parks and recreation centers.

MCPR has started an initiative called Connecting Children to Nature (CC2N). This initiative is designed to bring nature based resources to urban recreation centers so children can experience nature in their own space instead of being expected to go to nature preserves and other "natural" spaces to experience it. The Butterfly Highway is one way that MCPR is planning to bring nature to the urban centers. I have partnered with MCPR to install Butterfly Highway gardens at all recreation centers, as well as bird nest boxes and feeding stations to create NWF Certified Wildlife Habitats.

A need for increased environmental education for county staff was identified early in the project. Recreation center and park staff were only given basic training on the Butterfly Highway gardens and pollinators. After reflection on the process, it was determined that comprehensive training for facility staff should be provided prior to garden or habitat installations. Staff and recreation center patrons should also be given the opportunity to participate in the planning and installation of the garden. National Fish and Wildlife Foundation funded a grant to help provide comprehensive training for staff. Employees from different departments within Mecklenburg County were invited to a

three day, 24 hour training workshop to learn about wildlife habitats and how the Butterfly Highway can be better integrated into their work and programs. It was recently completed in January 2017. I trained 21 MCPR and other county staff that were trained as NWF Habitat Stewards which included extensive training on pollinators, pollinator gardens, and habitats.

Participation in the Butterfly Highway has helped government organizations with new opportunities to increase ecosystem service production. This includes improved environmental practices by using more native plants in parks and facilities landscaping. The Butterfly Highway has helped MCPR add 10 acres of native wildflowers and grasses to new and existing projects. One project includes 5 acres of land at the new Southview Park. The original plan was to seed the area with a mix of Bermuda and lespedeza, plants that reduce soil erosion but have no significant value to wildlife. Now the area has been seeded with a "meadow mix" as well as native tree saplings. Two of Charlotte's formal urban parks, Romare Bearden and First Ward Park, have converted several beds to Butterfly Highway pollinator pitstops. There are currently Butterfly Highway signs in the parks, but MCPR staff that work in the parks have asked for kiosks to put brochures that would help educate the public about the Butterfly Highway.

5.7 Butterfly Highway and the future

The Butterfly Highway is supported as an official program of NCWF and was launched as a statewide initiative in February 2016. There are currently over 1,400 registered Butterfly Highway pollinator pitstops and the network is continuing to expand across the state. One challenge will be staying true to the roots of the Butterfly Highway and keeping a focus on grassroots community engagement in environmental

conservation. Through the relationship with CAW, the Butterfly Highway will be able to continue to impact and create change in underserved communities in Charlotte. I believe that the model created with the Butterfly Highway in Charlotte can be recreated as long as there is a commitment from the stakeholders to engage in a meaningful and intentional method of engagement as has been demonstrated here. Forcing a project onto as community when it doesn't fit with community needs and wants will not be a successful project. That this was based on needs that were identified by the community is a core reason this project has been so successful.

A next step for the Butterfly Highway will be to seek out opportunities to replicate our work in communities across the state. The cities of Rocky Mount and Concord, have expressed interest in creating a similar program within their government departments to expand opportunities for recreation programming, environmental education, and habitat restoration. These discussions are ongoing.

On a policy level, the Butterfly Highway will be leveraged as a mechanism to create local and statewide policy changes regarding native plants and pollinator protection. Currently I am working with several utility companies on improving right of way management to create sustainable habitats for pollinators. These are important connectors within the statewide Butterfly Highway. We are also planning to test native seed mixes to see if they meet state requirements for vegetation reestablishment after disturbance.

Knowledge gained from this study has been used to expanded the ecological wisdom model to intentionally include PAR, local knowledge, social capital, connection

to nature, and environmental justice. Additional work is needed to expand the ecosystem services provision loop through CHANS. The Center for Applied Geographic Information Science (CAGIS) at UNC Charlotte has ongoing research on CHANS and ecosystem services. I propose a collaboration with CAGIS to explore this model further.

CHAPTER 6: CONCLUSIONS

The Butterfly Highway is an initiative that transcends all levels of engagement from grassroots partnerships to state level programs. It has helped neighbors create new connections with one another over flowers and butterflies and brought million dollar corporations to the table to discuss community impacts and pollinator habitat restoration. From a research perspective, the Butterfly Highway has brought new insight to the ideas of adaptive co-management and shaped new inputs to the Ecological Wisdom model.

