

# Batty Landscapes





# **Batty Landscapes**

Rethinking Urban Pests

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## **Acknowledgements**

This project would not have gotten as far as it has without the push of my thesis professor David Hill. I'd also like to thank my parents for financially supporting me to give me this opportunity. Lastly I'd like to thank John Anderson for introducing me to the field of landscape architecture.





How can the presence and value of bats in Florence, Alabama be made legible throughout the city, whilst also attempting to address the issues of White Nose Syndrome

# Abstract

As a species we humans dominate the lands in which we live. Because of this we have started to lose respect for other species and often quickly dismiss them. This thesis looks to address this issue and change the way in which we value species. The species chosen to be the focal of this study is bats, as bats are one of the most misunderstood species and are often considered a pest. Bats however are one of the most ecologically valuable species in the world and benefit the lives of humans in tremendous ways. The goal of this thesis is to use bats as a tool to get people rethinking the way in which they value species by creating a shared realm in which both people and bats coexist. The project takes place in Florence, Alabama, a city surrounded by a healthy bat population, and attempts to make visible the presence and value of these bats. The design attempts to draw the bats in to the heart of the city by using a series of “bat trails”. These trails, composed of gardens and various light structures, act as insect attractors, which in turn attract bats as insects are the food source for nearly all species of bats in the United States. This introduction of bats in to the city is further supported by the creation of a large scale bat roost, called “The Bat House”. This structure not only supports the bat population but it also acts as an iconic feature within the heart of the city that the residents can identify and associate with the bats. The most important aspect of the structure however is its potential to combat white nose syndrome, a deadly fungus that has killed over six million bats in as little as seven years. The hope is that the city can not only rally around the bats and help them to survive this threat, but that the city also sees a shift in their thinking and readdresses the way in which they handle other ecologies.

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# Introduction

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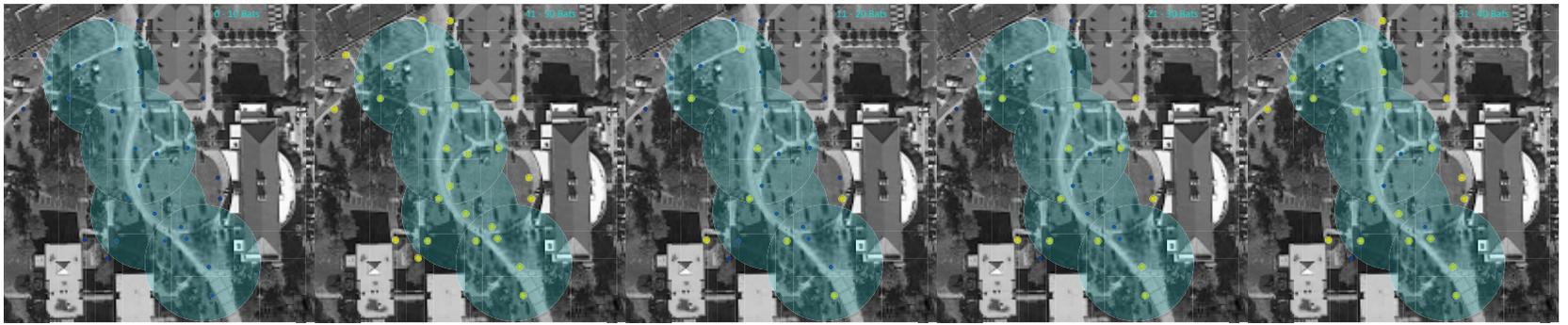


## Theoretical Framework

The framework for this thesis is based around the idea of working with unwanted and undesirable forces, and doing so within the public realm. This framework is composed of five key overarching themes that act as a lens through which I choose to view the field of landscape architecture with. These themes are the constants that I carry forward throughout my work which then adapt to the specifics of each project. The five themes include utilitarian principles, ideas of inconvenience, education, and mutualism, all whilst taking place within the public realm. In regards to utilitarian principles, the main goal of every project is that it works for the greater good and benefits as much of the larger ecosystem as possible. This idea is centered around the fact that in the past we as humans have been very quick to push ecology out of the places we inhabit, and because of that we now tend to dominate the lands in which we live. Though we have started to see a shift in this thinking, the landscapes we design are still primarily focused on human activity, which in turn creates inconvenient landscapes for a majority of non-human species. By removing the focus from human activity and giving more emphasis to the things we share the world with, we can balance the scales and create landscapes that are ultimately beneficial for all. This ties directly in to the theme of mutualism by having each force support and benefit one another. The final three themes all somewhat tie together directly. Creating landscapes that educate is extremely important, and is something that should be done in a way which subconsciously lets the visitor learn, not having to depend of signage or text to explain the happenings. It is so important to educate because often the negative impacts we have on things are a result of our lack of understanding. The best example of this would be in regards to habitat destruction, in that often we wipe out key areas of habitat for species without ever even knowing they were present until it is too late. Educating with landscapes also gives people the chance to understand the systems in which they live, and see how they benefit from these systems. By having all of this take place within the public realm it not only increases the exposure of the project but it helps facilitate the educational process with it being presented to larger populations. Inconvenience plays a somewhat special role in that it really connects to the idea of working with the unwanted and undesirable and how these forces will initially create an inconvenient or uncomfortable landscape. The eventual goal is that as people learn to understand and appreciate these forces, they no longer are considered inconvenient or uncomfortable and are instead welcomed. While these forces could be a wide variety of things, for the sake of this thesis it has been narrowed down to animal species, more specifically bats. The idea of addressing animal species was chosen because it is what I see as the largest gap within the field of landscape architecture. As previously mentioned, human activity and social conditions are typically the primary focus of designs, and they are often achieved through the use of various materials and plant species, often ignoring animal species. However, as people I believe we have the responsibility to assist and restore the things that we have put in danger, and I believe that landscape architecture has the tools to do this. A big part of this issue though is centered around the way in which we value species as a whole and on an individual level.

## The Value of Species

When discussing the value of species, opinions will vary depending upon who it is you are talking to. These opinions will range from things like all species being valuable, to just megafauna species being valuable, to just those species that directly benefit us as the ones that are valuable. What makes it so difficult to discuss is the way in which we characterize the value and the fact that the deeper the discussion goes, the more convoluted and contradictory it often gets. Because of this, I find the best answer to be that every species is indeed valuable in and of itself, and that every species should be valued. This takes the approach of a much more philosophical view in order to remove a lot of the variables that end up tainting opinions. Every species is an artifact of the Earth's history and brings with it a wealth of knowledge. With this thinking we are instead able to value species for what they are, and recognize the astonishing feats that had to take place throughout time to allow for said species to exist. Edward McCord, a biologist and the author of "The Value of Species", says it best in that, "Countless events have determined the evolutionary paths of each form of life here on Earth. Since these detailed sequences are unique and unrepeatably, no species on Earth could have evolved anywhere else in the universe, and no species can ever occur again once it is gone." He adds that, "Any "living thing" is an instance in which a single flame of life remained aglow all through its ancestry." By shifting our thinking to this style we can begin to appreciate every species equally based on its existence as opposed to the services it offers.



TOP: Plan view of concourse lights  
 BOTTOM: Perspectives of concourse lights

## Early Examples

This thesis project started with a completely different direction in mind, but after a one week design test I found myself on the path towards working with bats. This early test was inspired by the idea that we push ecology out of our public realm in order to make it more comfortable. Because of that, this test looked to reverse the roles and force us as humans to accept ecology back in to these spaces in order to have features which we cherish. The design was working under the premiss that pedestrians feel a sense of security at night in well lit areas, hence the abundance of lighting along a main concourse on the Auburn University campus. The result of this design would make it so that if a certain species was not present within a given area, in this case bats, then the lighting along the concourse would be significantly reduced, leading to a more uncomfortable feeling for pedestrians. However, if bats were present in the area, noted by a series of skyward facing motion detectors, then the lighting would turn on. The quantity of lighting in the area would be associated with the quantity of bats, meaning that if there were more bats in the area then more lights would be turned on. While this test never went in to an extreme level of detail it set the foundation for future work to come.

The second design test was a response to an idea by Chris Woebken, and artist (shown later), who proposed the retrofitting of billboards in New York to act as bat roosts. The original idea is quite fascinating in how it repurposes an extremely common feature found in a New York city, whilst still utilizing the original function of the billboard as an advertisement mechanism to promote the presence of bats. My critique however was that the same thing which acts as a strength of the project (the abundance of billboards) also hurts in a way, as in a city where thousands of billboards are already ignored, what stops this from blending in and becoming another one of those? Keeping all the design strategies and goals the same, I simply suggested that these billboards are instead transplanted in to areas in which they become far more visually stunning. The example I choose to show is that of a well-manicured residential neighborhood. The juxtaposition between the industrial-esque billboard and the residential home is enough to make a statement on its own, but is ever further amplified by the projections on the billboard screen. Instead of projecting slightly cryptic messages as the original design intends, I decided to be far more literal. During the day the screen would project the happenings on the inside of the billboard, showcasing the bat inhabitants and letting residents know of their presence. At night the screen would simply turn white and display the message “Your Pest Control Service Is Now Active” both informing the neighborhood residents of the bats role within the system as well as acting as an insect attractor for the bats to feed around. This project is what really set in motion the desire to work with animal species and is where I began to research how the field of landscape architecture addresses these issues.



