Mutual Flourishing

Uplifting Mutually Beneficial Relationships Between Humans and Colorado Native Species Through Urban Landscape Design

Maya Handelman
Program in Environmental Design
Undergraduate Honors Thesis

Mutual Flourishing:

Uplifting Mutually Beneficial Relationships Between Humans and Colorado Native Species Through Urban Landscape Design

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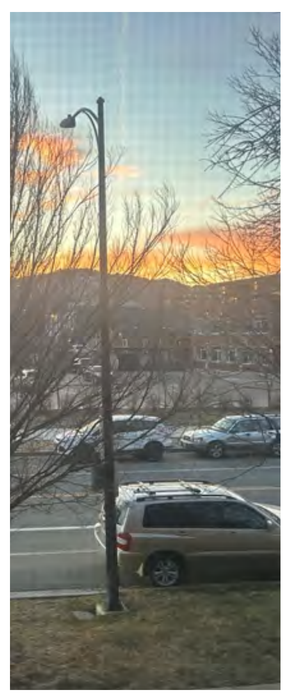
This thesis is dedicated…

To Emily, who's mentorship not only made this project possible, but also inspires me to uplift all beings and people.

To Becca for showing me the beautiful, hopeful stories of Barn Swallows and science.

To my parents, Tyler, and Eva for talking through countless ideas and always supporting me.

To the tree outside my apartment window for reminding me that the world is so much bigger than me and my computer screen.

Abstract:

This thesis examines how landscape design of urban spaces can uplift mutually beneficial relationships between humans and other species. For tens of thousands of years, humans have co-evolved with other species forming mutually beneficial relationships, interactions between other species and humans in which individuals from both species experience benefits. These symbiotic relationships have been studied through both Western Science and Traditional Ecological Knowledge, allowing a holistic understanding of ecological and cultural co-benefits. However, human development, industrialization, and colonial ideology have increasingly disconnected humanity from the natural world, reinforcing a hierarchical view of humans as separate from and superior to nature.

Though these human-made factors have caused an environmental crisis and created flawed urban spaces, human tools, such as the design of the built environment have the potential to address aspects of this calamity through supporting positive human-other species relationships. While there is existing scholarship on mutually beneficial relationships between humans and other species, it has yet to be applied to the design field, specifically landscape architecture. This thesis uses speculative design to understand how urban landscape architecture can foster these mutually beneficial relationships and offers a universal guide to this process through an interactive guidebook.

To better understand how design of the built environment can influence these mutually beneficial relationships, I examine relationships between humans and three Colorado native species: Barn Swallows, Sweetgrass, and Cottonwood trees, through a series of speculative design collages. Speculative design serves as a tool to envision alternative futures, using hypothetical scenarios to challenge prevailing practices by visualizing a hopeful future in which these important mutualistic relationships have a place in our developing urban world. My research employs a cyclical speculative design process, integrating research, site inventory, design iteration, and analysis to develop both the speculative design collages and a guidebook for designing spaces showing how landscape architecture can fulfill the potential to promote mutual flourishing in urban spaces. If built, these spaces will significantly benefit humans and other species, increase habitat space and urban biodiversity, and bring humans closer to understanding that we are a component of a natural system with the potential for positive impact.

Table of Contents:

Table of Figures:

Figures:

INTRODUCTION

Topic Overview

Cycle of Benefits

In a time of modernity and rapid development, humanity has lost connection with the natural world and relationships with nonhuman species. In Western ideology, instead of seeing people as part of nature, we see nature as a finite resource that must be conquered, developed, and depleted. This separation started as far back as the inception of Abrahamic religion and was brought to popularity during the Enlightenment period when Descartes theorized the human mind as separate from the physical body. This philosophy elevated the idea of humans as superior to nature, changing our relationship from an interconnected part of the ecosystem to a hierarchical one. In the United States, increased industrialization caused people to become further separated from the land and food sources. The U.S. Wilderness Act of 1964 defined nature as "set aside as something pristine and free of the modern human touch" furthering the gap between humans and our interrelated place in nature (Vining, Merrick, and Price 2008, 1).

This ideology has led to urban deficiencies that damage all species. Rapid urbanization has led to the creation of spaces that overlook the essential connections between humans and the environment, as well as species that depend on the habit being destroyed. In the United States, one-third of all species are at risk of extinction, in part due to habitat displacement in urban environments. For example, between 1966-2014, the North American Barn Swallow population decreased by a cumulative 46%, largely due to habitat loss and pesticide use (Swallow Conservation). Sweetgrass's survival is threatened by wetland destruction and suppression of natural fires (Shebitz' and Kimmerer 2004, 108). Another major consequence of this ideology is the development of urban and landscape design that not just ignores human mutual relationships, but threatens them by placing humans as separate from the natural world. But, as I explore in this thesis, this devastating disconnect does not have to be the future of our world.

Robin Wall Kimmerer, a Potawatomi botanist and author, including the book *Braiding Sweetgrass*, writes, "All our flourishing is mutual," referring to human's interconnectedness with the natural world (Kimmerer 2013, 166). For thousands of years, humans have co-evolved with other species forming mutualistic relationships, defined as interactions between species (wildlife and plants) and humans in which individuals from both species experience benefits (Cram et al. 2022, 843). As designers of the built environment who work directly with ecology, landscape architects are in the unique position to center mutually beneficial relationships between humans and other species in urban spaces.

This thesis examines urban landscape design's potential to foster mutually beneficial relationships between humans and other species through an interactive guidebook. I explore this topic through three examples of Colorado native species that share mutually beneficial relationships with humans; Barn Swallows, *Hirundo rustica*, Sweetgrass, *Hierochloe odorata*, and Cottonwood trees, *Populus deltoides.* This method can be extended to any species with a co-beneficial relationships to humans.

Barn Swallows have coevolved with humans for over 7,000 years and construct their nests exclusively on man-made structures (Smith et al. 2018). Globally, the presence of Barn Swallows provides rich cultural importance, as illustrated through mythology and art, while significantly lowering agricultural pests (Skye Fachon, 2021) Sweetgrass is beneficial to North American

Indigenous people as a material for basketry, perfume, and medicine. It has evolved to grow faster and stronger when conscientiously picked by humans (Kimmerer 2013). Lastly, native trees, like Cottonwoods, provide numerous benefits to human health, wellness, and community when cultivated and cared for. Cottonwoods specifically provide necessary shade and shelter in grassland biomes and are spread through man-made water channels.

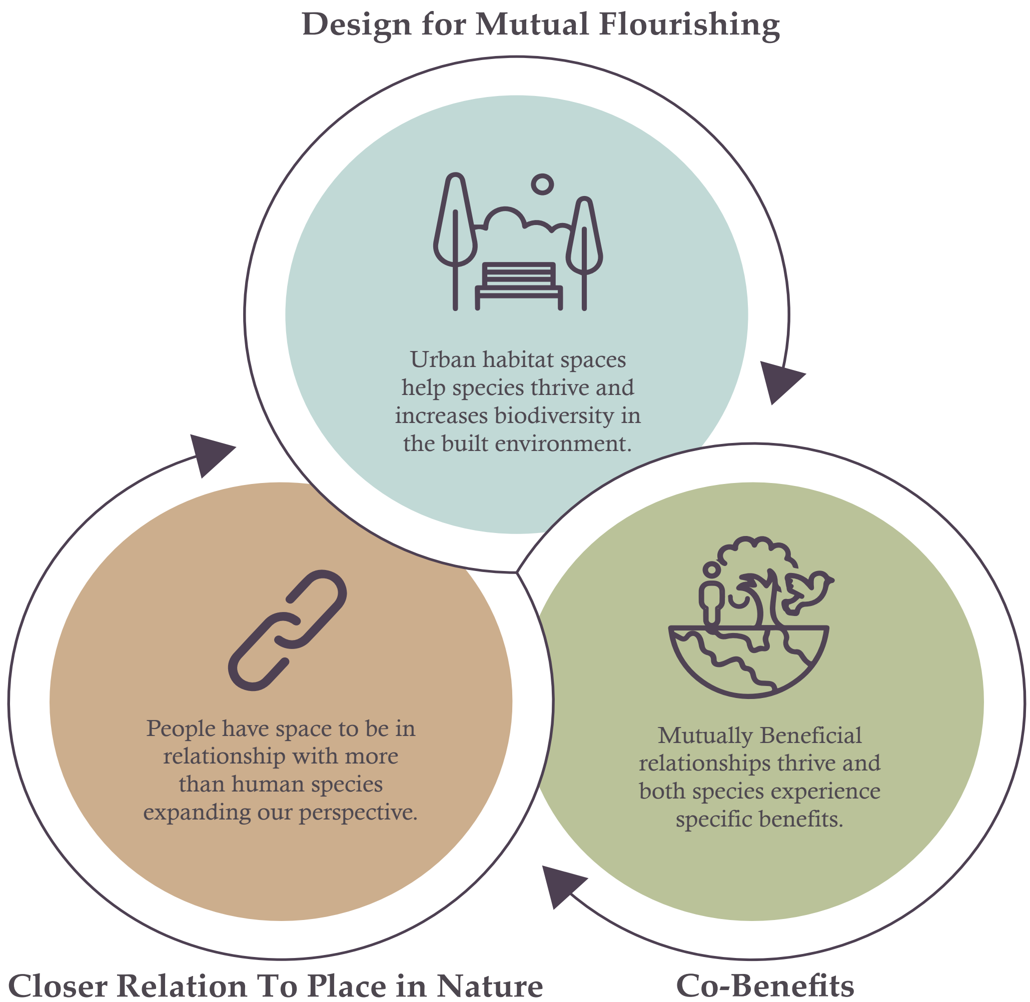
Designing to support mutually beneficial relationships between humans and Colorado Native species has not yet been fully explored in the context of landscape architecture, making my project particularly relevant. Furthermore, there is yet to be research and resources on how to design landscape architecture through the lens of mutualistic relationships. So far, most knowledge of positive human relationships with other species is based in the fields of Western biology or Traditional Ecological Knowledge (TEK). As I later elaborate upon, there are a multitude of theories in the environmental design field that begin to explore users other than humans in the design process. More-than-human design prioritizes the interests of species other than humans in the design of the built environment. Biophilia focuses on designs inspired by natural forms and processes (Ednie-Brown et al. 2020). Additionally, Animal Aided Design is where wildlife actively participates in the design process (Weisser and Hauck 2017). Though all of these include or are inspired by more-than-human species, they do not consider the perspective of humans as part of nature or capable of mutually positive relationships with plants and animals. I use these design theories as a foundation to apply Robin Wall Kimmerer's aforementioned theory on mutual flourishing to landscape architecture.