Major contributions of the Butterfly Highway

1. Trust is critical to replicating a project such as the Butterfly Highway in a community. Projects must invest sufficient time to build trusting relationships with stakeholders to be successful.
2. The Butterfly Highway is a case study of an intervention that can address social and environmental issues at the neighborhood and community scale. Most interventions focus on the environmental or the social. This intervention was successful at both. Part of the reason for success was listening to the needs of the community and finding a way to address a known environmental need with a known social need.
3. Government agencies struggle with departments creating silos where they only focus on working within their own department. Agencies know that this occurs

but it can be a time and resourcing consuming problem to address. The Butterfly Highway was identified as an intervention to bridge the silos as it brought together professionals from multiple departments and agencies to work on recreation, beautification, and natural resource planning through one singular project.

4. The Butterfly Highway gives a new perspective on barriers to participation in conservation activities. The most common barrier identified was lack of access to opportunities. People can't participate in projects that they don't know exist.
5. A revised and expanded theoretical model of inputs to the Ecological Wisdom framework is proposed based on findings from the Butterfly Highway.

The case study of the Butterfly Highway makes a significant contribution to the Ecological Wisdom literature as much of the current writings are based on philosophy and theory but little has been written about how it can be applied. This study provides guidance on how we can begin to build wise cities using local knowledge at the neighborhood level. A manuscript is currently in process to showcase the Butterfly Highway as a case study for Ecological Wisdom in practice.

A significant outcome of the Butterfly Highway is the establishment of a new community-based environmental and wildlife coalition called the Community Alliance for Wildlife (CAW) www.cawcharlotte.org . Five participants of the Butterfly Highway are founding members of the organization. During informal conversations about the Butterfly Highway, participants asked me, "what's next?". At first I, didn't have an answer but additional conversations led to the idea of the CAW. North Carolina Wildlife Federation (NCWF), an affiliate of the National Wildlife Federation (NWF) offered for

CAW to become one of their local chapters. As a part of this, NCWF would provide capacity and support during the organizing phase. This includes physical support such as providing a meeting location, nonprofit status, and staff time to assist with organizational capacity such as emails and meeting preparations. Through NCWF, I partnered with CAW leaders to write a grant request to the National Fish and Wildlife Foundation (NFWF) for seed money to build the organization. We received a grant for $50,000 to create a pilot program to train 16 community members to become NWF Habitat Stewards. The grant also provides funding to create an additional 100 Butterfly Highway gardens in the community where CAW works as well as certifying the spaces as NWF Certified Wildlife Habitats. CAW leaders were engaged as partners from the beginning of the project development, through the grant writing phase, and now in the implementation phase.

Piedmont Natural Gas (PNG) owns a two-acre parcel adjacent to several Butterfly Highway participants' homes. Representatives from PNG met with one of the homeowners who expressed interest in a pollinator habitat restoration project and PNG agreed they would pay to install a one acre pilot site for a native pollinator meadow. This site had previously been a nuisance site for PNG. An adjacent homeowner would call them multiple times each year to come cut the grass when it got too tall. The site was not being used for anything and was something that they spent money on to maintain. The space was not considered to be an asset to the community and the constant need to remind them to mow created a poor relationship between PNG and the homeowners. The site was prepped for planting and seeded with a native meadow mix in December 2015. Employees from PNG and community members hand seeded the site as a community

event. In summer 2016, the site had some grass as well as flowering plant growth. Figure 21 shows the before and after photos. Per the maintenance agreement for managing a meadow the site was mowed late July 2016. This time instead of residents complaining about the grass needing to be cut, they complained that their flowers were cut down. The community now calls the site their "Secret Garden". While PNG funded the project, and will physically manage the mowing protocols, the community feels ownership over the meadow garden which will result in long term co-management of the space.

This study also provides a meaningful case study of bridging social and ecological systems research. One of the most difficult aspects of this study as a researcher was bringing together the knowledge and methodologies of the social and natural sciences. There are numerous conversations about why we need to practice transdisciplinary research but the actual practice can be extremely challenging at times. In many ways as academics we are stuck in silos just as I observed within in our municipal organizations. In my own case, the Butterfly Highway bridged the silos of social science and natural science, qualitative research and quantitative research, and community planning and conservation planning to help realize a more holistic view of building healthy and sustainable social and environmental systems.