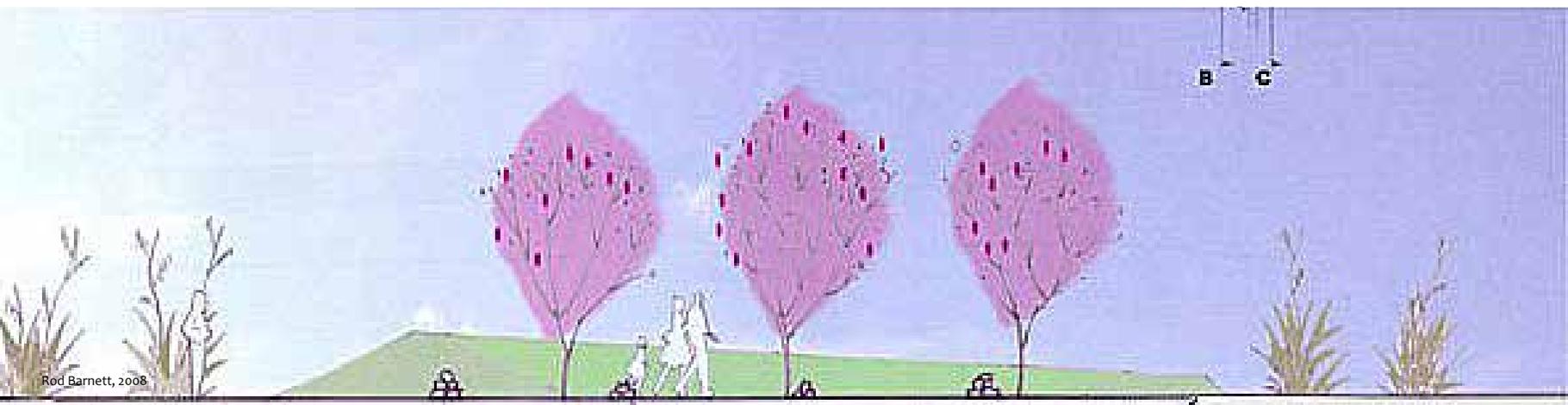
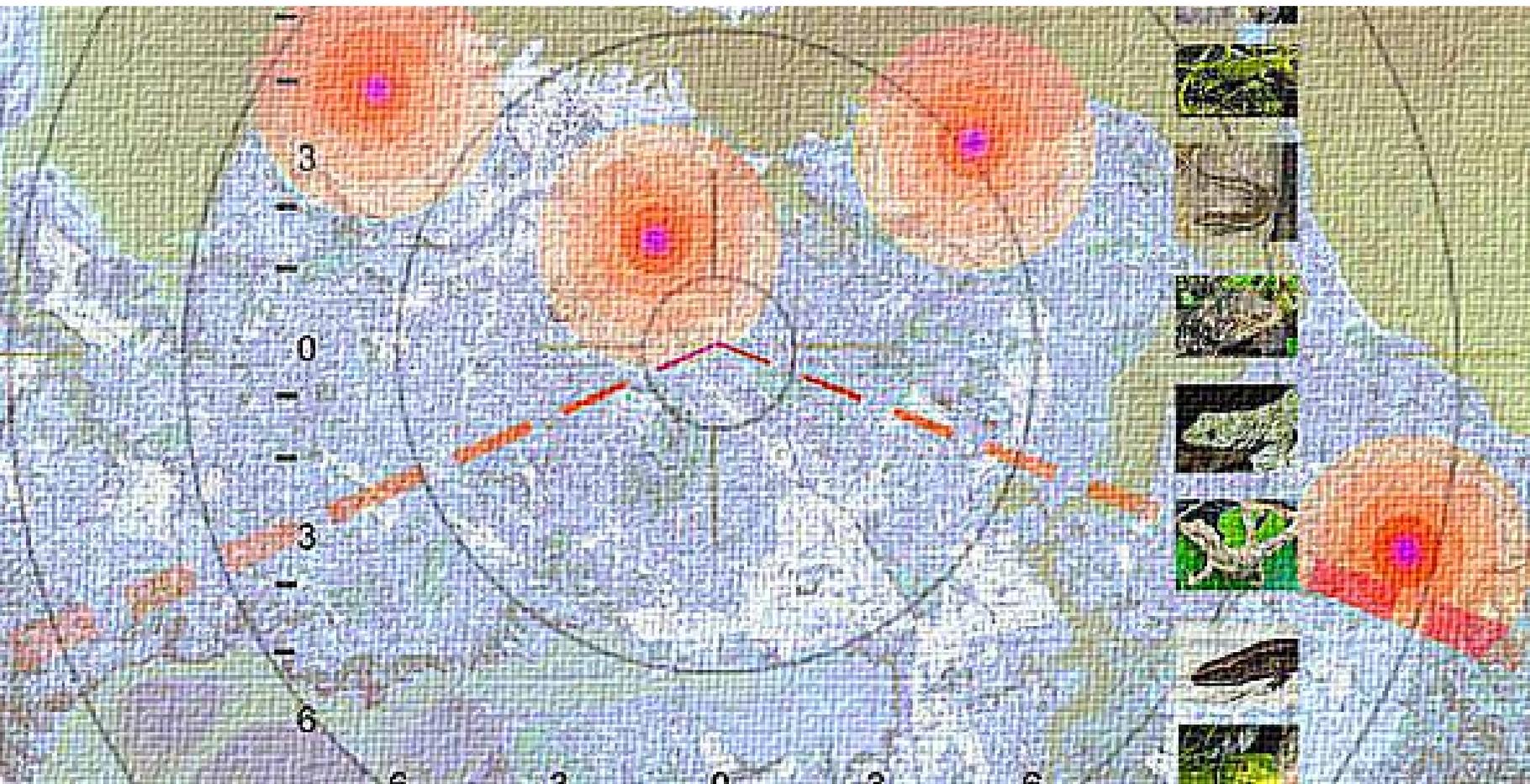
TOP: Daytime view of bat billboard  
BOTTOM: Nighttime view of billboard

## **Janet Rosenberg & Studio - Landscape Architect**

(RED) A Wildlife Crossing - Denver, Co

(RED) A Wildlife Crossing, an entry in the ARC Wildlife Bridge competition, attempts to recreate a crucial wildlife corridor that has been severed by a major roadway outside of Denver, Colorado. The roadway is surrounded on both sides by crucial wildlife habitat, but creates a dangerous scenario of crossing for both animals and the vehicles on the road. Because the color red is seen by humans but not by many mammals, this design serves as a landmark without becoming a distraction to the wildlife it serves (Rosenberg 2010.)





## **Rod Barnett - Landscape Architect**

### Under The Radar - Auckland, New Zealand

Exploring urban landscape architecture, this project focuses on native lizards in the Auckland area and their connection to the volcanic fields which the city is built upon. The project relied on GIS mapping to locate key areas of interaction between people and lizard habitat to which “lizard gardens” would be implemented. These data sets include things like lizard populations, volcanic rocks, and a network of cycleways and walkways. The “lizard gardens” are enhanced areas of lizard habitat which utilize local geologic features to create landscapes that are still attractive to humans (Rod Barnett 2008). The project seeks to draw attention to the web of biotic and geologic relationships which lies just under the radar of Aucklanders, and which provides the special character of the landscape that they interact with on a daily basis (Rod Barnett 2008).