As part of my final product, I contribute two speculative design plans in collage form to showcase possible versions of urban landscape architecture that supports mutually beneficial relationships between humans and native species. I use my design method to create a unique design framework guiding other landscape architects through the process of designing for mutual flourishing between humans and other species.

In order to create a guidebook applicable to a wider array of architects and locations, I focus on vacant lots because they are ubiquitous to urban landscapes. Vacant lots also hold vast potential to increase biodiversity and community benefits. Although perceived as unproductive land destined for future development, urban vacancy is not a blank canvas. Oftentimes, vacant land improves urban biodiversity and acts as a wildlife sanctuary (Kim, Miller, and Nowak 2018). Landscape architecture centering mutually beneficial relationships between humans and other species has the power to transform these spaces to benefit both wildlife and humans.

In this thesis, I argue that there are mutually beneficial relationships between humans and Colorado species that can be uplifted by redesigning vacant urban spaces. Vacant urban lots contain the potential to hold biodiverse ecosystems when carefully and consciously designed. This will result in a cycle of benefits for both humans and local species as illustrated in the diagram to the right.

As seen in figure 1, if landscape design in urban spaces succeeds in fostering mutually beneficial relationships between humans and native species, both parties will benefit. For example, if we consider Barn Swallows' needs when spaces



Cycle of Benefits (figure 1)

are designed, it will inform material and form of structural elements as well as plant selection, lighting, and water. This will allow Barn Swallows to have increased habitat and receive the benefit of human-made structures for nesting. In turn, humans will benefit from general increased green space, a decrease in insects and agricultural pests, and a closer relationship to a culturally important species. This approach not only increases urban biodiversity but also strengthens people's connection to our place in nature. By showcasing the positive relationships humans can have when considered as integral parts of the ecosystem, it encourages a shift in perspective. In virtuous cyclical fashion, designers, planners, and community members are inspired to incorporate more species-inclusive approaches in their work, leading to increased mutual flourishing.

I begin with a review of the design theories, Western scientific theories, and traditional ecological knowledge theories influencing this research. I then provide the necessary background to support the claim of a mutually beneficial relationship between humans and Barn Swallows, Sweetgrass, and Cottonwoods. I then detail the methodology guiding my research culminating in three speculative designs and an interactive guidebook to support other Landscape Architects' design for mutual flourishing. By creating an interactive guidebook that can share the process of creating spaces for mutualistic relationships with Landscape Architects, this thesis can help spark and support this cycle of benefits.

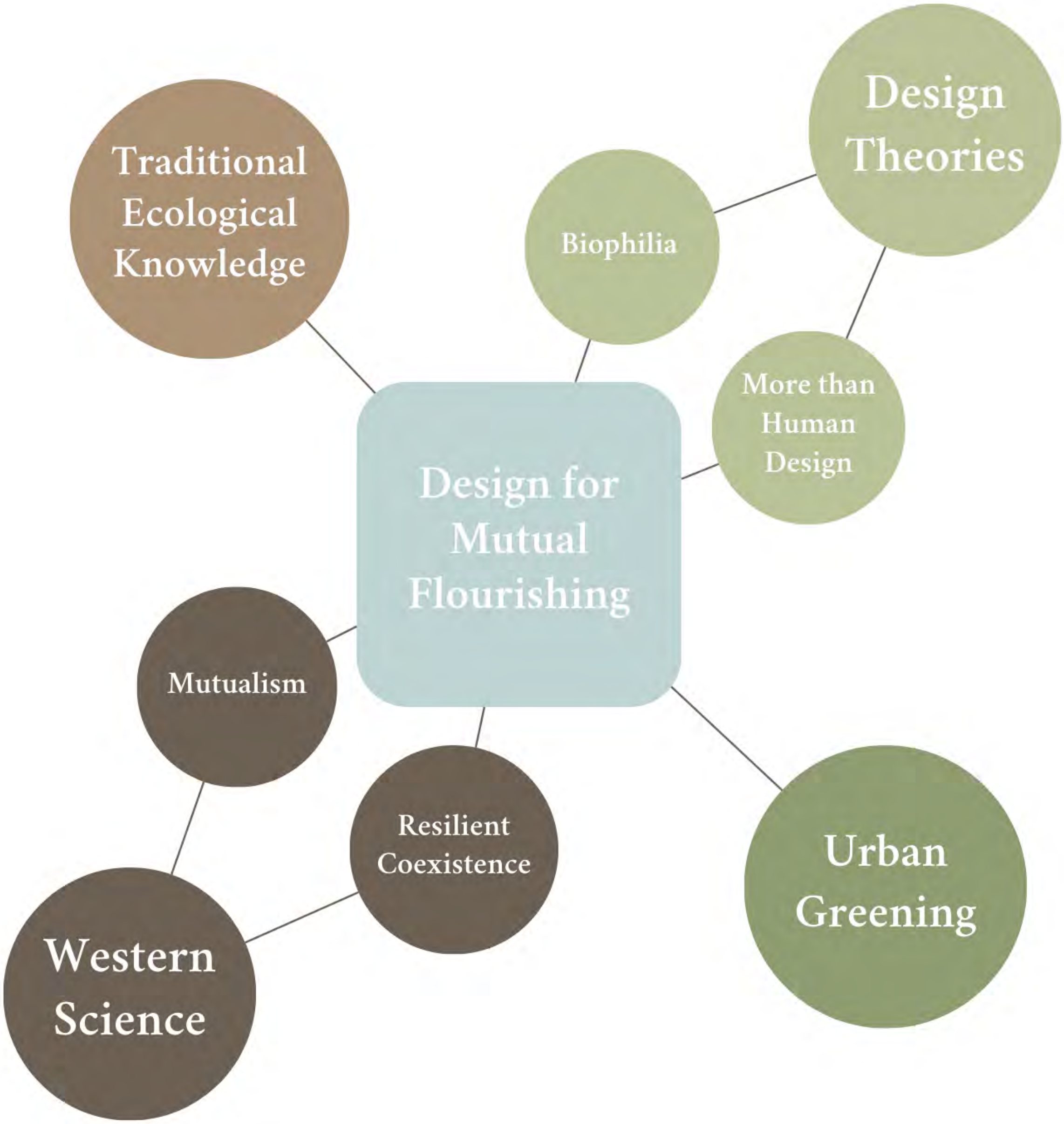
INFLUENCES

Western Science

Traditional Ecological Knowledge

Urban Greening

Design Theory



Influences Map (figure 2)

Through my exploration, I have identified ideas from four different domains that have influenced my research: Western science, Traditional Ecological Knowledge, design theory, and urban greening. Western Science provides background information on mutualism and categorization of human-wildlife relationships. Traditional Ecological Knowledge highlights humans' place in ecosystems, emphasizing the importance of culture and art. Design theories such as Biophilia and More-than-human design emphasizes the importance of designing for and being inspired by other species. Research on urban greening allows us to understand the multitude of benefits from increasing green space in urban areas.

Western Science:

Mutualism is a type of symbiotic relationship defined as "any interaction between two species in which individuals of both species experience a net benefit" (Cram et al. 2022, 843). This definition is helpful because it highlights the importance of recognizing positive relationships between species. Though much research is focused on interactions between two wildlife or plant species, humans are also involved in mutualistic relationships. According to Carter and Linnel, there are immense opportunities for humans to benefit from wildlife-provided ecosystem services, economic opportunities, and overall closeness with nature (Carter and Linnell 2023). For example, pollinators help our crops and bats eat harmful insects (Cram et al. 2022, 842). Generally, Western science focuses on wildlife and plant relationships, excluding humans from the ecosystem. Cram's definition of mutualism and the rigid categorization of species' relationships can exclude difficult-to-measure benefits such as cultural impacts or art.

Previous research has been conducted on human-wildlife interactions in urban spaces. For example, Carter and Linnel's research focuses on analyzing ways to adapt governing structures to support positive human-wildlife interactions. Their study outlines eight different archetypes of human-wildlife relationships ranging from negative, neutral, to positive. The negative relationships are described as *zero-sum losers*, in which one species is harmed for the other benefit; *Eradication*, in which wildlife species are purposefully weakened by humans; *Sporadic Nuisance*, in which wildlife benefit from human spaces but humans fail to adapt to include them; and *Reciprocal Damages,* in which both species fail to adapt to include the other. The positive archetypes include *Fragile Stability,* in which the wildlife is ignored in human spaces; *Tolerant synanthropic*, in which species gain benefits of urban spaces and are tolerated by humans; *Conservation Reliance,* in which fragile species depend on human protection; and lastly, *Sustained Co-benefits*, in which both species adapt and benefit from the other.

These archetypes help clarify the different relationships between humans and wildlife and identify key features of ones that are mutually beneficial. Carter and Linnel argue that there are immense opportunities for humans to benefit from peaceful coexistence wildlife. In return, humans can protect species through conservation policies, habitat restoration, and species rehabilitation. The study concludes that a key way to influence positive shifts is reconnecting humans to their place in nature through rethinking knowledge systems and highlighting the benefits of human-wildlife coexistence (Carter and Linnell 2023). Though Carter and Linnel's research includes supporting mutually beneficial human-wildlife interactions through government and policy change, it does not cover the design of the built environment.

Traditional Ecological Knowledge:

Traditional Ecological Knowledge (TEK) expands Western science' definition to include cultural knowledge from indigenous peoples (Kimmerer 2011). According to Kimmerer, TEK approaches "nature as a living community, people with human and nonhuman persons, all contributing to the integrity of the system" (Kimmerer 2011, 268). Unlike Cram's definition of mutualism which focuses on wildlife and plant relationships, ignoring humans' place in the ecosystem, TEK highlights it. TEK also centers difficult-to-measure benefits such as cultural impacts and art. By combining TEK with Western biology studies, we gain a holistic view of positive relationships between humans and other species which we can then apply to Landscape Architecture.

In her chapter in *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture,* Kimmerer interlaces TEK with restoration practice and design. Restoration is not sustainable without repairing cultures and people's relationships with nature. Kimmerer outlines seven goals that combine ecological and cultural restoration. This thesis is deeply influenced by the goal to "Focus on cultural keystone species," "Restoration of kincentric relationships" and "Restoration of traditional land management for the benefit of nonhuman relatives (i.e., biodiversity)" (Kimmerer 2011).

Julia Watson, a designer and environmentalist, coined the term Lo-Tek design referring to resilient design innovations rooted in TEK. Lo-Tek designs are built upon human symbiosis within ecological systems. Lo-Tek design counters the generic approach to climate change in which universal solutions are applied to varying sites. Instead, Lo-Tek's philosophy is based on localized solutions that work with natural systems instead of forcing change. (Watson et al. 2021) Though Watson's Lo-Tek design is more oriented towards an infrastructure scale, this philosophy can be employed to influence the design of vacant urban spaces.