Figure 21. Northwood Estates/PNG Secret Garden meadow before planting and after one year growth.

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APPENDIX A: IRB AND CONSENT FORMS

(print on CHARP letterhead)

Informed Consent Form

Project Title
The Butterfly Highway: connecting people and nature

Introduction: The Butterfly Highway is a community-based restoration project that will restore native pollinator habitats in urban areas and collect data on native butterflies and other pollinators.

Investigators:

Angelique Hjarding, PhD Student, Department of Geography and Earth Sciences, University of North Carolina at Charlotte

Dr. Janni Sorensen, Assistant Professor, Department of Geography and Earth Sciences, University of North Carolina at Charlotte

Eligibility:
You are eligible to participate in this study if you are a resident of Enderly Park, Washington Heights, University Park, Druid Hills, Graham Heights, Northwood Estates, Oaklawn or another neighborhood partner. If you are over the age of 18, you are eligible to participate. You are ineligible for this study if you do not meet the above criteria.

Procedure and Subject Involvement:
This consent form covers the entirety of the Butterfly Highway project and the optional focus groups and interviews after participation in the project.

Your participation is entirely optional.

Involvement in the Butterfly Highway project will entail but is not limited to attending meetings to learn about urban biodiversity and conservation, participation in a community mapping project, planting native flower gardens and observing and identifying butterflies and other native pollinators.
During the focus group we will be asking you a variety of questions about your experiences in working with the Butterfly Highway. Please review the attached interview guide for a list of the

questions we plan to ask and understand that you are free to answer or not answer any of the questions.

We will be using a digital audio recorder to audio record the focus groups. We will later transcribe this conversation; however, we will de-identify the data. In other words, your name will not be matched with your answers to the interview questions.

Risks of Participation:
There are no foreseeable risks to your participation in this process.

Benefits of Participation:
The Butterfly Highway offers an opportunity for residents to take action in a neighborhood beautification and environmental restoration project and participate as a citizen scientist in collecting butterfly and other pollinator data in their neighborhoods.

Volunteer Statement:
You are a volunteer. The decision to participate in this study is completely up to you. If you decide to be in the study, you may stop at any time. You will not be treated any differently if you decide not to participate in the study or if you stop once you have started.

Privacy and Confidentiality:
All data collected by this study will be de-identified. The following steps will be taken to ensure confidentiality:

- Your name and any other personally identifiable information will not be used for any portion of the project or for subsequent research papers stemming from this process. During participant observation note-takers may denote the speaker but the name used will be anonymized and not be that person's actual name.
- Audio recordings to be transcribed will be kept in a locked office on UNC Charlotte's campus.
- After transcribing the focus group portion of this process, we will erase the audio recording. Names of speakers from the focus group will be de-identified in the transcripts.

Statement of Fair Treatment and Respect/Contact Information:
UNC Charlotte wants to ensure that you are treated in a fair and respectful manner. Contact the university's Research Compliance Office at (704) 687-1871 or email at uncc-irb@uncc.edu if you have any questions regarding how you are treated as a study participant. If you have further questions about the project after today's activity, please contact Joe Howarth (thowarth@uncc.edu) or Janni Sorensen (jsorens2@uncc.edu). You may also call the CHARP office at (704) 687-1310.

Approval Date:
This form was approved on 12-11-2014

Participant's Agreement:
I have read the information in this consent form. I have been given the chance to ask questions about the study, and those questions have been answered to my satisfaction. I am at least 18 years of age, and I agree to participate in this research project. I will be provided a copy of this form.

_____	_____
Researcher Signature	Date
_____	_____
Participant's Printed Name	Date
_____	_____
Signature of Participant	Date

Copy of Current IRB approval

OFFICE OF RESEARCH COMPLIANCE
9201 University City Boulevard
319 Cameron Hall
Charlotte NC 28223-0001
(704)-687-1871
Web site:
Federalwide Assurance (FWA) #4801

To: Angelique Hjarding
Geography & Earth Sciences

From: IRB IRB

Approval Date: 11/17/2016
Expiration Date of Approval: 11/16/2017
RE: Notice of IRB Approval by Expedited Review (under 45 CFR 46.110)
Submission Type: Renewal
Expedited Category: 7.Surveys/interviews/focus groups
Study #: 14-1130

Study Title: Butterfly Highway: Connecting People and Nature

This submission has been approved by the IRB for the period indicated.