# Bats

Misconceptions

Ecological Value

Human Benefit

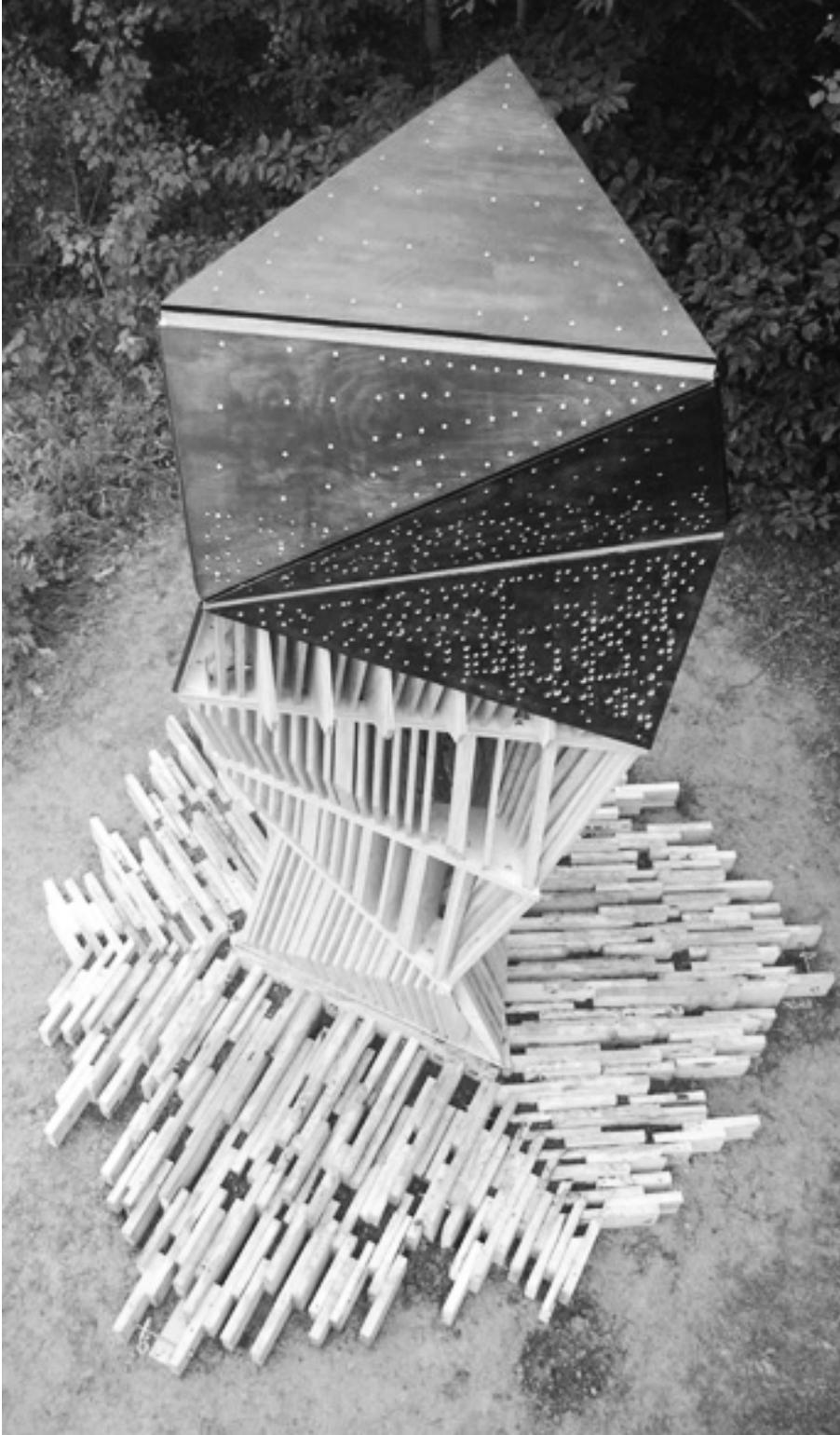
Case Studies

The Threats

## **Joyce Hwang - Architect**

### Bat Tower - East Otto, Ny

In an attempt to bring visibility to bats, the Bat Tower challenges the notion of the typical off-the-shelf bat house. Rather than innocuously fading into the background, the tower stands as a prominently visible sculpture (Hwang 2010). Drawing from the idea of a vertical cave, this design looks to provide bat habitat while increasing public awareness of these critical components in our ecosystem. Located next to a lake, the site offers a wide abundance of mosquitoes and other bat-attracting insects that act as a food source (Hwang 2010). Insect friendly plantings are also planted at the base of the tower, further increasing the draw for bats. The structure itself is formed by a pattern of grooves on both vertical and horizontal surfaces, allowing for bats to easily climb into and tower and cling to the ceiling (Hwang 2010).





BATS TAKING OFF FOR  
INSECT SNACKS

## **Chris Woebken - Artist**

### Bat Billboard - New York, Ny

In collaboration with Natalie Jeremijenko, the Bat Billboard creates alternate forms of bat habitat by utilizing commonplace features within a city, billboards. These interactive billboards not only act as bat habitat, but also serve as a novel social interaction between bats and humans (Woebken 2010). The display of the billboard allows for visual interpretations of what the bats would say if they could communicate with humans, as well as various statistical bits that could be shared. Billboards were chosen due to their abundance and visibility, all whilst being an underutilized structure. One of the most important additions includes the lining of soil propagation boards that act not only as insect spawning grounds which serve as a food source, but these boards also act as insulators to keep the temperature and humidity within the billboard at a level that does not allow for the growth of the white nose fungus.

# Bats

## Misconceptions

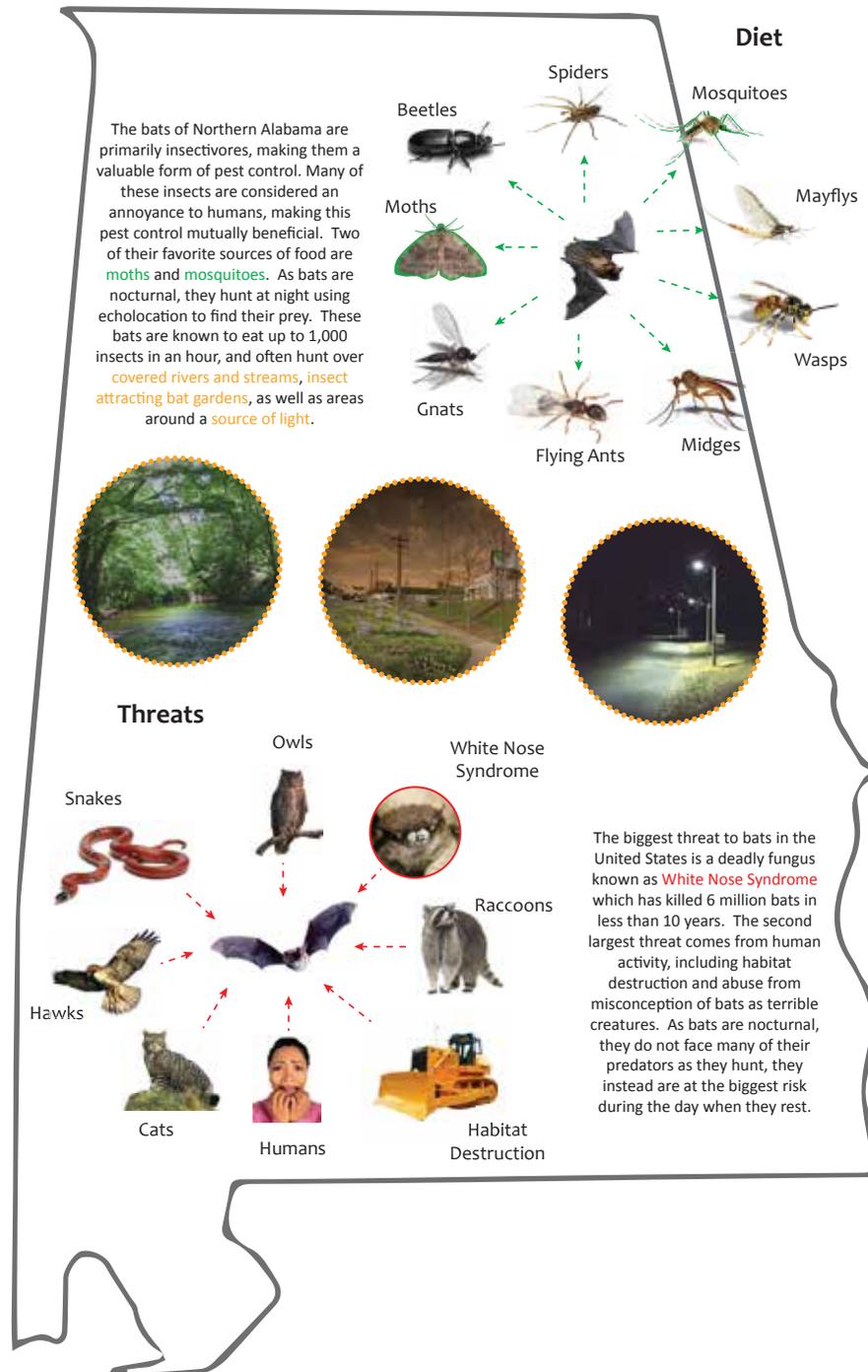
Bats are fascinating creatures, and as there are more than 1,300 different species of bats in the world, there is a lot that can be said about them. Bats make up a quarter of all mammal species on earth and are the only mammals that can fly (Bat Conservation International 2015). One of the biggest reasons I decided to work with bats is due to all the misconceptions we typically apply to bats. Something that may surprise people is that bats are everywhere. They are all around us, but because of both their size and time of activity, we rarely end up noticing them and that is where a lot of these misconceptions arise from. Though these misconceptions are starting to slowly fade due to an increase in awareness with things like the Congressional Bridge in Austin, Texas, many people would still associate bat activity with something out of an Alfred Hitchcock movie. Bats do not try to fly at your head and get tangled up in your hair, and bats do not try to drink your blood. In fact there are only three species of vampire bats in the world, none of which live in the United States, and again, none of which try to feed on human blood. Another big misconception is that bats are dirty disease carriers, transmitting things like rabies and ebola. While it is true that some bats do indeed carry and transmit these diseases, the amounts are so low that fewer than one percent of bat populations are found with these diseases (Bat Conservation International 2015). In terms of cleanliness, bats are quite clean as they are known to be quite meticulous when it comes to cleaning their fur. The last main misconception is based around the idea that bats are blind. This is in fact false, as bats can actually see up to three times better than humans. While they do often rely on echolocation to guide them, this for the fact that they fly at night when it is difficult for any creature to see.