Urban Greening:

There is a wealth of research on the many advantages of urban greening for humans. Urban greening is the practice of increasing plants and green space in urban environments (Lohr 2010). Examples include studies highlighting urban greening effects on stress reduction (Ulrich et al. 1991), decreased recovery time from surgery or illness (Ulrich 1984), increased pain tolerance (Lohr and Pearson-Mims 2000), increased productivity for college students (Tennessen and Cimprich 1995), and healthier communities (Brogan and James 1980). Furthermore, there are several theories about why humans receive these benefits, all of which stem from our coevolution rooted in all of nature. Theories include both an innate relationship with greenspaces, especially trees, as well as learned behaviors. Balling and Falk's research confirmed that humans are innately drawn to savanna biomes and grassland landscapes (1982). Balling and Falk later theorize that this phenomenon is due to savannas being the ideal place for humans to survive during our evolutionary origin (2010). Other research describes the calming effect of natural visuals such as color and repeating fractal geometric patterns (Redies, 2007; Kaufman and Lohr, 2008). Additionally, the many negative effects of growing up in urban environments that lack green space is a pressing concern for an increasing number of children (Lohr 2010).

Design Theory:

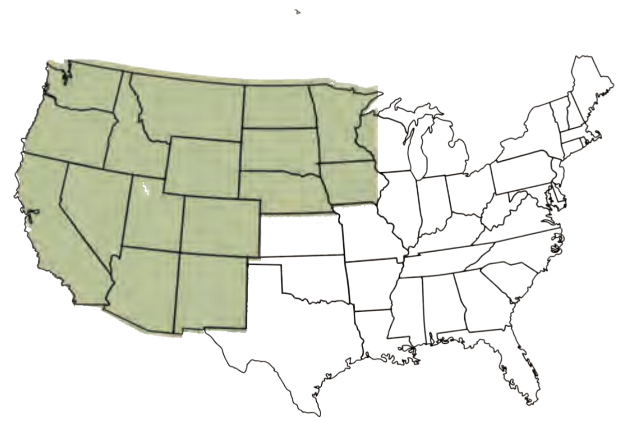
More-than-human design and Biophilia are design theories that prioritize nature, other than humans, in the design process. More-than-human design attempts to move beyond the Anthropocene by focusing on non-human needs in addition to human interests. More-than-human theory is built on the realization that all design projects alter ecologies, impacting the environment (Ednie-Brown et al. 2020). More-than-human design is an umbrella theory that encompasses many perspectives on posthuman design. Biophilic design aims, "to satisfy our innate need to affiliate with nature in modern buildings and cities" use of natural elements or motifs in urban spaces for human benefit (Kellert 2015). Though these theories are useful to understand design that includes of humans' innate connection and coevolution to other species, they do not center elements of reciprocity or relationality, essential to mutual flourishing.

SPECIES BACKGROUND

Barn Swallows

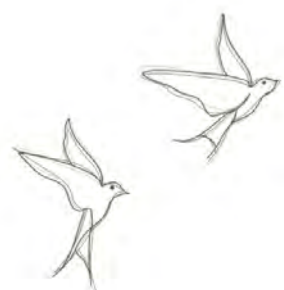
Sweetgrass

Cottonwoods



Sweetgrass *(Hierochloe odorata)*

Cottonwood trees *(Populus deltoides)*



Barn Swallows (*Hirundo rustica)*

<u>Subject Species U.S. Habitat Range (figure 3)</u>

This thesis focuses on three species native to Colorado that have present and historic mutually beneficial relationships with humans. Additionally, these species lack urban habitats that support and provide sustained care for their unique needs. Since there are few strictly scientific studies on the biological effects of other species on humans, I have included cultural sources as well.

Barn Swallows:

Barn Swallows, *Hirundo rustica*, are small aerial insectivorous with a rust orange chest and two long tail streamers. Barn Swallow ranges cover most of North America, Europe, Asia, and swaths of Africa and South America. They nest and breed in the Northern Hemisphere, including Colorado, in the summer months before migrating to the Southern Hemisphere for the non-breeding season. In Colorado, the breeding season is between May 31st and July 12th. The North American Barn Swallow population has declined by 46% since 1966 due to habitat loss, decreased small scale agriculture practices, increased urbanization, and changes in how barns are built and managed (Swallow Conservation).

Barn Swallows are unique in that they have coevolved with humans to only nest on man-made structures (Smith et al. 2018, 4201). Their nests are small cup-shaped structures attached to vertical walls and are made from mud, hay, and horse hair. Barn Swallows will reuse nests from previous years and have two clutches of three to six eggs each breeding season (Brown and Brown 2020). Barn Swallows build their nests on protective structures such as barns, sheds, bridges, or porches, due to the proximity of water and aerial insect prey (Smith et al. 2018). Before human co-evolution, ancestral Swallows nested in caves. According to genetic analysis, there is statistical evidence that Barn Swallows began nesting on human structures 7,700 years ago, roughly 5,000 years after the first evidence of human agriculture and architecture. This diversion from the ancestral Swallow population illustrates a rich history of coevolution with humans. Expansion of human architecture coincides with Barn Swallow population growth (Smith et al. 2018, 4209), showing historical benefits from humans that continue to the modern day.

Humans receive beneficial ecosystem services and cultural value from our proximity to Barn Swallows. Both studies and community knowledge show the value of Barn Swallows in decreasing agricultural pests. A study in Italy showed that the presence of Barn Swallows at Cattle farms decreased flies by over 50% (Roseo 2024). In the United States, many forums by farmers and property owners focus on the benefits of Barn Swallows, particularly that they eat mosquitoes. Examples of forum posts are located in the appendix. A pamphlet created by the Cooperative Extension System, an education network for farmers and ranchers under the US Department of Agriculture, created and distributed a fact sheet on Barn Swallows and how to attract them to farms (Daly 2002).

Rituals of this Good Earth, a website created by Avani Skye Fachon, shows the impacts Barn Swallows have had on humans all around the world. According to an interview with Dr. Basma Shata, an Egyptian ornithologist, symbols of Barn Swallows have been found in ancient Egyptian papyrus. European folklore tells of Barn Swallows having the ability to heal both the human body and mind. There are many superstitions surrounding Barn Swallows in China: they are a symbol of luck and it is an honor to have a Barn Swallow nest on your house. Traditions and superstitions surround Barn Swallows all across the globe, from sailor tattoos to legends of Swallows burning houses down for revenge in Russia. Globally, there are many examples of Barn Swallows being used in art as symbols of hope, Spring, and connection with nature (Skye Fachon, 2021).

Sweetgrass:

Sweetgrass is a perennial rhizomatic grass named after its fresh vanilla fragrance. There are many homotypic synonyms, but *Anthoxanthum nitens, Anthoxanthum hirtum,* and *Hierochloe odorata* are most commonly used. Sweetgrass's native range includes northern Europe, Asia, and most of North America (Barkworth and Allred 2021). A study conducted in response to concerns of basket weavers in Akwesasne, a Mohawk Nation located in the North East United States, indicates that the species is declining rapidly, possibly due to habitat destruction, specifically wetlands, and lack of controlled and natural burning (Shebitz' and Kimmerer 2004). Sweetgrass has an abundance of cultural, medicinal, and material uses worldwide, particularly by enslaved peoples and Indigenous Americans.

During the 1700s and 1800 enslaved Africans were forcefully brought to the coastal areas of Southern Carolina. The variety of different African traditions blended to create a unique culture called Gullah–Geechee defined by language, cuisine, and crafts. A vital part of Gullah-Geeche culture and economy is woven Sweetgrass Baskets originally made for winnowing rice and serving food. In modern times, gentrification and urban expansion have replaced native Sweetgrass habitats with concrete. "'I Still Have the Old Tradition': The Co-Production of Sweetgrass Basketry and Coastal Development" analyzes the different ways African American Sweetgrass basket weavers attempt to gather material and sell their art amidst so much development and social change. Through quantitative data on Sweetgrass populations and interviews with basketweavers, the study concludes that it is important to protect these historical art

forms through urban planning and legislation (Grabbatin, Hurley, and Halfacre 2011).

Sweetgrass is most frequently used by Indigenous peoples for basketry and ceremonial smudge. The Iroquois Nation have historically wove baskets for both practical use and as an art form. Currently, the Mohawk and Seneca people of the Iroquois nation continue the tradition of Sweetgrass basketry and it is vital for basketweavers’ income (Shebitz and Kimmerer 2005, 257). In the Great Plains region, which includes what is now Colorado, Sweetgrass (motsé’eon□ tse) plays an important role in the Northern Cheyenne tribe’s ceremonies and creation story. According to Jim Spear, a member of the Northern Cheyenne tribe, Maheo, the creator, wove Sweetgrass with sinew and rolled it with Buffalo tallow to create the Earth, (Hart 1981, 9). During the Sacred Arrow ceremony, Sweetgrass is burned on charcoal 445 times. The smoke is used to purify the items, space, and members of the ceremony. Jim Spear states that “We renew the life of the Cheyenne people through the use of this Sweetgrass” (Hart 1981, 9). Recently, the American Chemical Society has identified chemicals in Sweetgrass that repel mosquitos, providing an additional benefit (American Chemical Society 2015). Sweetgrass is important to both practical, spiritual, and cultural use. Spear believes that the decline in Sweetgrass population is in part “the reason that we (the Northern Cheyenne) are losing our old ways” (Hart 1981, 10). Tragically, in the past 43 years since this statement was recorded, Sweetgrass populations continue to disappear.

“The Teaching of Grass” is a chapter in Robin Wall Kimmerer’s *Braiding Sweetgrass*, a collection of short stories of Indigenous teachings and connections within nature. The poetic story

takes the format of a research study following one of Kimmerer’s graduate students, Laurie Galluzzi, who researched the effects of different methods of harvesting Sweetgrass. Over two years, Laurie observed three plots of Sweetgrass: one of which was picked the traditional way; one that was picked by taking half of each plant; and a control plot with no human intervention. The results show that both plots Laurie interacted with grew more than the control plot, leading to the conclusion that, “Humans participate in a symbiosis in which Sweetgrass provides its fragrant blades to the people and people, by harvesting, create the conditions for Sweetgrass to flourish” (Kimmerer 2013, 164). This study shows both a human cultural benefit provided by Sweetgrass when used in Indigenous basketry and proves humans support Sweetgrass growth.