Study Description:
This project will consist of three primary goals and activities: a community-based conservation project, a butterfly inventory and creation of the "Butterfly Highway" in the low income crescent of Charlotte. This highway will be comprised of sustainable perennial butterfly gardens that will provide a low cost way to "green" existing infrastructure in urban neighborhoods, parks and other pockets of under utilized green space. In addition to butterflies, this highway will also serve as a habitat for bees, birds and other local wild pollinator species. The project will be facilitated by the Charlotte Action Research Project (CHARP), a research group based at the University of North Carolina Charlotte, that uses action research to support the most challenged neighborhoods in Charlotte. Participating neighborhoods will be recruited from those which CHARP has long standing partnerships with.

Investigator's Responsibilities:
Federal regulations require that all research be reviewed at least annually. It is the Principal Investigator's responsibility to submit for renewal and obtain approval before the expiration date. You may not continue any research activity beyond the expiration date without IRB approval. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.

If applicable, your approved consent forms and other documents are available online at
http://uncc.myresearchonline.org/irb/index.cfm?event=home.dashboard.irbStudyManagement&irb_id=14-1130.

You are required to obtain IRB approval for any changes to any aspect of this study before they can be implemented.

Data security procedures must follow procedures as approved in the protocol and in accordance with ITS Guidelines for Data Handling and the End User Checklist.

Any unanticipated problem involving risks to subjects or others (including adverse events) should be reported to the IRB using IRBIS.

This study was reviewed in accordance with federal regulations governing human subjects research, including those found at 45 CFR 46 (Common Rule), 45 CFR 164 (HIPAA), 21 CFR 50 & 56 (FDA), and 40CFR 26 (EPA), where applicable.

CC:
Janni Sorensen, Geography & Earth Sciences

APPENDIX B: QUALITATIVE RESEARCH INSTRUMENTS

Focus Group Guide

Butterfly Highway Focus Group

May 4, 2016 6pm-8pm
Smallwood Presbyterian Church, Charlotte, NC

Focus group facilitators:
Angel Hjarding: Doctoral Candidate in Geography at UNC Charlotte
Janni Sorensen: Associate Professor, Department of Geography and Earth Sciences and Director, the Charlotte Action Research Project. UNC Charlotte.

Agenda:
6:00 - Welcome and Introductions, Sign consent forms, update contact information
6:15 - Dinner and social
6:45 – Review Interview questions provided by Angel, give feedback on wording, tone, and meaning
7:15 – Discuss themes and questions from participants to add to interviews (see attached sheet)
7:45 – Wrap up and additional questions

What is this research for?

Angel's doctoral dissertation research at UNC Charlotte. Research aims to identify:

- How does a community or neighborhood benefit from participating in a project like the Butterfly Highway?
- How does an individual benefit from participating in a project like the Butterfly Highway?
- What are the reasons people do not participate in projects like the Butterfly Highway?
- How can communities and cities/governments work together to equally meet community needs, environmental needs, and economic needs?

Next steps:

1. Transcribe and review focus group discussion
2. Prepare final set of interview questions and send to Focus group participants for final feedback.
3. Interviews will be conducted with neighborhood residents beginning the week of June 1
4. Interviews will be concluded by June 30
5. Results will be presented to community at a community celebration event in October

Incentives for interviews:

- Are they needed?
- If so, what can we offer? New Butterfly Highway sign if they meet and maintain criteria?
- Other suggestions?

Discussion topics for group

- Neighborhood assets and challenges
- Resident participation in community organizations
- How do you feel beautification can affect your neighborhood?
- What do you feel is positive about your neighborhood?
- What challenges is your neighborhood facing?
- What changes has your neighborhood experienced and why do you think they have occurred?
- How do you feel participation in the Butterfly Highway has impacted your neighborhood?
- How do you feel about defining neighborhood boundaries?