## Ecological Value

Despite the previous talk on the value of species, I do realize that not everybody shares the same opinion and that often the quantitative values are important to present. On a global scale, it is difficult to find many species that have a greater ecological impact on the systems they inhabit than bats, as they are considered keystone species in many regions. Being a keystone species means that the role that species plays in a particular ecosystem is so important, that if the species was removed, then said system would collapse. The reason bats have such value to systems is because of the multiple roles they play. Depending on the species, bats can act as pollinators, fertilizers, seed dispersers, and pest controllers. Nectar-feeding, pollinating bats are some of the most crucial to their systems, especially in deserts and rainforests. Though very few of these species exist in the United States, their benefit is seen in desert regions where these bats pollinate giant cacti and agave, both of which would struggle to thrive without pollination from bats (Bat Conservation International 2015). In rainforest systems, fruit eating bats inhabit possibly the largest role of regenerating these forest systems with seed dispersal. Though there are a wide range of birds and other animals that play the part of seed dispersers in these systems, many of them shy away from the more open areas in fear of predation. Fruit bats however don't quite have this same fear as they are nocturnal and face far less predation, making them more likely to traverse these open areas and drop seeds. These fruit bats also tend to target hardy and fast growing plants, that allow for the growth of more delicate understory plants beneath. A more relevant role to what is found in the United States is that of pest control. Nearly every species of bat found in the United States are insectivores, or insect eaters, and can eat over 1,000 insects a night (Bat Conservation International 2015). Bats are responsible for reducing large populations of crop damaging insects, such as the corn earworm moth. As a side effect of this we see a reduction in the amount of pesticides that get introduced into the environment, something that benefits all. The last role that bats play, fertilizers, is a culmination of all of these. Bat guano, or bat droppings, is a highly nutritious fertilizer with a concentration of 10-3-1 (10 percent nitrogen, 3 percent phosphorus, 1 percent potassium) making it promote fast, healthy growth. What makes it so beneficial is that it is not only a natural fungicide, but it is fully effective in its natural state.

## Human Benefit

Bats have strong economic impacts as well, and save United States Agriculture alone nearly \$4 billion dollars annually in pest control (Bat Conservation International 2015). This also ties back in with the previously mentioned point of the reduction in pesticide use we directly see because of this. This reduction in pesticide use is not only seen at this nationwide agricultural scale, but it is also seen at city scales, and all the way down to individual home owners. Even going back to nectar-feeding bats and their role in the pollination of the agave plant, we see their impact on economics as agave is a key ingredient in the tequila industry. Bat guano is another economically valuable item that is sold as an organic fertilizer, and as long as it is harvested in safe way that does not disturb the bats then it is quite feasible. Moving beyond the economics, humans see even more benefits from bats. The increased pest control creates a reduction in disease carrying insects as well as reducing human annoyance associated with these insects. A lot of these benefits have been focused on the role that bats play within a system, but bats themselves offer incredible and valuable knowledge, especially for medical fields. As previously mentioned, bats use echolocation to assist their flying. Echolocation, also known as biological sonar, is the use of reflected sound waves to located objects. Along with dolphins, bats and their echolocation have been studied for years to assist with helping the blind learn to “see” and navigate. Vampire bats, the ones most people would associate as “bad bats”, are actually some of the most medically important. To best understand this, one should first understand how a vampire bat feeds. The vampire bat does not latch on to an animals neck and suck its blood. It instead creates a small wound and licks the blood as it flows out. In order to keep the blood flowing, the saliva of a vampire bat acts as an anticoagulant, thinning the blood and allowing it to flow freely as long as the bat is there. This anticoagulant, medically nicknamed “Draculin”, is being explored as a treatment for patients with or prone to heart attacks and strokes due to its ability to break down blood clots, and it has shown promising results (Hepler 2011).



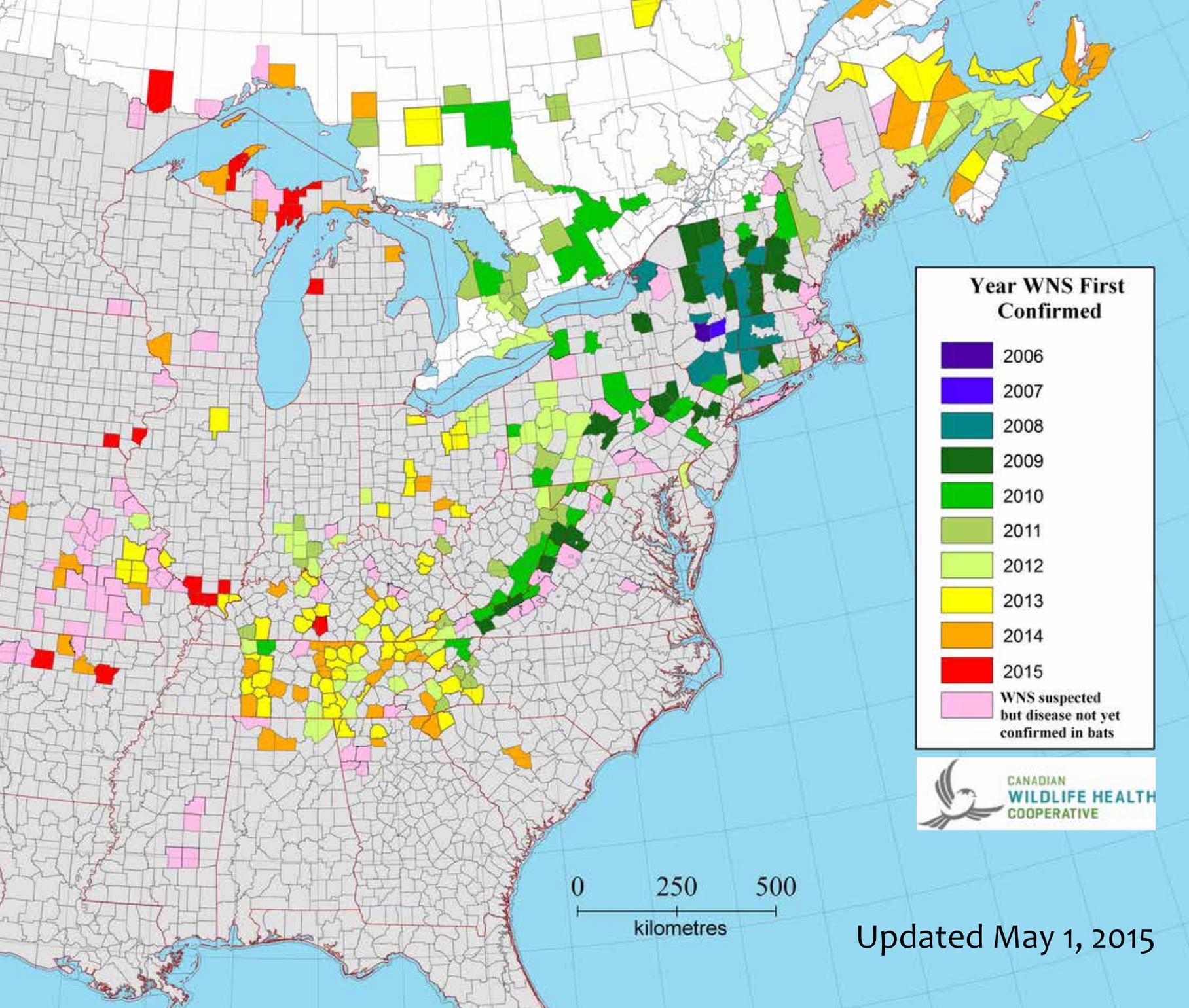
Graphic showing the diet, threats, and habitat associated with bats

## The Threats

Like many species, bats are threatened by a variety of forces, but only two of these genuinely put bats at the risk of extinction. Natural predation is not a major threat to bat populations as they have evolved throughout history in to the nocturnal creatures they are, which has been enough to limit predation risks. The two major threats are seen in habitat destruction by humans, and white nose syndrome. Both of these are escalated by the fact that bats naturally reproduce slow, often only producing one pup a year. Habitat destruction occurs for a variety of reasons, often human-based expansion, but is also heavily attributed to a lack of knowing. This ties back in to the earlier talk on misconceptions and how we often are not aware of the presence of bats around us, and that's why making bats more legible is such an important part of this thesis. White nose syndrome, by far the most lethal threat to bats in North America is a cold weather fungus that has killed over 6 million bats in 7 years, and shows no signs of letting up. The fungus, *Pseudogymnoascus destructans*, grows on the skin of bats whilst they are hibernating, often covering their wings and nose. The fungus grows in cold temperatures of roughly 39 - 59 degrees Fahrenheit, but will not grow above 68 degrees Fahrenheit (U.S. Fish & Wildlife Service 2015). The fungus spreads via physical contact, but is often transported from roost to roost by human activity such as spelunking. Whilst the fungus can be lethal to bats in its own right, it primarily kills bats by waking them during their hibernation periods and causing erratic behavior. Bats are extremely vulnerable during hibernation as their bodies nearly shut down, relying on stored up fat deposits to support them. Normally this is not an issue, but when they wake up and become erratic during this period due to the fungus, they begin to quickly burn this stored energy supply. The bats become dehydrated and hungry, and often take off in flight in a trance-like state during all times of the day. If the bat is coherent enough to look for food, it is unfortunately out of luck as during winter seasons there are no insects to eat. Because of this, the bat typically burns up all of its energy and starves to death. The biggest problem with all of this is that as of now there is no practical way to cure the fungus. The best solution is to try to prevent the fungus from ever growing, and that is the route this thesis attempts to take. Other means of removing the fungus involve heavy use of a variety of nasty chemicals that are almost as dangerous in their own right as the fungus itself. There have been some breakthroughs very recently (2015) involving a bacteria that naturally grows on the skin of bats that could kill the fungus. The outlook of this bacteria seems promising when you consider that the same white nose fungus has been identified on bats in Europe, but is drastically less lethal, which may be due to European bats having higher levels of this certain bacteria. Though this bacteria is naturally occurring on the skin of bats, there are still always dangers in artificially applying a substance to any species, therefore the best solution still seems to be creating bat habitat that prevents the growth of the white nose fungus in the first place.