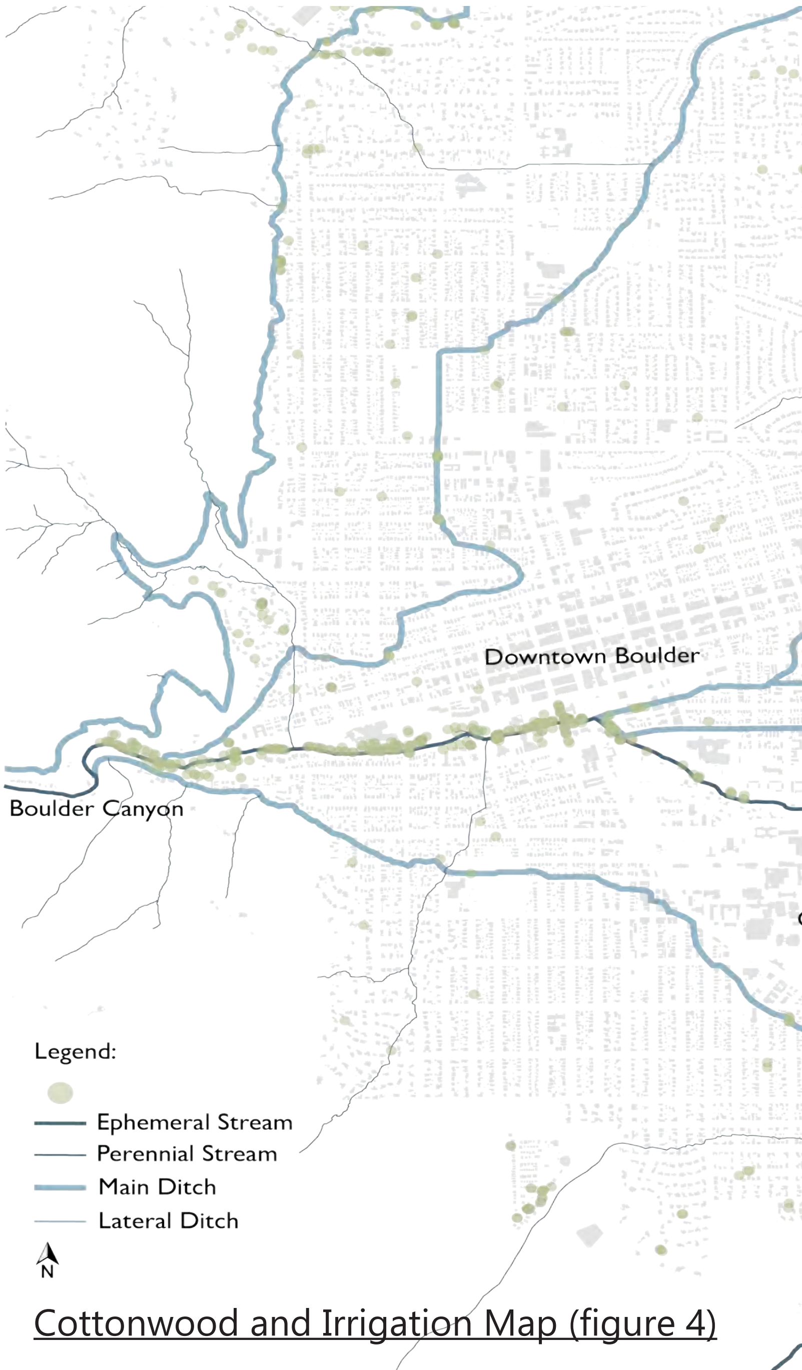
Cottonwoods:

Cottonwoods, *Populus deltoides*, are a large riparian tree native to North America. Cottonwoods are one of the fastest-growing native trees and can reach over 100 feet in height. They are named after the airborne seeds female trees produce in Spring and have foliage that turns yellow in Fall. Cottonwoods are one of the few large shade trees native to the plains of Colorado. ("Populus deltoides (Eastern cottonwood) | Native Plants of North America" 2022). Additionally, Cottonwoods provide immense habitat support for birds. According to a 1976 study of Boulder Creek, Cottonwood groves only accounted for .2 percent of land in Boulders, but created one of the most dense and diverse spaces for bird species (Cruz, 1976).

Trees have long provided humans with many benefits. They are vital to our species' survival. Analysis of over 100 ethnographic studies on hunter-gatherer relationships to trees concluded that benefits range from the practical,l such as access to fire fuel, food, and shelter to cultural benefits such as placemaking, providing recreational spaces, and spiritual connections. The research concluded that hunter-gatherers have always had a deep relationship with trees, and that tree presence was a key factor in where groups settled. The religious importance of trees also leads hunter-gatherer groups to respect and conserve trees, rather than view them as a resource ready for depletion (Ugalde and Kuhn 2024).

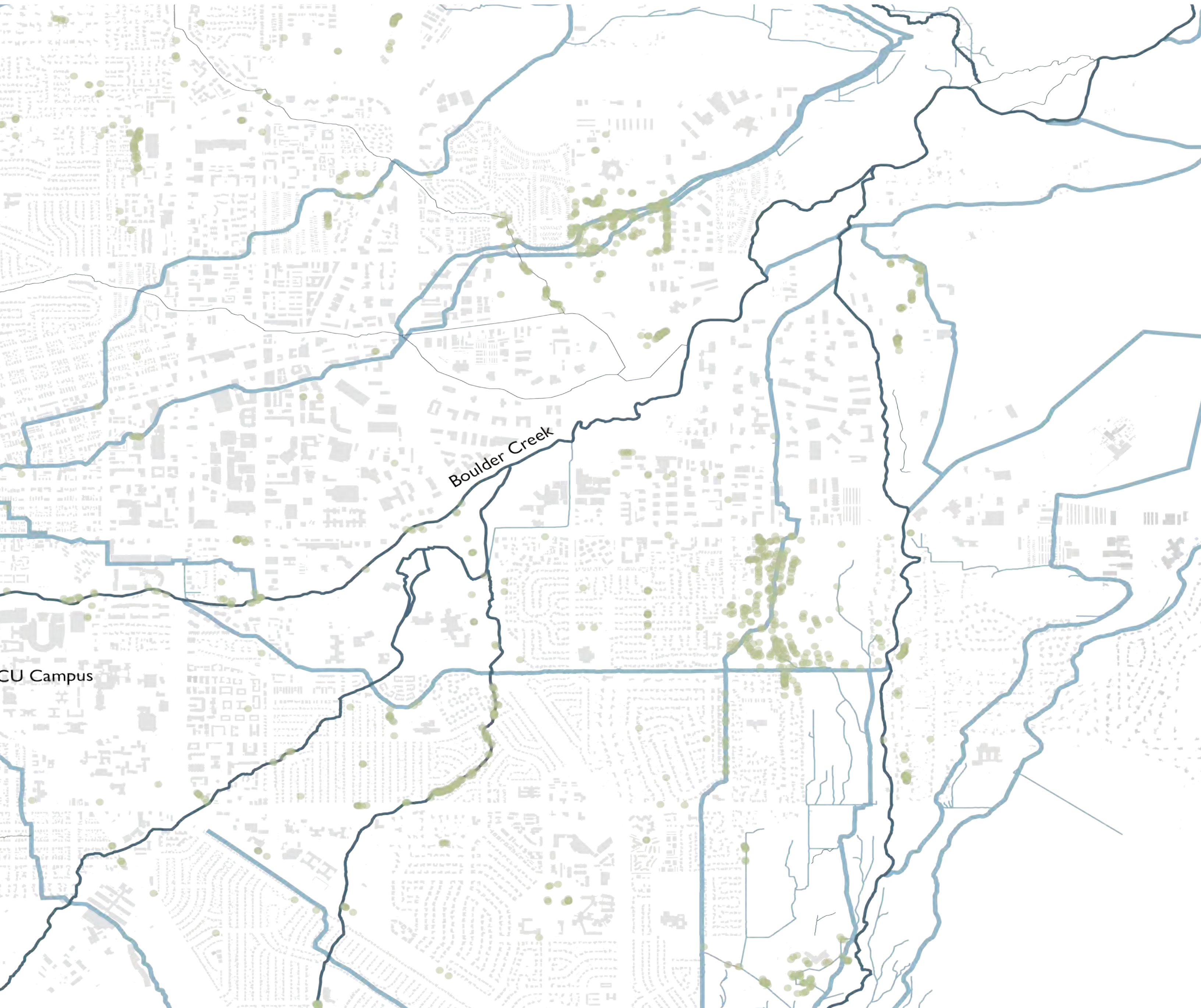
In Northern Cheyenne culture, a Cottonwood post is placed in the center of each Massum Lodge. During the winter, Cottonwood was used to feed horses and dry branches to start fires. In the Spring, the inner bark was sometimes eaten. The buds of Cottonwood trees were ground to create white, green, red, and purple dyes for paint (Hart 1981, 37).

Strong community and individual relationships between humans and trees continue into the modern day. A study conducted in Finland from 2019-2020 from a survey of 1,662 participants found that 68% of respondents had a favorite tree. Results concluded that individual relationships with trees bring joy, admiration, nostalgia, and the opportunity to nurture something larger



Cottonwood and Irrigation Map (figure 4) than oneself (Vainio et al. 2024). In Melbourne, Australia, city officials created an email account intending for citizens to report tree concerns and maintenance needs. Instead, the inbox was flooded with emotional responses dedicated to the trees themselves such as, "Dear 1037148, You deserve to be known by more than a number. I love you. Always and forever" (Phillips and Atchison 2020). These studies show the potential to approach urban trees with the goal of ongoing co-relationships. This shift in perspective and process is especially important because urban tree canopy is declining in major US cities (Roman 2014).

Cottonwoods' habitable range has expanded dramatically thanks to human development. Cottonwoods only live in riparian soil conditions, a scarcity in the plains biome. However, due to man-made irrigation systems, Cottonwoods have benefited from an increased habitat. The map below overlays individual Cottonwood trees and the irrigation ditch system of Boulder, Colorado, illustrating the relationship between Cottonwood trees and infrastructure.