Proposed Butterfly Highway Participant Interview Questions

Length: 60 minutes
Location: participant's home
Recorded on audio only
Participant will be given a hard copy of the interview questions

Name:

Address:

Own/rent:

Length of time as resident:

Birthplace:

Occupation:

Questions about community

1. Do you consider yourself to be active in the community? If no, why not?
2. Do you attend community/neighborhood meetings?
3. Do you volunteer with any organizations in your community? What type of activities are you involved in?
4. Do you trust the leadership in your community?
5. What changes would you make to your community organization and leadership?

Neighborhood beautification

1. What things do you like about your neighborhood?
2. What things would you change about your neighborhood?
3. Describe your ideal yard.
4. Do you enjoy spending time outside?
5. If yes, what do you enjoy most about being outside?

Conservation and green space

1. Have you visited a neighborhood or community park in the last 12 months?
2. If so, why did you visit the park and what activities did you participate in?
3. Do you feel you have a say in what community parks look like?
4. What things do you like or dislike about parks you have visited?
5. Have you ever visited a nature preserve, state park or National Park? Why or why not?
6. Have you attended a meeting or event for a nature or conservation related organizations? If yes, tell me about the event and participation experience.
7. Have you ever made a donation to a nature or conservation related organization?
8. Do you participate in the city recycling program?
9. What does environmental conservation mean to you?

Butterfly Highway Participation

1. Did you host a Butterfly Highway garden during the summer of 2015?
    a. If yes,
        i. Who contacted you about being a part of the Butterfly Highway?
        ii. Why did you decide to participate?
    b. If no,
        i. what were the reasons you did not host one?
        ii. If given the opportunity to host a garden in 2016, would you?
2. Do you still have your Butterfly Highway box? If no, why do you no longer have it?
3. What were your expectations of being a part of the Butterfly Highway?
4. Did you enjoy participating in the Butterfly Highway project?
5. Did you observe and record any butterflies visiting your yard during the summer of 2015?
6. Do you notice Butterflies and bees more often in your yard after participation?
7. Do you feel a connection to others in your neighborhood or community that also participated in the project?
8. Did neighbors ask you about the Butterfly Highway?
9. Do you think the Butterfly Highway has had an impact on your neighborhood?
10. Has your participation in the Butterfly Highway changed how you feel about your neighborhood?

Final Butterfly Highway Participant Interview Guide

Interview

Length: 60 minutes
Location: participant's home
Recorded on audio only
Participant will be given a hard copy of the interview questions

Name:
Neighborhood:
Own/rent:
How long have you lived in the neighborhood:
Charlotte native or where from:

Questions about community

1. Were you active in your community before you joined the Butterfly Highway?
    a. If yes, what types of activities did you engage in?
    b. If no, what was it about the Butterfly Highway that made you want to participate?
2. Do you attend community/neighborhood meetings? If no, why not?
3. Do you volunteer with any organizations in your community? What type of activities are you involved in? If no, why not?
4. Do you trust the leadership in your community? If no, why not?
5. What changes would you make to your community organization and leadership? If no, why not?

Neighborhood beautification

1. Do you have any previous experience with gardening or farming?
2. Was gardening or farming a part of your upbringing? Did you have a family farm or garden?
3. What does neighborhood beautification mean to you?
4. Describe your ideal yard.
5. What would you do to beautify your neighborhood?
6. What things do you like best about your neighborhood?
7. Do you enjoy spending time outside? What do you enjoy most about being outside?

Conservation and green space

1. What does environmental/nature conservation mean to you?
2. Have you visited a neighborhood or community park in the last 12 months?
3. If so, why did you visit the park and what activities did you participate in?
4. Do you feel you have a say in what community parks look like?
5. What things do you like or dislike about parks you have visited?
6. Have you ever visited a nature preserve, state park or National Park? Why or why not?
7. Have you attended a meeting or event for a nature or conservation related organizations? If yes, tell me about the event and participation experience. If not attended, why?
8. Have you ever volunteered or made a monetary donation to a nature or conservation related organization? If not donated (volunteer or monetary) Why?
9. Do you participate in the city recycling program?