RIGHT: Map showing the current spread of the white nose fungus in the United States and Canada

Map taken from [www.whitenosesyndrome.org](http://www.whitenosesyndrome.org) 2015



# Design Strategies

Florence, Alabama

Bat Trails



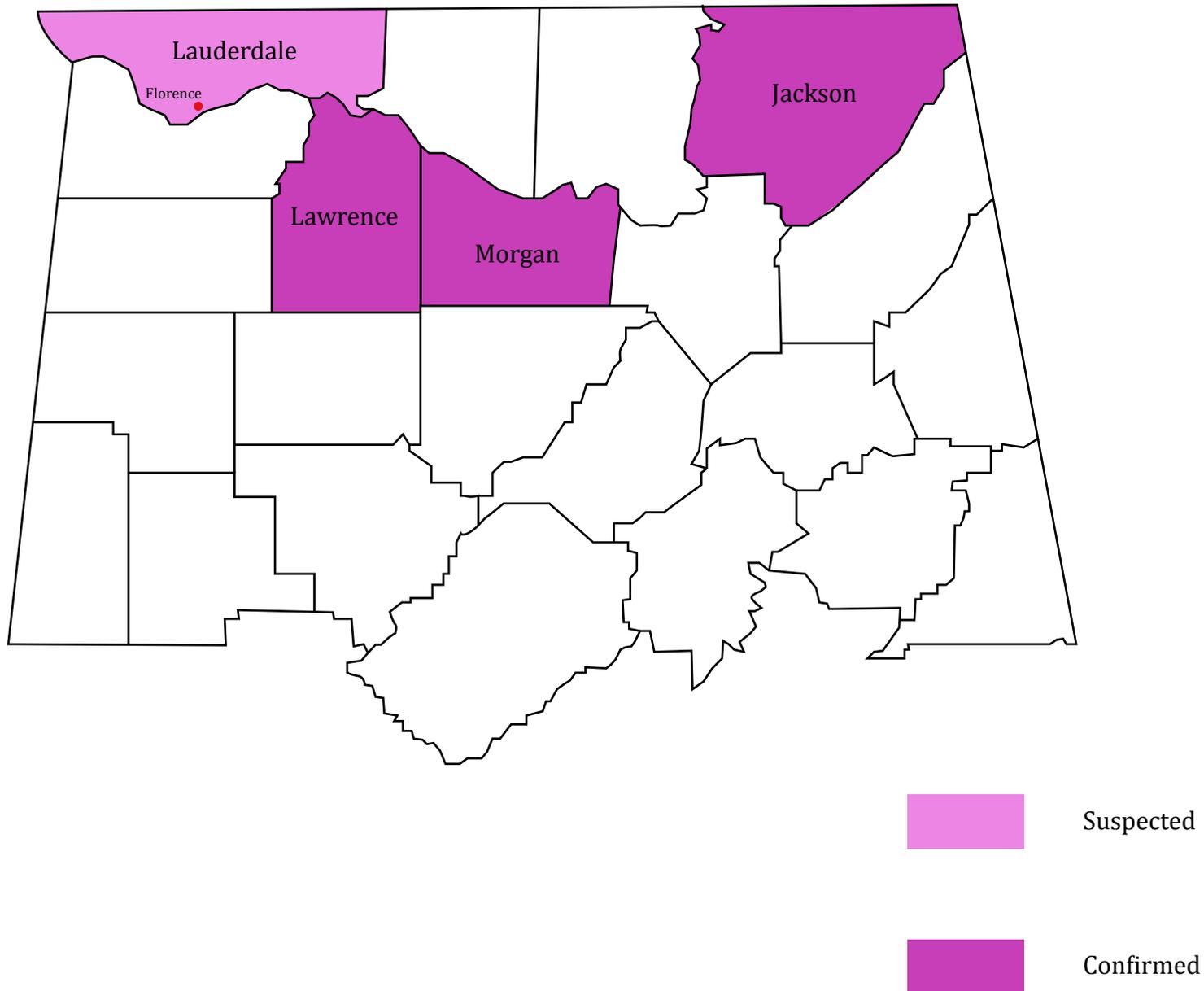
## Florence, Alabama

Located in Lauderdale county in Northwest Alabama, Florence is the 11th largest city in the state with a population of almost 40,000 (U.S. Census Bureau 2010). Florence receives a boost to its population and economy from the University of North Alabama, located just blocks from the city's downtown core. Home to many historic registered houses and neighborhoods, the city is culturally rich and boasts a wide variety of festivals and tourist attractions including things like the Frank Lloyd Wright Rosenbaum House and the W.C. Handy Museum. The southern portion of Florence borders the Tennessee river, a feature that played a significant role in the establishment of the city. Known as "Alabama's Renaissance City", Florence is the ideal place to start this cultural movement in rethinking what we consider to be urban pests.

RIGHT: View of the O'Neil Bridge in Florence, Alabama  
Photograph taken by Tyler Ross, 2011



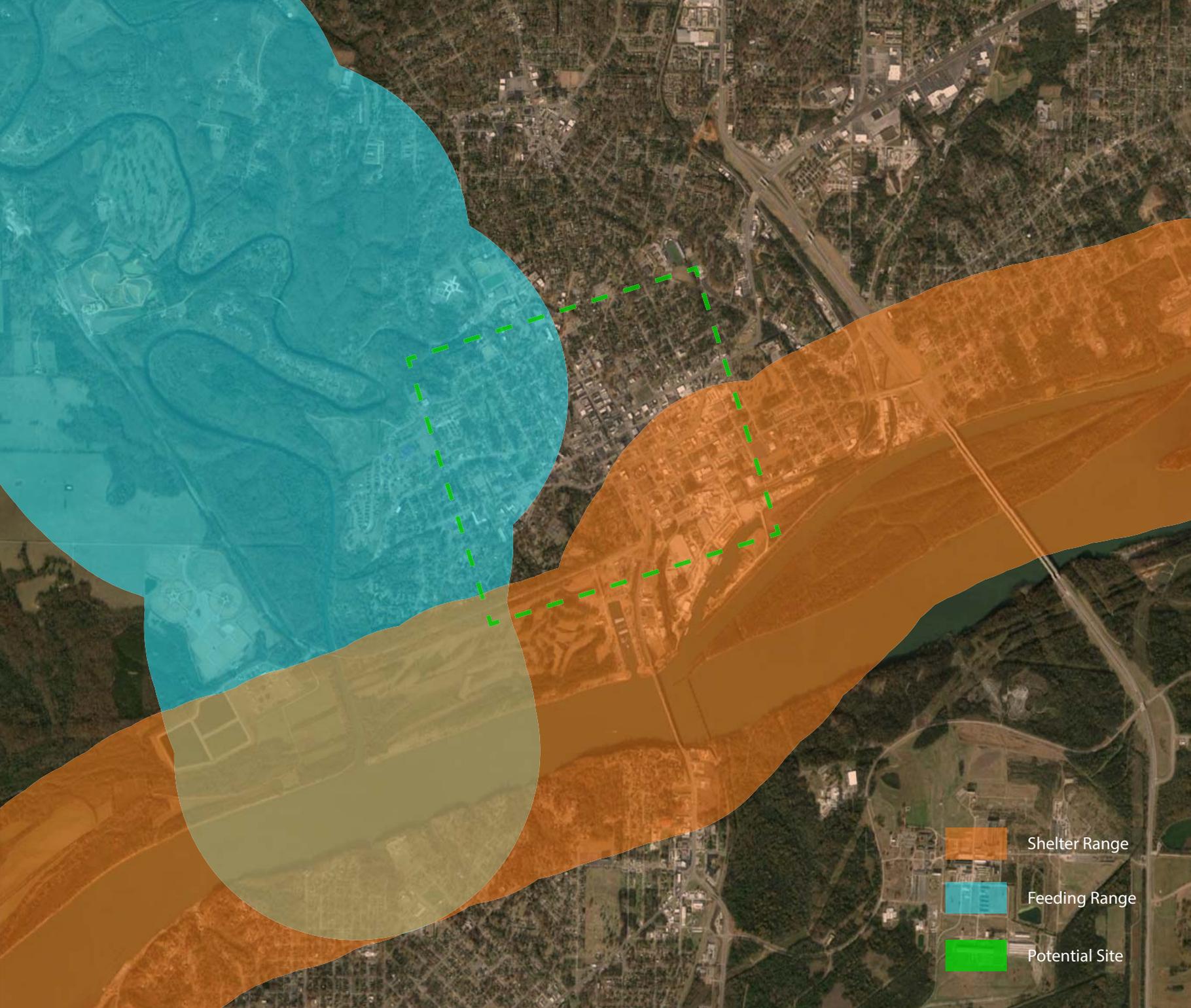
# Outbreak of White Nose Syndrome in Alabama