METHODOLOGY

Speculative Design

Methods

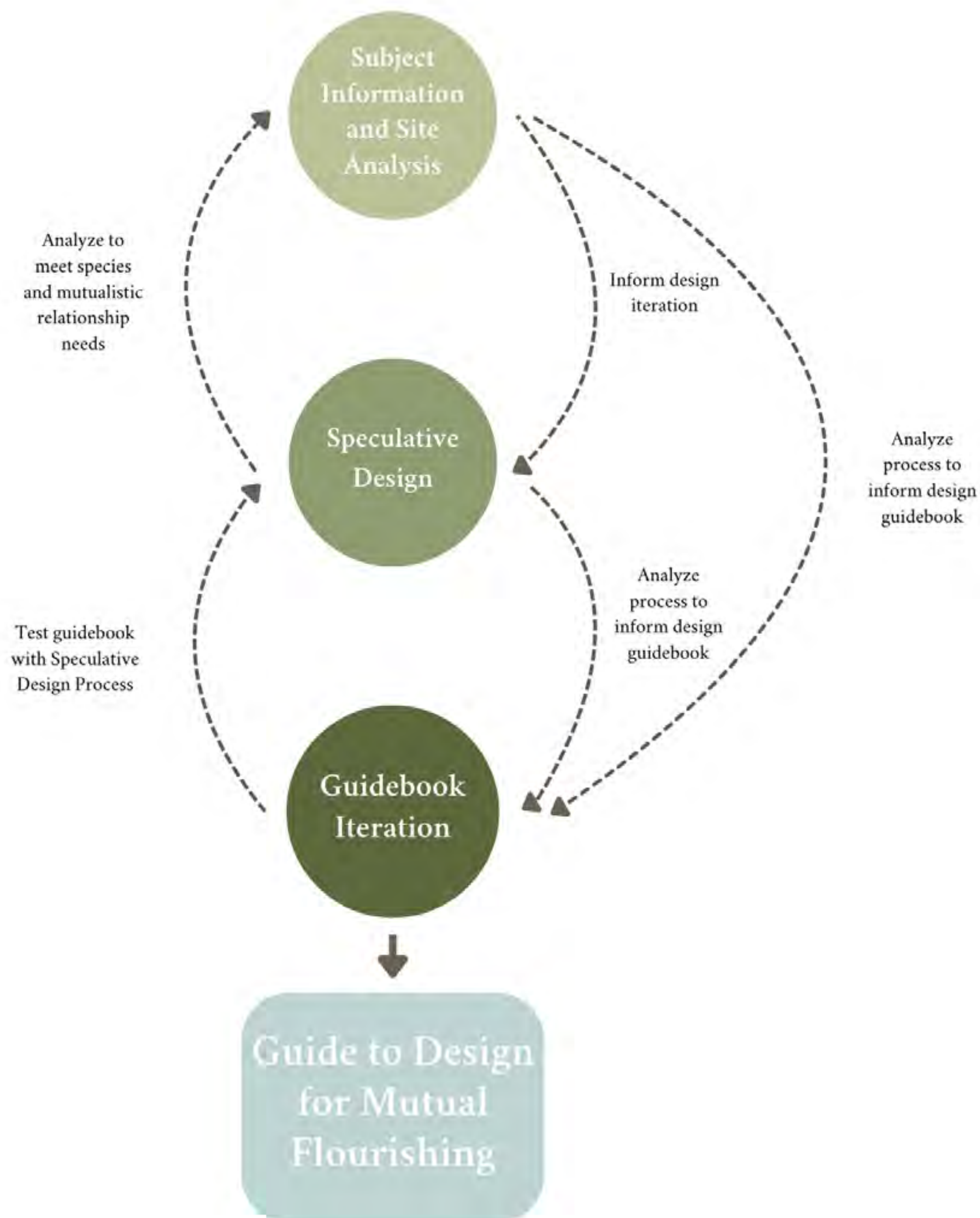
Speculative Design:

Speculative design is a term coined by designers Anthoney Dunne and Fiona Raby in their book *Speculative Everything* and is a key component of my research. Speculative design is an extension of critical designs that present "testimonials to what could be, but at the same time, they offer alternatives that highlight weaknesses within existing normality" (2013, 35). Though initially created in response to emerging technology, critical design is a process that can be used to comment on any component of the status quo. Speculative design goes one step further in offering a preferable alternative future. As stated by Dunne and Raby, the goal of speculative design is, "not in trying to predict the future but in using design to open up all sorts of possibilities that can be discussed, debated, and used to collectively define a preferable future for a given group of people" (2013, 6). The result of these designs can act as a catalyst for public debate on what people truly want for the future of our society. As research, speculative design is a process used to create a concept for a hypothetical scenario. It uses design as research to question current conditions and visualize alternate futures in which different values are upheld (Galloway and Caudwell 2018).

Methods:

The focus of this research is the mutually beneficial relationships themselves. To explore the process of designing for mutual flourishing, I chose the subject relationships between humans and three other species: Barn Swallows, Sweetgrass, and Cottonwood trees. The parameters for selecting these subjects are native Colorado species that benefit humans culturally and/or ecologically and in return receive benefits from humans. I also selected two vacant urban lots to be the sites for speculative design. The parameters I considered for site location were size, urban density, and proximity to water.

This thesis utilizes a cyclical process of speculative design and analysis to create a defensible and usable guidebook on designing for mutual flourishing. As discussed, speculative design offers preferable alternative futures. It is an inherently theoretical practice, so designs



Methodology Diagram (figure 5)

are not yet physically built or tested (Galloway and Caudwell 2018). However, because this is a research project, the designs still must be analyzed and based on factual information. To do so, I formed three components that I continually analyzed and compared with each other. The first is research inventory and analysis of information on my subjects' mutualistic relationships and the current conditions of the two sites. Second is two speculative design collages that imagine redesigned urban spaces to support the subject relationships. The designs consist of a combination of hand-drawn sketches and digital rendering in Photoshop. I used this research and speculative design process to both create and test the third component; a design process for mutual flourishing shared through an interactive guidebook.

First, I reviewed primary and secondary sources to identify specific co-benefits and species needs. The primary documents I reviewed include the CU herbarium collection, accounts of TEK, digital message boards, County of Boulder GIS datasets, and design project precedents. From this information, I analyzed each species' needs to find specific design requirements. The design characteristics I focused on are plant choice, water quantity and quality, soil type, lighting/sun, materiality, and structure/form. I then used the information on co-benefits to identify design requirements such as species-human proximity, the need for a gathering space, educational elements, and maintenance.

Site inventory and analysis encompass many different procedures for inventory of space. I visited each site to experience how the spaces felt like in person, taking pictures and notes on physical sensations, smells, and noises in the area. Notes also included signs of plant, animal, and human use. Additionally, I created sketches on observations that stood out to me. Outside of site visits, I looked into the history of each site through ArcGIS maps, Google Earth, and the real estate resources, Zillow. The culmination of this information was used to determine the habitat quality of current site conditions along with opportunities.

The speculative design process began with photographing the three empty lots to act as the base for the collages. I started design iterations with loose sketches and ideation, informed by my previous research. Then, each iteration was compared to the specific species and habitat design requirements. This cycle was continued until all design requirements were met, and all speculative design elements were supported by data. Once finalized, I refined the visual elements for each speculative design and added annotations necessary. Materials for the speculative collages include colored pencils, images, and Adobe Photoshop.

I constructed the guidebook in conjunction with the research and design process. As I was working with the test subjects, I identified questions and activities that could be informative to the research and design process. After collecting useful activities, I used the subjects' mutualistic relationships as a test to see if the questions and exercises were useful and covered all aspects of designing for mutual flourishing. I then edited the guidebook accordingly and repeated iterating to ensure the quality, clarity, and relevance.

FINDINGS

Species and Habitat Design Needs

Human Design Needs

Current Conditions

Speculative Designs and Analysis

Species and Habitat Design Needs:

To relate knowledge of species' needs and preferred habitats to design elements, I organized information into six design requirements often prioritized in landscape architecture practice: plants, water, soil, lighting, material, and form. Plants are a main building block in landscape design and can either support or harm the subject species. Water presence and needs often dictate the site's microbiome, where plant species will thrive, and inform grading changes and irrigation needs. Soil composition is based on the percentages of sand, silt, and clay particles and can be altered during site preparation before design construction. Plants prefer specific types of soil composition and can even improve soil quality through nitrogen fixation and phytoremediation. Lighting refers to both sun requirements for photosynthesis and artificial lighting that can affect species. Material refers to anything abiotic in the design, often used for structures, furniture, or pathways. Lastly, the form indicates the shape, size, and spacing of the design elements. These categories broadly apply to most species' habitat needs while addressing specific design considerations.

Species and Habitat Design Needs:

	Plants	Water	Soil	Lighting	Mater
Barn Swallows	Barn Swallows rely on plants that attract flies (the largest part of their diet are crane flies (Tipulidae), horseflies (Tabanidae), and robber flies (Asilidae)). They need fine grasses to be used in nest construction and proximity to open fields for foraging (Brown and Brown 2020).	Barn Swallows depend on water source to provide mud for nest building (Brown and Brown 2020).	Makeup from mud sampled from a Barn Swallow nest in Montana: 56.4% sand, 31.5% silt, and 11.9% clay (Brown and Brown 2020).	Barn Swallows feeds on insects attracted to light or artificial light at night (Brown and Brown 2020).	Avoid vi metal sic causes o for chick use woo concrete is often v nests. Th been exa human h in nest c as well. Brown 2
Sweetgrass	Sweetgrass population abundance has a negative relationship with the presence of red clover, wild carrot, and nonnative dicots (Shebitz' and Kimmerer 2004, 101). It pairs well with other short native grasses and taller perennials (Nadia Hassani, 2024).	Sweetgrass has been found and examined growing in wetlands such as salt marshes, fens, swamps, and marshes along with dry roadsides (Shebitz' and Kimmerer 2004, 99).	The PH of observed Sweetgrass sites is 5.01 to 7.63 and sand content was 42.6%, to 94.2% (Shebitz' and Kimmerer 2004, 101). Sweetgrass prefers moist, sandy soil over clay and its root structure excels at erosion control (Nadia Hassani, 2024).	Sweetgrass has been recorded growing under tree canopies from 0% to 56.6% (Shebitz' and Kimmerer 2004, 101). Requires partial to full sun for at least half of the day (Nadia Hassani, 2024).	N/A
Cottonwood	Invasive riparian plants such as Russian Olive and Tamarisk can displace Cottonwoods by outcompeting for water ("Cottonwood Management" 2015).	Cottonwoods must have close proximity to water sources such as lakes, rivers, streams, irrigation ditches, or lowland areas ("Cottonwood Management" 2015).	Cottonwoods can thrive in all soil types except constantly water-logged. They are tolerant to saline, pollutants, and a wide range of PH levels.	Cottonwoods can tolerate sun, partial shade, and full shade.	N/A