Butterfly Highway Participation

1. Did you host a Butterfly Highway garden during the summer of 2015?

    a. Who contacted you about being a part of the Butterfly Highway?
    b. Why did you decide to participate?
    c. Do you still have your Butterfly Highway box? If no, why do you no longer have it?
        i. If you did not like the box, what other options would you suggest to make a butterfly garden fit better with your yard?
    d. What were your expectations of being a part of the Butterfly Highway?
    e. What did you enjoy about participating in the Butterfly Highway project?
    f. What did you not enjoy about participating in the Butterfly Highway project?
    g. Did you observe and record any butterflies visiting your yard during the summer of 2015?
    h. Do you notice Butterflies and bees more often in your yard after participation?
    i. Do you feel a connection to others in your neighborhood or community that also participated in the project?
    j. Did neighbors ask you about the Butterfly Highway?
    k. Did you tell others about the Butterfly Highway?
        i. Do you think the Butterfly Highway has had an impact on your neighborhood?
        ii. Has your participation in the Butterfly Highway changed how you feel about your neighborhood?
        iii. How do you feel being called a citizen scientist?

Government Professional Interview Guide

Government Professional Interview

Length: 45 minutes

Interview Location: Participants office or other mutually agreed location

Questions:

Background

1. What organization are you affiliated with?
2. What is your role in the organization?
3. How long have you been with the organization? What is the mission of your department/organization?
4. How does your organization engage the public? Such as the planning process/decision making/visioning? What do you think are the strengths of this approach? How do you think this could be improved?
5. What is your education and/or training background?
6. In what ways do you have opportunities for community members to engage with nature both individually and as a community?
7. Are there opportunities for people to volunteer within your organization?
8. Do you see any barriers for participation in a volunteer program with your organization?

Butterfly Highway

1. How did you first learn about the Butterfly Highway?
2. Is the Butterfly Highway a project that is known in your organization?
3. Is your organization currently engaged with the Butterfly Highway? In what ways?
4. What kind of impact could the Butterfly Highway have on your organization's programs?
5. How do you feel the Butterfly Highway could further impact your organization?
6. Could the Butterfly Highway be a model for future programs in your organization?
7. In what ways could your organization improve the reach and/or capacity of the Butterfly Highway?
8. In what ways do you feel the Butterfly Highway has had an impact on neighborhoods and the larger community?
9. How do you think the Butterfly Highway has had an impact on wildlife and the environment?
10. How do you think the Butterfly Highway has had an impact on beautification?
11. Do you feel Butterfly Highway volunteers are more capable of being a resource because they have been trained?
12. Do you see the Butterfly Highway as a way of getting people more engaged in public parks, greenways and other outdoor spaces?

Participant Observation Guide

Participant(s) Names:

Neighborhood:

Address:

Has participant been IRB consented?

Date garden planted:

Date of visit:

Was the participant home?

Did you see any butterflies? If so, how many?

What was the state of their garden?

How many plants were still alive? %

Did you collect completed citizen science forms (give to Angel)?

Did you leave additional blank forms?

What additional observations were made during the visit?

APPENDIX C: PARTICIPANT OBSERVATION AND INTERVIEW DATA

The table below expands on the participant observations collected and interview responses related to answering the research questions for this study. It is not a comprehensive list of all responses collected but is representative of the diversity of responses given.

Research question/theme	Response type	Quote/observation
RQ1. Motivation to participate		
Social capital	Participant observation	Neighborhood leader said they want to improve connection to neighbors
Beautification	Participant observation	Community members said they want to improve beautification
Beautification	Participant observation	Numerous neighborhood association meetings attended discussion around beautification
Self interest	Interview response	Because I love nature. It's an individual thing with me. I could make my own decisions about how I wanted it to be. and you know watering, tending, caring that would be my thing. I didn't have to depend on someone else to do that. (BH8)

Protect nature	Interview response	For me it was to take a blah piece of dirt and make it something beautiful. It sits on a fairly visible area. When you talked about, going back earlier to neighborhood beautification, I agree you have places that have flower gardens and that type of thing creates beauty. So that was one of the reasons. The expectation that it would make things a little nicer to look at. (BH5)
Protect nature	Interview response	Because I am interested in butterflies and I think they are beautiful and I think they are worth preserving. We don't want to lose our butterflies. (BH6)
RQ1. Barriers		
Capacity	Participant observation	Community members said that access to resources was a barrier to beautification
Cost	Participant observation	Community members said that cost was a barrier to beautification
Cost, capacity	Interview response	Time and interest. Again, I lived here and I didn't really do anything. Until I moved here and I didn't want to be that person that complained about where I lived. I wanted to be an agent of change. I wasn't going to just sit and say, look at this. I wanted to be a part of the community and have a voice and for someone to hear my voice and it just all culminated into us getting active. (BH2)
cost	Interview response	How long are we supposed to keep up the butterflies (observations). We kind of got lazy. We still watching, when we see one we just haven't written it down. (BH11)