When it came to picking a site, there was a small list of criteria that I set. This list included the presence of white nose syndrome, high human and bat population, and key bat habitat features (primarily access to water). With white nose syndrome being the epidemic that it is, I put more emphasis on it as a criteria than the other features and really wanted to work in an area where I could address the issue. Based on data gathered from the national site for white nose syndrome ([whitenosesyndrome.org](http://whitenosesyndrome.org)), one can see that Alabama has four counties where the fungus has been identified, three of those being confirmed. This fungus was first identified for Alabama in 2011, and most recently in 2014. Lauderdale County, the northwestern most county in Alabama which Florence is located in, differs from the other counties in that the fungus has only ever been suspected of being present, but it has never been confirmed by the appropriate agencies. A question commonly asked is why I chose to work in the one unconfirmed county as opposed to any of the three confirmed ones, and the answer is quite simple in that the best strategies to combat white nose syndrome are those that prevent it from ever growing. By addressing this issue in areas unconfirmed, but still at risk, I find that resources could be better well spent. This is by no means saying that there is nothing to be done for the other three counties, but the approach needed varies drastically and many opportunities are lost, especially when it comes to increasing the visibility and interaction between bats and humans. With that said, I still wanted the strategies I used in Florence to hold some relevance and value for all areas throughout the United States, but confirmed and unconfirmed.

Now looking more specifically at Florence, conditions of the surrounding area were almost perfect in terms of the relationship between bat and human habitat. The western edge of the city is bordered by Cypress Creek, and the southern edge is bordered by the Tennessee River, both of which are key areas of bat habitat. Looking at the graphic on the right, you can see the interaction and overlap between these features, with the city having the opportunity to really merge the two together and act as a bridge between them. While bats do currently inhabit areas within the city they are far more likely to stick to these corridors along the edges, so the design really looks to pull the bats in to and through the city.

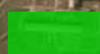
RIGHT: Map showing an overlay of bat habitat zones based around the city of Florence, Alabama



Shelter Range



Feeding Range



Potential Site



Florence, AL

Key Cave National Wildlife Refuge



A bonus feature that played a significant role in me picking Florence over other cities is the addition of the Key Cave National Wildlife Refuge. Located about 8 miles southwest of the city, this refuge is home to a diversity of creatures, several of which are endangered. The primary endangered species is the Alabama cavefish, but the refuge is also home to large populations of gray bats and the northern bobwhite quail (U.S. Fish & Wildlife Service 2015). While portions of this refuge are open to public access, several areas are off-limits including the cave itself. What makes Key Cave such an important feature to this thesis is how these refuge systems work. For very good reason, they are often isolated from the public and closed off in either specific locations or throughout the entire refuge. This makes perfect sense when you consider that the primary function of these areas are to protect the species that inhabit them. However, I find that this in a way diminishes some of their potential value. What I mean by this is that it is quite difficult to get people to care about something which they never get to see or interact with, or even know about for that matter. What comes to mind when I think about this is the World Wildlife Fund (WWF), and while this may not be the best example as it goes against my underpinning of the value of species (megafauna vs. “pests”) it does speak in a way to what I am talking about. The WWF is probably the most successful agency when it comes to bringing awareness and gathering public interest and monetary donations for endangered species because they promote the living hell out of their work. I find it to be even crazier when you think that the species they promote the most (giant pandas, tigers, polar bears, whales, etc.) and receive the most funding for are those that we as humans almost never interact with, yet they are still so successful. So trying to bring it all back around to this thesis, I would say that this reason, more than any other, is why working in the public realm is such a valuable resource and why being able to juxtapose Key Cave to downtown Florence was such a draw.

LEFT: Map showing the relationship between Key Cave and Florence, Alabama

The last feature that played a prevalent role in my selection of Florence was its reputation for large, well-known festivals. The city holds a variety of festivals throughout the year, with a majority of the larger ones taking place in the second half of the year. Leading back to the previous talk on the value of increasing public awareness, I really wanted to create the potential for this project to have some sort of large bat event associated with it, or its own festival in this case. Looking at the graphic on the right, when the yearly calendar of activity for the local bats is overlaid with Florence's festival calendar it becomes clear that there is the potential for a bat festival during that first month where the bats are coming out of hibernation. Being able to have a bat festival is not only valuable in terms of increasing awareness, but it serves as additional branding for the city of Florence giving them more incentive to accept a project like this. All one has to do is look at the city of Austin, Texas and what they have gained from the Ann Richards Congress Avenue Bridge. Though the role of the bridge as a bat roost was initially a massively unwanted accident, the city has grown to accept and appreciate this and now generates upwards of ten million dollars annually in tourism revenue from the bats alone (Bat Conservation International 2015). Though Florence may or may not ever see economic benefits on the same scale as Austin, the city can form a sense of pride based around their efforts to combat white nose syndrome and save bat populations that those in Austin simply can't do, as the fungus (fortunately) has yet to reach Texas.

**Gray Bat**  
*Myotis grisescens*



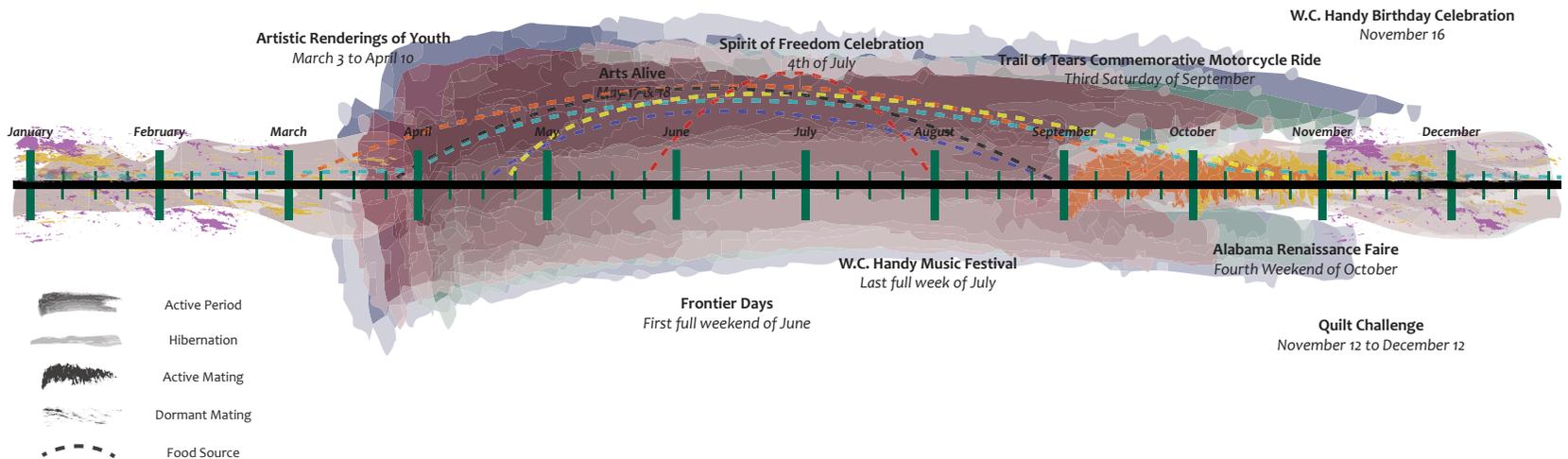
**Little Brown Bat**  
*Myotis lucifugus*



**Big Brown Bat**  
*Eptesicus fuscus*



Mosquito    Mayfly    Moth    Gnat    Beetle    Wasp



Calendar showing an overlay of bat activity with festivals located in Florence, Alabama





## Bat Trails

As previously mentioned, the city of Florence sits right between two key areas of bat habitat with Cypress Creek to the west and the Tennessee River to the south. As working within the public realm was a major goal of this project, a connection needed to be formed between these two features which could run through the city and really entice the bats to inhabiting that specific location. This connection is formed by a series of three trails, or corridors, that run throughout the city, linking the features together. The condition of each trail differs from one another, but the primary features include bat gardens (shown in orange) and various styles of lighting (shown in teal). Bat gardens are special plantings that consist of heavily-scented and night-blooming plants, which act as insect attractors and spawning grounds. Lighting also acts as an insect attractor through the phenomena known as phototaxis. The gardens and lights indirectly attract the bats by directly attracting the food source of the bats. Said differently, bats will go to where their food is, therefore these trails look to increase their food source within the city. Both the gardens and lights also serve as visual cues to the presence of bats during their time of inactivity, whether that be during the day or when they are hibernating. Within the trails, specific sites were selected to act as areas of intensity, or “hotspots” (shown in red) where people who are really interested in viewing the bats can go and watch. Though this idea of bat watching may not appeal to everyone within the city, these hotspots still act as aesthetically pleasing park space that all can enjoy.