Human Design Needs:

rial	Form	Proximity	Infrastructure	Maintenance
inyl and ding as it verheating ks, instead d or e. Horse hair woven into here have amples of hair found onstruction (Brown and 2020).	Barn swallows prefer sites that have evidence of old nests and will reuse old nests for many years. They build nests on vertical walls with covered overhangs frequently atop a horizontal ledge, rafter, or light fixture. Willing to fly through small windows or openings to reach nests (Brown and Brown 2020). Barn swallows need at least 20 inches of space between each other. Most nests are built 6-10 feet above the ground (Daly 2021).	Barn Swallow proximity to human gathering spaces lowers mosquito and other pest populations.	Space for humans to observe barn swallows “dance” as they hunt for insects.	Do not use pesticides, insecticides, or herbicides as they are detrimental to Barn Swallow’s health.
	Since Sweetgrass spreads prolifically through rhizomes, it is best planted in large swaths or drifts. Each plant can grow between 10 to 24 inches in height and spread up to 24 feet (Nadia Hassani, 2024).	In order to harvest Sweetgrass, people need safe and easy access to the plant (Grabbatin, Hurley, and Halfacre 2011, 639).	Gathering Spaces are needed to host weaving classes or space to sell baskets. Grabbatin, Hurley, and Halfacre 2011, 639).	Maintaining wetlands, controlled burning, and sustainable harvesting practices contribute to Sweetgrass population growth (Shebitz’ and Kimmerer 2004, 108).
	Cottonwoods are the fastest-growing native tree in Colorado growing at a rate of up to 13 feet per year. Their height and canopy spread can exceed 100 feet.	When Cottonwoods are established near urban waterways, they can mitigate flood devastation by stabilizing soil, slowing flood water runoff, and increasing water infiltration (“Cottonwood Management” 2015).	Space to comfortably enjoy spending time outside in the summer in the shade of the Cottonwood tree.	Cottonwood regeneration can be promoted by cutting down one healthy tree so the intact root system can sprout suckers to grow into more trees (“Cottonwood Management” 2015).

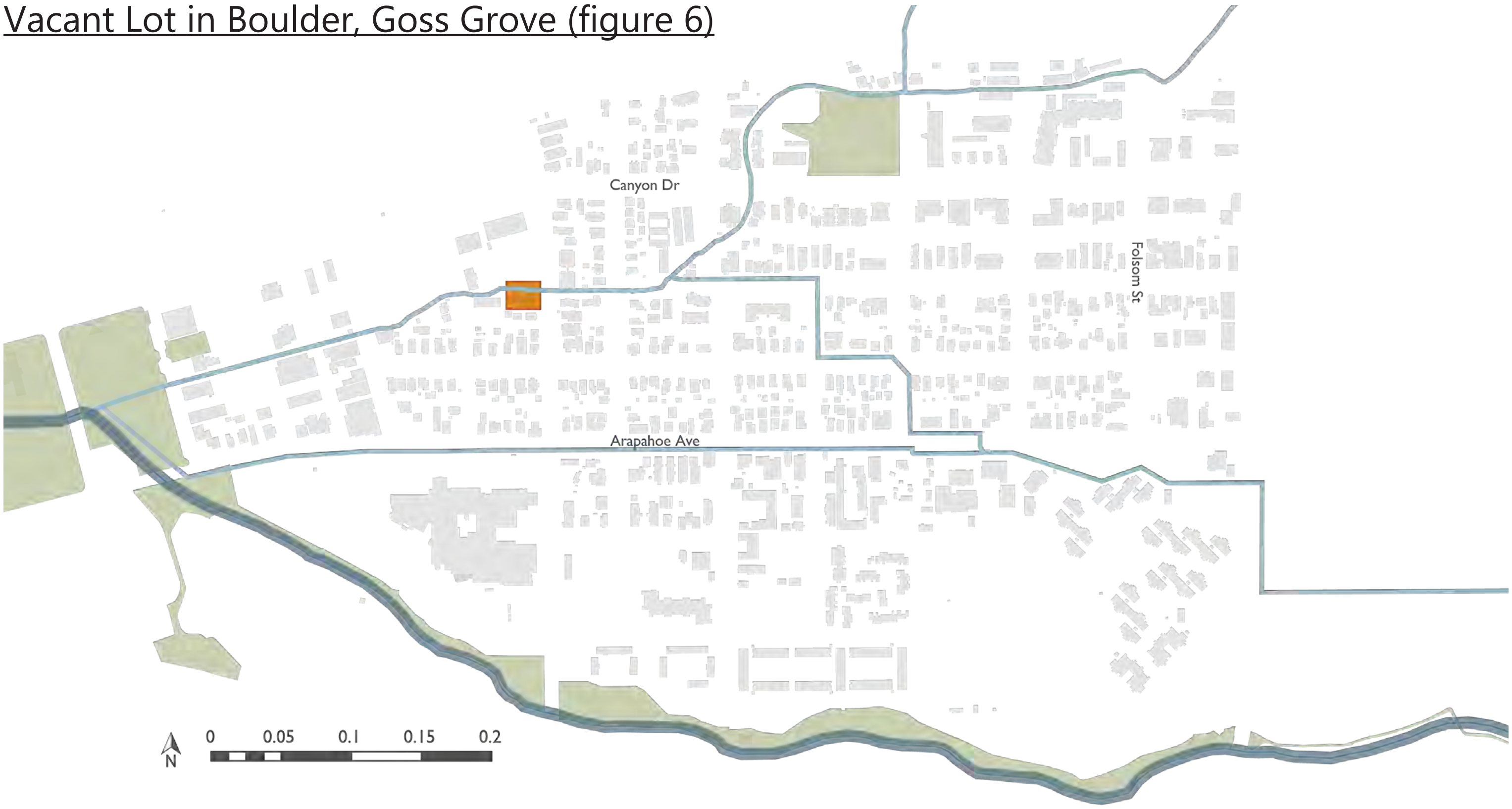
Current Conditions:

The primary way urban landscapes are designed and developed leads to immense environmental degradation. Urban development heavily impacts habitat loss, biodiversity, and watershed health (Zipperer, Northrop, and Andreu 2020). Globally, 13 million hectares of forest are destroyed annually for agriculture, urban development, and infrastructure use. This not only demolishes forest habitat, but the system of roads and urban infrastructure creates fragmentation, lowering the quality of surrounding environments. This loss of habitat space in forests and other less-researched biomes causes decreases in species diversity and abundance (Zipperer, Northrop, and Andreu 2020, 11). Additionally, urbanization impacts water quantity and quality by lowering rates of water infiltration, increasing stormwater runoff, and altering natural waterways and related ecologies. Highly vegetated landscapes can infiltrate up to 50% of rainwater to replenish groundwater. If these spaces are urbanized and vegetation levels and soil health are decreased, only 15% of water is infiltrated, increasing stormwater runoff (Zipperer, Northrop, and Andreu 2020, 5). Another effect of urbanization is the Urban Heat Island Effect, in which heat-absorbing building materials such as asphalt and concrete increase surface and ambient temperatures by up to 5° during the day and 11° at night (Zipperer, Northrop, and Andreu 2020, 13).

One way to begin addressing these issues is by increasing urban forestry, urban plant diversity, and permeable surfaces. Many cities in the United States have attempted to increase their urban canopy through programs such as the Million Tree Initiative. These programs centered around planting trees often fail to consider care when planting and long-term maintenance, leading to only half of trees surviving for more than 20 years (Roman 2014). A survey of 20 major cities showed that since 2009 17 cities' tree canopy decreased and 16 cities' impervious surfaces increased (Nowak and Greenfield 2022). Vacant lots are an opportunity to improve these current conditions through ecological health and human-nature relationships.

Site one is a small-sized vacant lot in Goss Grove, a mixed-density neighborhood in Boulder. Site two is a medium-sized vacant lot located in Valverde, Denver between an industrial and residential zone.

Vacant Lot in Boulder, Goss Grove (figure 6)



Vacant Lot in Denver, Valverde (figure 7)

Boulder Site Current Condition

(figure 8):

Boulder Site Current Conditions:

ns

The first site is located in central Boulder on 17th Street and Canyon. The lot, previously developed as a single family house, is .225 acres and is currently vacant. The site is in a busy location as students from both CU Boulder and Boulder High School walk by on their commute to class. Proximity to Pearl Street and downtown Boulder also increases visitors. As seen in the above collage, the site does not have high-quality ecological habitat or space for human use. The majority of the vacant lot consisted of densely packed clay soil, unable to support diverse plant ecologies. The creek segment on the right side of the site is sunk four feet below the existing grade, much steeper than a naturalized river form, limiting the riparian habitat. Additionally, the lot is currently fenced off, discouraging any human use.

At the time of my observation, the site was overgrown with weeds and leaf litter. Though this made the space challenging for me to navigate, it provides valuable habitat for hibernating insects, particularly native pollinators. I heard bird calls from the trees in the back corner of the site. However, I did see several marker flags indicating the location of underground infrastructure. When I returned to the site in January, the vegetation and ground cover had been cleared and a fence was built to prepare for construction, destroying the natural habitat that existed. Vacant sites are inherently dynamic, whether change is from nature's reclamation or human development.

There is opportunity in the site's adjacency to the Boulder left-hand ditch, mountain views, and residential neighborhoods. There was a mature Cottonwood tree on the back right corner of the site, though humans were unable to enjoy the tree's full benefits. Unfortunately, the Cottonwood tree was recently removed to prepare for construction.

Val

Valverde Site Current Conditions:

The second site is a vacant lot located in Valverde Denver at 1996 W Bayaud Ave. The site acts as the edge between a residential neighborhood and industrial zone. It borders a large but underutilized public park and is 2,000 feet away from the South Platte River, a vital habitat corridor. The lot itself is .48 acres and was a residential single-family home from 1993 to 2014. As seen in the current conditions, the site does not have quality ecological habitat or programming for humans. When visiting the site, the only signs of life I observed were an ant hill, some remnants of lawn, and two sprouted Siberian Elm stumps. Siberian elm is invasive to Colorado and can out compete with native species for water. Some broken glass, litter, and ATV tracks were the only signs of human use.