Cost	Interview response	Just other than not having the time. The last 6 months or so have been pretty hectic. (BH7)
RQ2. Outcomes BH neighborhood participant		
Social capital	Participant observation	Participants said that neighbors would call each other just to talk about the butterflies they had seen.
Social capital	Participant observation	Participants came together and helped neighbors plant their Butterfly Highway gardens.
Environmental literacy	Interview response	I expected that the flowers that we planted would attract certain butterflies and we would record them. I have seen those little cabbage butterflies around and I never knew what they were. So this was a learning experience for me to. (BH1)
Environmental literacy	Interview response	Yes it really really brought it all home. It was like, oh! They need flowers that they are attracted to here. Because once they are here and the bees are here. They can pollinate. The birds come back, the birds eat the worms. All of this was like yes yes. And you learn that at school but I think once it becomes something in your life that impacts you. (BH2)
RQ2. Outcomes Government professional participant		
Connection to community	Participant observation	Community members came out to help install Butterfly Highway gardens at recreation centers and parks.
Ecosystem services	Participant observation	Maintenance and horticulture teams now look at how they can use native plants and more biodiversity friendly plantings in their projects.
Connection to community	Interview response	It's beautiful it really really is. And personally, as an environmentalist I

		think it's been really great. And there's also been some real support on council's end. and we have citizens who are now coming up to our elected officials and saying hey these are some of the things that we want. We care about wildlife we want and we want to see this that happen. And so, as a result it's been really really awesome. (GP4)
Connection to community	Interview response	I think it shows them that we are also part of the community. So if someone from the neighborhood is like oh I am part of the butterfly highway and they see the sign, oh you are part of the butterfly highway too. That's great. I think it shows there is a commonality, an interest, it shows hey they are doing something other than just basketball. They are doing something more. (GP3)
RQ3. EW ethics and values		
Trust	Participant observation	Conversations with community leaders about outside organizations that have broken trust of the community by not following through with what they promised.
Trust	Participant observation	Neighborhood associations have been used as a resource to help access grant funding but the funding has never directly benefited the neighborhood.
Culture and traditions	Interview response	I think in my community, in the African American neighborhoods, we have lost the tradition that our elders carried on for so long. It is past time for us to go back to the old timey way. And that begins with hello, how are you doing? They don't do that much no more. They pass each other on the street

		and keep going. So there are some things, traditions that we grew up with that don't have any meaning and I think that is against us. (BH8)
Social connections	Interview response	It is a great neighborhood. It really is and we take care of each other. We watch out for each other and that kind of thing. (BH9)
RQ3. EW constraints social capital		
Community capacity	Participant observation	Many neighborhoods don’t have the capacity to write neighborhood matching grants.
Capacity	Participant observation	Some projects that would be assets to the community do not move forward with support of the entire community because many of the older residents are afraid of change.
	Interview response	Meanwhile I joined the community relations board and I am still active on it. I still get connections to really help out community with code enforcement and with community relations (BH11)
	Interview response	well listen, Velma Leek. You know who that is? She told us, we were there for a meeting for the voting, and they told us there was no room for us to go into. So she came by and she said, from now on, if you want a room, you call me. That's what she told us. Call me. So it shouldn't be where you got to worry about a meeting room. You are the neighbor you live in this neighborhood.
RQ3. EW – ecosystem services		
	Interview response	It's the urban conflict. Especially the suburban conflict. Man over nature as we call it in the business. But if they could learn there is more things that could be used that

		would be good. It's coming. It is just coming slow. My industry is addicted to what is the new and latest plant. What's the new tweak of the color of a hydrangea. Or it gets a little taller. or it takes sun better. Or these combinations when they are all blooming together they are so wonderful. Natives need to encompass some of that. They need to be able to grab some of that to be able to equally compete. That's the reality of it. I mean we struggle and we talk every now and then about look at these beautiful plants that came from a nursery but you know they had to spray them to keep. Fungicides and all of this. (GP2)