University of  
North Alabama

Downtown  
Core

Burrell Slater  
Community Center

Eliza Coffee  
Memorial Hospital

The Bat  
House





The lighting used throughout the trails consists of both existing lighting as well as a new lighting feature. This new feature is a special and unique form of lighting that is adapted from the English installation artist Bruce Munro. Famous for his Field of Light installations, as seen in the picture on the left, and boasting many successful projects such as Longwood Gardens in Pennsylvania, the Atlanta Botanical Gardens in Georgia, and the Cheekwood Gardens in Tennessee, efforts are to be coordinated with Mr. Munro to create a permanent version of his Field of Light installation that offers a greater diversity in the size of light pieces available. Instead of having a variety of colors, these new lights will instead consist of bluish-white lighting similar to that of LEDs. This is due to the fact that bluish-white lighting is the most effective in terms of attracting insects.



W. C. Handy  
Museum

W Dr Hicks Blvd

Bat Garden Trail





Burrell Slater  
Community Center

Eliza Coffee  
Memorial Hospital

The  
Bat House

W Dr Hicks Blvd

S Court Street

S Pine Street

# Carver Heights Hill Plan



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The southernmost trail, or “garden trail”, runs along Dr. Hicks Boulevard and serves as an east/west connection between Cypress Creek and the downtown core of Florence. This trail is primarily composed of bat gardens and the use of existing street lighting. The plant palette of the gardens stays somewhat consistent throughout the trails, but the quantity of what gets used varies from trail to trail and garden to garden. As the garden trail features larger areas of open space, it has a larger quantity of bigger blooming plants such as Alabama azaleas, Mount Airy fothergilla, smooth hydrangeas, and moonflower. The lighting along this trail consists of the existing street lights, which are the higher leveled lights that are attached to powerline poles. This higher-up light allows for strong projections of shadows along the street and parking lots, something that will be a little more unique to the area. The hotspot for this trail is located along the western end at what is being called the Carver Heights Hill. Located adjacent to the Carver Heights neighborhood, this hill serves as an elevated viewing platform for both the neighborhood and the entirety of the city. The hill is laid out with ten striations of bat gardens, every striation being its own plant species, each of which are also filled with “bat lights”. Reclinable benches are placed between striations to allow for a planetarium-esque viewing style.

LEFT: Plan of Carver Heights Hill  
NEXT PAGE: Perspective of Carver Heights Hill