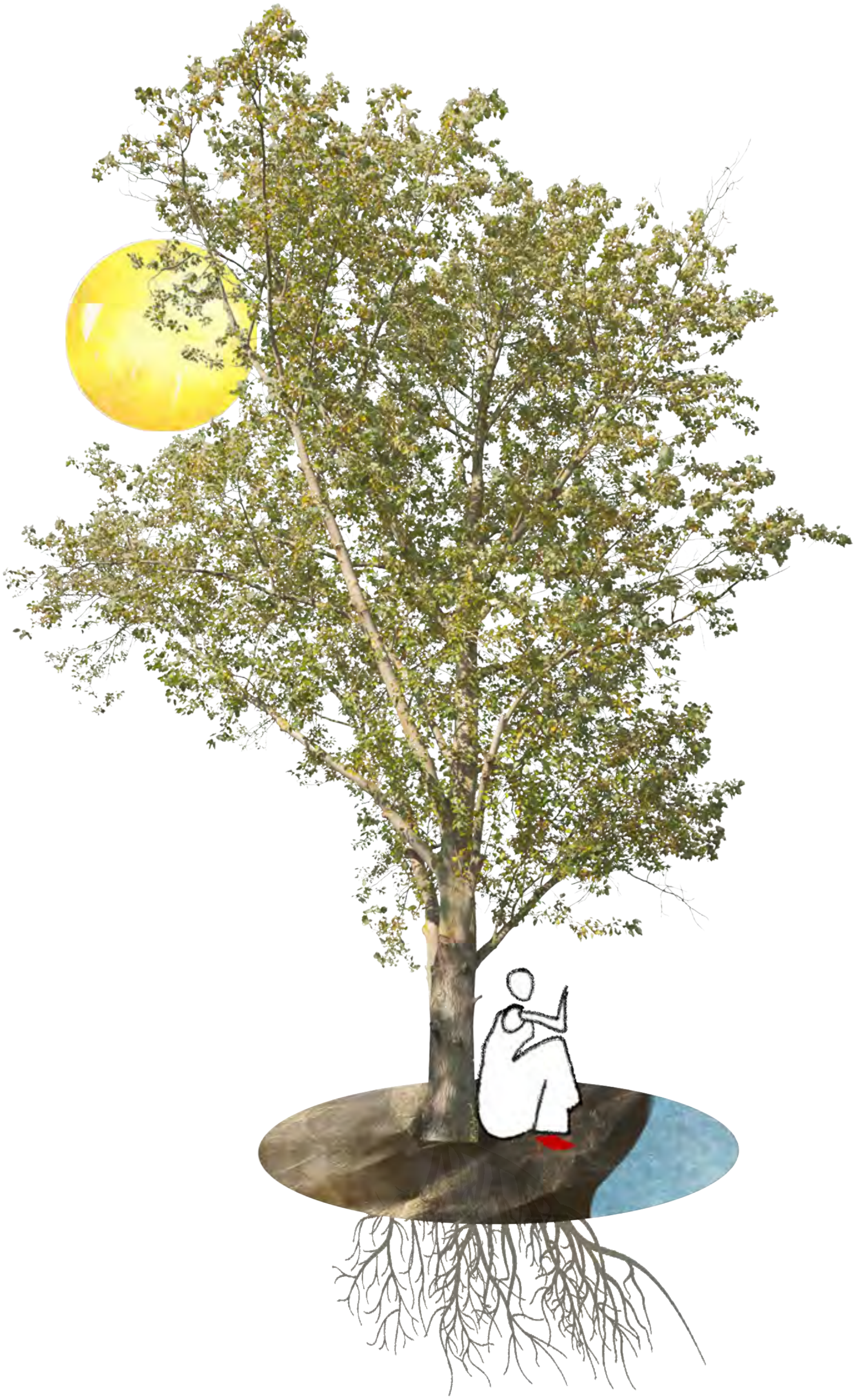
Visiting the site was an overwhelmingly uncomfortable experience. The sun was exceptionally bright due to the lack of trees or shade structures and wind lifted dust into the air. The vast and empty site offered no sense of refuge from the unpleasant sounds and smells emanating from the semi trucks and industrial district. However, opportunities to create a much-needed shaded outdoor recreation and gathering space exist in the site's proximity to the residential area. Proximity to the South Platte River provides the opportunity to address water quality, mitigate potential flooding, and expand the important habitat corridor.

verde Site Current Conditions

(figure 9)

Moments of M

(figure 10): The primary goal of these speculative designs is to
subject Colo



Cottonwoods provide shade and
a place of refuge for relaxation.
Humans provide irrigation for the
Cottenwood’s water needs.

Sweetgrass
material fo
practices. Ha
stimula

Mutual Flourishing

imagine space for mutual flourishing between humans and the three
rado native species.

provides a fragrant
r important cultural
arvesting by humans
tes new growth.

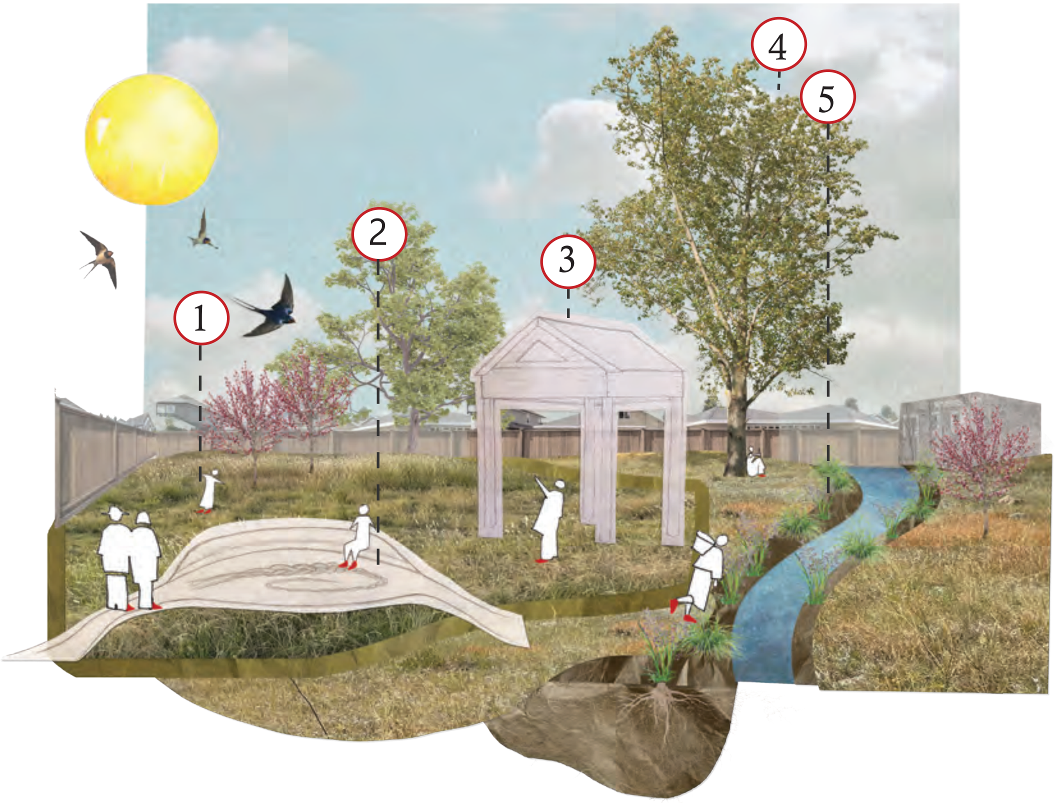
Barn Swallows eat pests and provide artistic and cultural inspiration. Humans provide structures needed for nesting and artificial nests.

Boulder Speculative Design Collag

(figure 11)

ge

1. Native Grass and Perennial Meadow
2. Gathering Space
3. Nesting Structure
4. Cottonwood Support
5. Riparian Garden



1 Native Grass and Pe

A combination of Color
Gramma, Bouteloua gracilis, Big
gerardii, Yellow Indiangrass, Sorg
Perennials (American Wild Plum,
Bee Balm, Monarda fistulosa, and
Penstemon secundiflorus) planted
will provide excellent foraging hab
and pair well with Sweetgrass. Th
grasses attract insects essential to
and the grasses are an ideal mater
construct nests.

2 Gathering Space

This medium-sized gath
a stamped concrete floor and a lar
bench. The path will connect the
gathering space, inviting human v
curved bench provides a space to
Swallows forage for insects. The c
with a spiraling sweetgrass braid,
woven basket, to highlight the cul
plant. The gathering space can be
to sit and braid or as a venue for s

How Are Design Needs Considered?

	Plants	Water	Soil	Lighting	Material	Form
Barn Swallows	1.	5.	5.	3.	3.	3.
Sweetgrass	1.	5.	5.	4.	n/a	5.
Cottonwood	5.	4.	4.	4.	n/a	4.

erennial Meadow
ado native grasses (Blue
Bluestem, Andropogon
hastrum nutans) and
Prunus americana,
l One-sided Penstemon,
in natural formations
bitat for Barn Swallows
ese perennials and
Barn Swallows diets,
ial for Barn Swallows to

hering space will feature
rge curved wooden
busy sidewalk to the
isitors. The comfortable
rest and watch the Barn
oncrete patio is stamped
inspired by the base of a
tural importance of the
used for basket weavers
mall basketry classes.

3 Nesting Structure

The new nesting structure mimics the form and material of Barn Swallows' ideal traditional barns and is inspired by successful structure precedents. The structure is ten feet tall, made from wooden planks, and includes rafters that Barn Swallows need to support their nests. The roof and enclosed upper third will insulate the structure while still providing easy access for the birds. The structure will include artificial clay nests to attract Barn Swallows for the first few breeding seasons until they establish their own nests. The nests will face the foraging habitat to increase chance of nesting.

4 Cottonwood Support

Due to the removal of the mature Cottonwood tree, a new tree must be planted in the back right corner of the site. This space, where the previous tree thrived, is an ideal location since it is next to the Left-Hand Ditch, meeting the Cottonwood's water and soil needs. The space is far from surrounding houses and roads ensuring fallen branches are not a safety concern. This tree will create shade and a comfortable space for humans to rest, find refuge from the fast paced urban environment, and contemplate one's interspecies connections.

5 Riparian Garden

In order to create more riparian habitat, I expanded the bank of the Boulder and Left-Hand Ditch to mimic a natural stream. This new riparian habitat will support Sweetgrass' water and soil needs. The garden will also be easily accessible to people via a path from the gathering space. The new riparian garden can be used by Barn Swallows to gather grass strands and mud for constructing their nests.

	Proximity	Infrastructure	Maintenance
Barn Swallows	2.	2.	
Sweetgrass	5.	2.	
Cottonwood	4.	4.	4.

Valverde Speculative Design Collag

(figure 12)

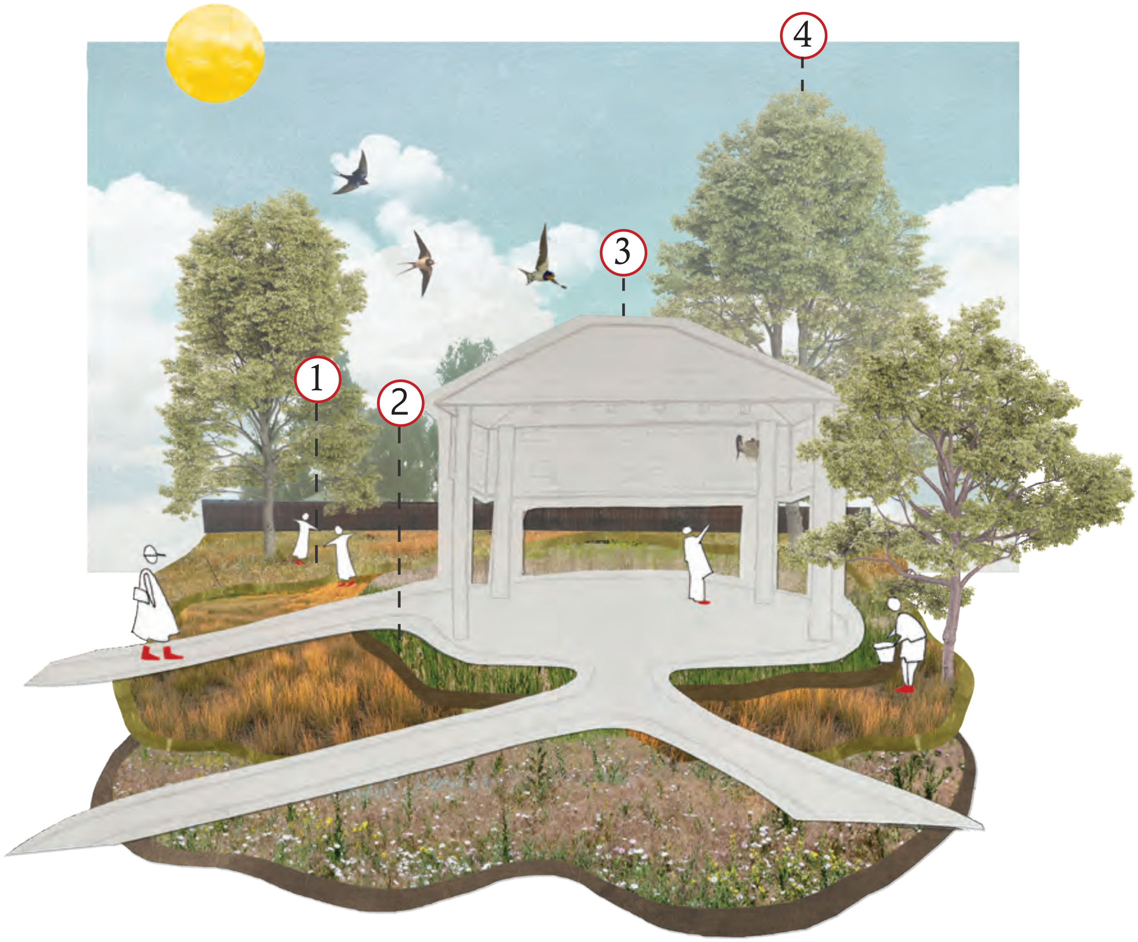
ge

1 Native Grass and Perennial Meadow

2 Sweetgrass Rain Garden

3 Nesting Structure and Gathering Space

4 Cottonwood Grove



1 Native Grass

Similar to the Bo
created with a combinatio
Gramma, Bouteloua graci
gerardii, Yellow Indiangra
(American Wild Plum, Pr
fistulosa, and One-sided P
will attract insects essenti
foraging space and the gra
Swallows to construct nes
create a comforting barrie
industrial zone.

2 Sweetgrass R

The Sweetgrass
the nesting structure roof
habitat. The gardens locat
range and is accessible by

How Are Design Needs Considered?

	Plants	Water	Soil	Lighting	Material	Form
Barn Swallows	1.	2.	2.	3.	3.	3.
Sweetgrass	1.	2.	2.	2.	n/a	2.
Cottonwood	1.	4.	4.	4.	n/a	4.

and Perennial Meadow

oulder speculative design, a meadow
n of Colorado native grasses (Blue
ilis, Big Bluestem, Andropogon
ss, Sorghastrum nutans) and Perennials
unus americana, Bee Balm, Monarda
Penstemon, Penstemon secundiflorus)
al to Barn Swallows diets, create
sses are an ideal material for Barn
ts. The height of the native grasses will
r protecting human senses from the

ain Garden

rain garden will collect rainwater from
to create the preferred soil and water
ion fits Sweetgrass' preferred shade
human gatherers from the pathways.

3 Nesting Structure and Gathering Space

The structure acts as both a large gathering space and a nesting structure capable of supporting many Barn Swallow pairs. The wooden roof and partial walls provide a safe nesting structure for Barn Swallows and protection from the sun and wind for humans. Solar powered lights can be attached to the structure to attract insects for Barn Swallows to forage and allow humans to use the space safely in the evening. The space can be used for individuals to relax, large groups to host classes, or special events where the proximity and relation with other species is a feature.

4 Cottonwood Grove

The Cottonwood Grove will create a beautiful space for play and relaxation. The trees' stunning height will produce a sense of grandeur for people, further grounding them in their connections with and place in nature. The trees will require initial irrigation to establish their roots, and later maintenance to promote regeneration for an even denser grove. This provides the opportunity for sustained relationships and caretaking.

	Proximity	Infrastructure	Maintenance
Barn Swallows	3.	3.	1.
Sweetgrass	3.	3.	3.
Cottonwood	4.	4.	4.

DISCUSSION

Discussion:

This research claims that landscape architecture projects have the potential to support mutually beneficial relationships between humans and other species by uplifting co-benefits and increasing urban habitat space. Furthermore, an interactive guidebook will help designers apply this process to create more mutually beneficial spaces and expand their perspective to include humans' potential for positive interspecies relationships. This claim is supported by two speculative design collages focused on three examples of mutually beneficial relationships between humans and Colorado Native species.

Site inventory and analysis of the two current vacant lots conditions revealed a significant deficit of high-quality ecological habitat and space for human enjoyment. However, all sites had strengths to build upon. For instance, the Boulder vacant lot's adjacency to the Left-Hand Ditch is an opportunity to support habitat biodiversity. The speculative designs reveal how each site can support mutually beneficial relationships when species and relationship needs are carefully considered. Currently, none of the two sites meet design requirements for human needs and only one or two per species' needs. Analysis of the final speculative design iterations shows that 48 of the 50 design requirements are met. The design element that fulfilled the most requirements is the Riparian Garden in the Boulder Speculative Design and the Nesting Structure and Gathering Space in the Valverde Speculative Design. Additionaly, each speculative design synthesizes all design requirements into clear concepts that support the three exemplar species and encourages humans to learn about and build beneficial interspecies relationships.

I created an interactive guidebook in conjunction with the research and speculative design process. This exercise allowed me to understand what questions, activities, organizational methods, background information, and goals are best suited to designing for mutual flourishing. The success of the speculative designs shows how the guidebook can help landscape architects create projects that support mutual flourishing. The process revealed that the guidebook also expands the designer's perspectives to explore personal experiences around positive connections with other species.

Furthermore, this new design process led to unexpected effects for other species beyond the three subjects. Since ecological systems are so interconnected, intentionally supporting specific species leads to increased overall environmental health. For example, the Native Grass and Perennial Meadow in the Boulder speculative design would also support pollinators and other bird species. The Riparian Garden would improve water quality through phytoremediation and stormwater management.

CONCLUSION

Conclusion:

My exploration of positive relationships between humans and other species inspired this research. In an age marked by widespread climate anxiety, I sought to discover a hopeful perspective, grounded in science, to inspire a fresh approach to landscape architecture. Though this thesis successfully illustrates the possibility of a future in which mutual flourishing is uplifted through landscape architecture, the journey revealed significant complications and limitations, as well as extremely degraded current urban conditions.

Throughout the research process, I discovered that information on positive relationships between humans and other species in strictly the Western Science Canon is extremely limited, often missing altogether. By expanding my definition to include Traditional Ecological Knowledge (TEK), I am able to understand culturally important species holistically. However, TEK is often shared solely through oral tradition and excluded from publishing, causing recorded information to again be limited and difficult to uncover.

Despite our understanding of the enumerable benefits of urban green space and biodiversity, the current design of urban environments is incredibly harmful to urban biodiversity and human-nature relationships. Additionally, prevailing design theory is human-centric, prioritizing aesthetics and human programing over holistic ecological health. However, this thesis shows that a deep understanding of these complex conditions and relationships can change urban landscape theory and architecture.

Since the scale of this project is limited, several next steps and additional lines of inquiry arose during my exploration. Looking forward, I suggest building and monitoring the designs' success through post-occupancy evaluations and studying the ecological impacts. I would also collect feedback from landscape architect professionals on the effectiveness of the framework to direct a final iteration of the guidebook. This thesis focuses on individual landscape designers and Architects leaving support for mutual flourishing at an urban planning and city policy scale yet to be explored.

Overall, this approach not only increases urban biodiversity and supports native species, it strengthens people's connection to our place in nature. Showcasing the positive relationships humans can have when considered as integral parts of the ecosystem encourages a crucial shift in perspective, furthering humans' potential for positive relationships with other species.

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Image Credits

Appendix

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Image Credit:

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Appendix

Posts from "Habitat Talk: A place for property managers to share information; Barn Swallows." https://habitat-talk.com/threads/barn-swallows.7676/.

Jun 21, 2017

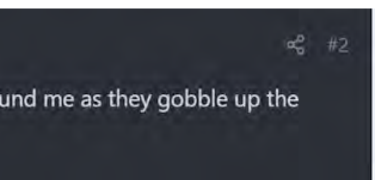
One of my favorite things about summer is when I'm mowing the lawn or running the brush hog and flocks of Barn Swallows fly circles around and arou
bugs in the air. They are the most graceful fliers. I definitely have a soft spot for them.

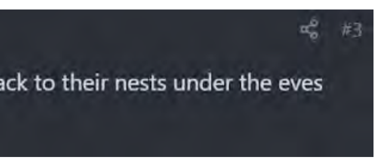
Jun 22, 2017

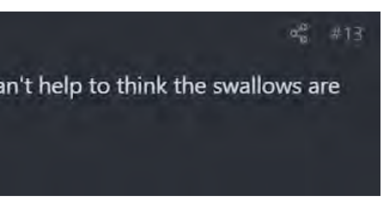
Early summer mornings are great when I have about 25-30 of them flying around the back of our barn. They are eating a ton of insects taking them ba
and feeding the chicks.

Jun 25, 2017

I have a bunch in my old building at the farm. A buddy and I fished till dark on a pond bank before we noticed the first mosquito. Not sure why, but ca
part of it.


#2
und me as they gobble up the


#3
ack to their nests under the eves


#13
an't help to think the swallows are