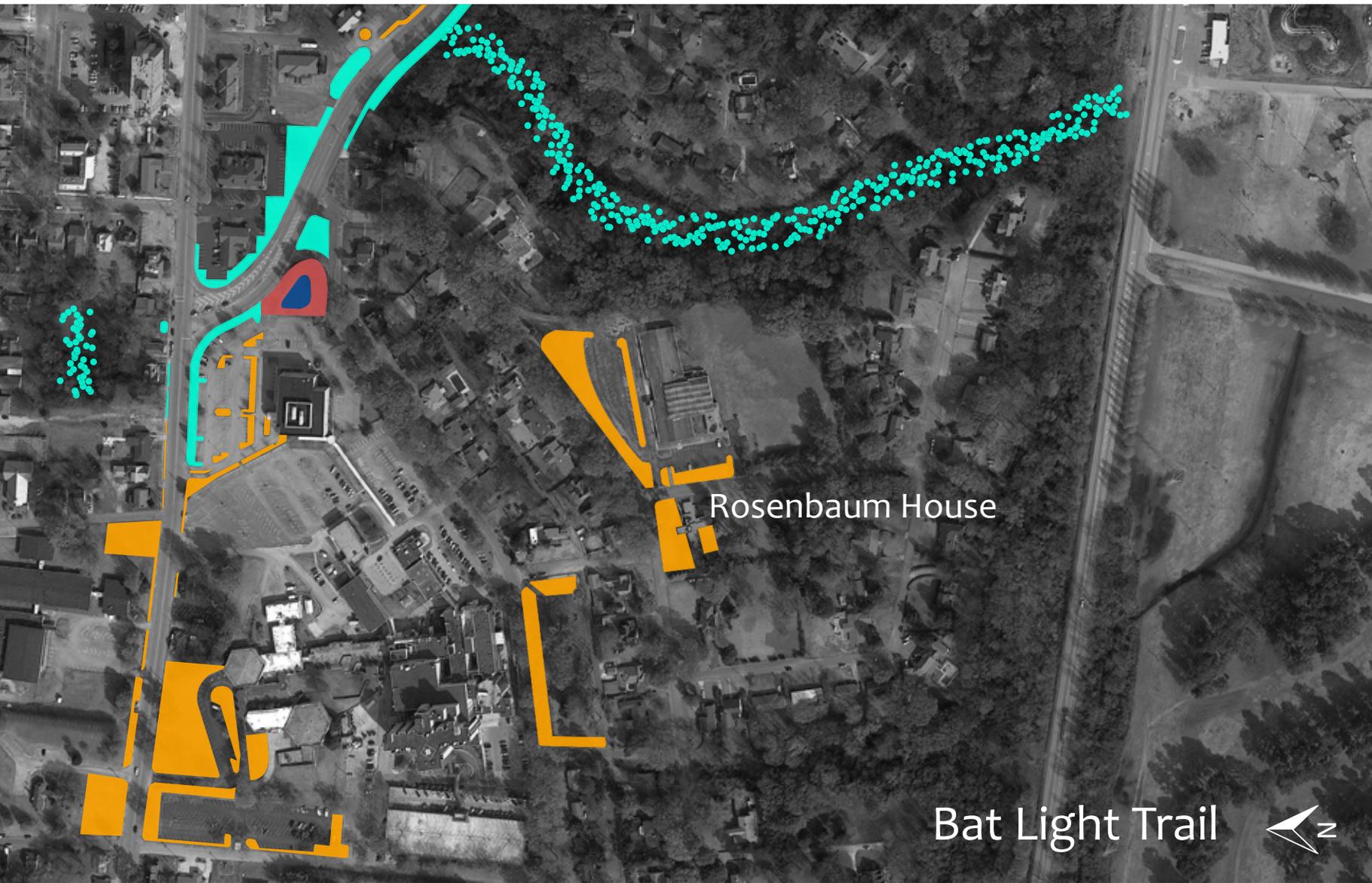




University of North  
Alabama Intramural Field



Greater Mount  
Moriah Church



Rosenbaum House

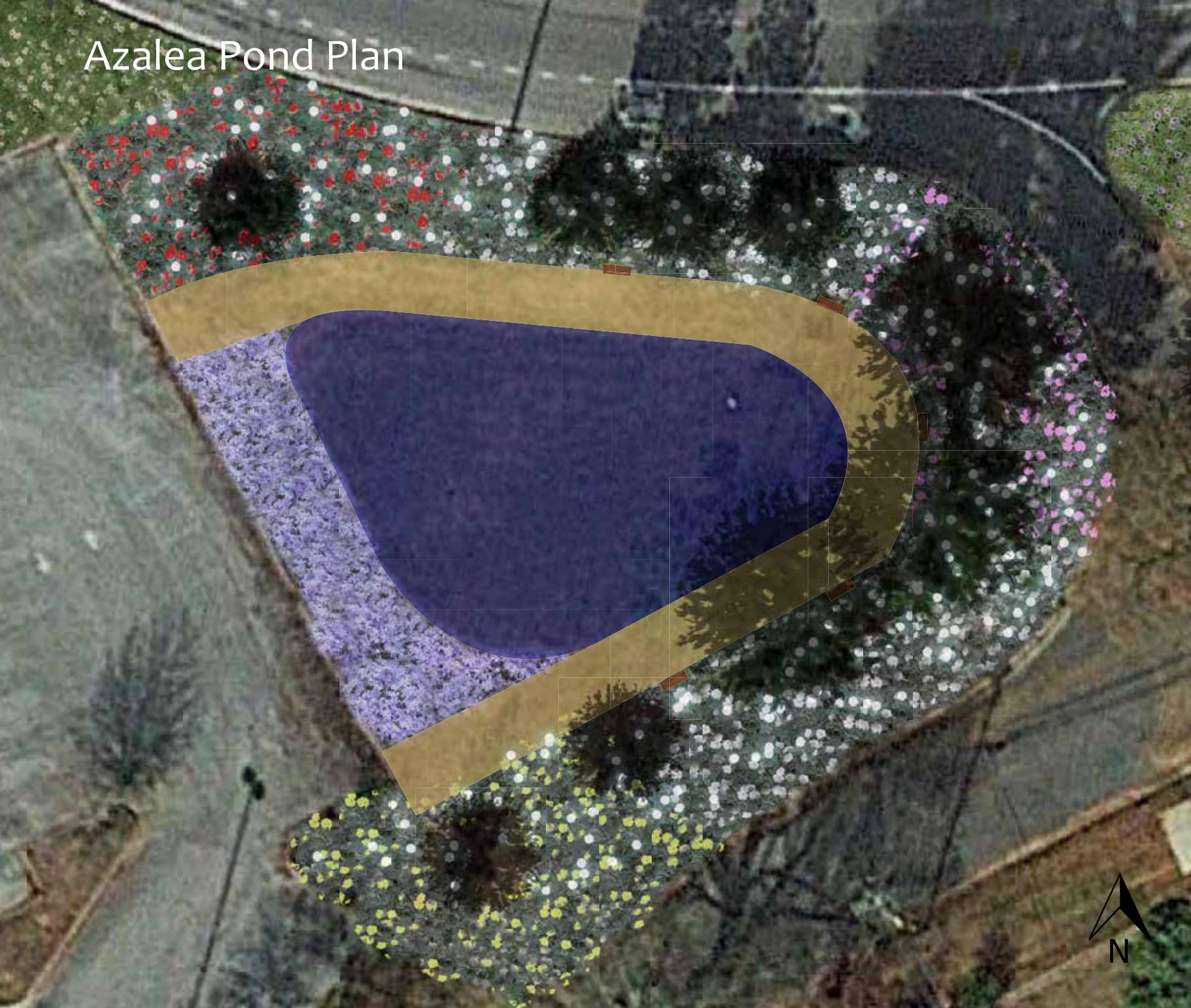
Bat Light Trail



The central trail, or “light trail”, acts as a north/south connection between Cypress Creek and the Tennessee River as it follows the form of an existing stream bed. This trail is by far the most unique in that it is solely composed of the bat lights. The only exception to this is where this trail intersects with the garden trail, with both lights and gardens present in that section. The bat lights within the trail will vary in size throughout, becoming larger and denser in certain areas, creating different feelings throughout. The light trail is intended to be a walkable corridor that is both visually stunning and mystical to inhabit. There have been some concerns with potential light pollution occurring because of this trail, but those effects have been carefully considered. Firstly, because the light has a spherical head and projects in all directions, the intensity of lighting given off by each pole is only dense around the bulb, with that intensity quickly dissipating the further it gets from the source. This is why so many of these poles can be used in a small cluster and not be overwhelmingly bright. Secondly, the condition throughout almost the entirety of the trail includes a dense canopy that has been formed along the stream bank. This canopy would block any potential excess light from spilling out and instead contain within the understory, though the care has been taken up front to prevent this from ever even becoming a concern. The hotspot for the light trail is located at its intersection with the garden trail. In what is being called the “Azalea Pond” pedestrians have the ability to not only watch bats fly and hunt, but they also have the chance to watch bats drink water. The Azalea Pond consists of a detention pond turned retention pond and thick hedgerow-like plantings of various azalea species, with the primary species being the white Alabama azalea. What’s unique about this area is that bats cannot simply sit around the edge of water and drink from it like many animals can. They instead have to swoop down and skim across the surface of the water in order to drink. Incorporating this feature was important because it gives the viewers a chance to witness a spectacle that very few people get to see.

RIGHT: Plan of Azalea Pond

# Azalea Pond Plan





Coby Hall



The Bat House

Court Street Bat Trail



The eastern trail, or “Court Street Trail”, serves as a north/south connection between the downtown core of Florence and the Tennessee River. This is quite possibly the most important trail in terms of the features it provides and the connection it forms with pedestrian activity. This trail is comprised of bat gardens, existing lighting, new tree lighting, bat lights, and a large scale “bat house”. The lighting and planting scheme of the downtown core is based off of the existing conditions. This means that all existing street lamps will remain, and all existing trees that line the sidewalk and road will be wrapped in LED lights. Existing plant beds at every intersection are replanted with bat gardens, primarily consisting of smooth hydrangeas and candytufts. The hotspot for the court street trail, and the hotspot for the entire bat trail system, is located at the southern end of the trail, right at the entrance of the city. Located within this hotspot is “The Bat House”, a large scale bat roost formed by retrofitting an existing building previously called The Hi-fi House which operated as an audio electronics store. All around the outside of the building is a combination of bat lights, tree lights, as well as a bat garden viewing area. The role of The Bat House is meant to not only be an iconic feature that everyone associates with the bats, but it is also meant to serve as a safe-haven for bats in regards to the white nose fungus. Playing off the idea of the Congressional Bridge in Austin, and various caves throughout the country, The Bat House allows for the creation of that evening spectacle where hundreds of thousands of bats leave a single location at once and nearly black out the sky. Though this spectacle is something that would be visible throughout the entire city, the bat gardens out in front of the building allow pedestrians a much more up close view. These bat gardens would contain some of the previously mentioned larger plants, as well as smaller plants like dwarf lilac, evening primrose, and false dragonshead. Questions often arise as to how The Bat House is going to attract bats, and unfortunately that answer varies. Both within and around the city of Florence lies a large population of bats. Whilst the population numbers for big brown and little brown bats (the most common in the area) are nearly impossible to calculate due to their widespread roosting in a variety of structures, it is known that over 40,000 gray bats live in Key Cave just miles away (U.S. Fish & Wildlife Service 2015). The best case scenario would see this established and healthy bat population find its way to The Bat House on its own, due to the conditions of the structure being catered to that which bats find most hospitable. The thinking is very similar to that of a bird house in which if you build it, and the conditions match, they will come. Once a small population is established, the process exponentially increases. Because of this, the backup plan would see the artificial insertion of any bat collected by various animal control services throughout the city.

# Bat House Plan







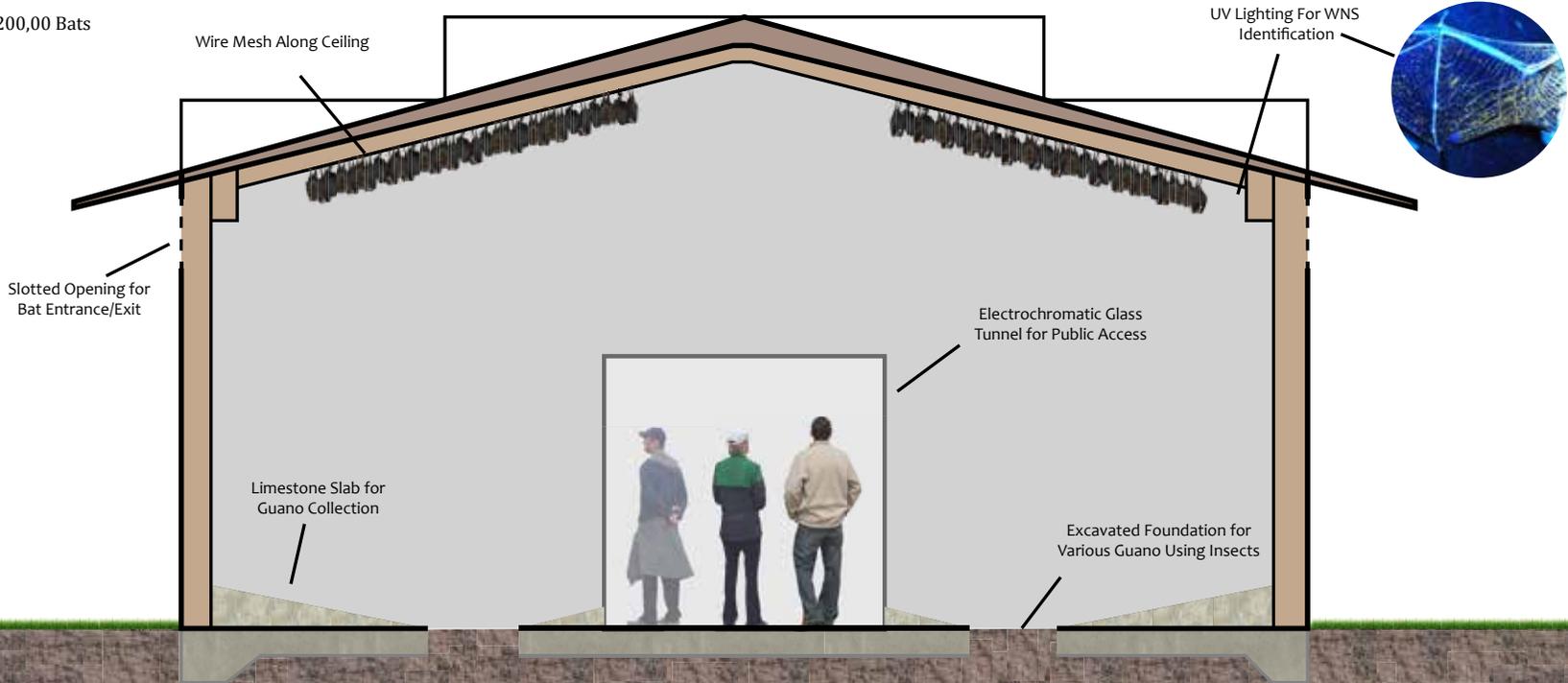
**The Bat  
Signal**

**THE BAT HOUSE**

The importance of The Bat House stems beyond its role as an iconic visual feature and really gets in to its potential to combat the white nose fungus. As previously mentioned, the white nose fungus is a cold weather fungus, thriving in areas of high humidity with a temperature in the range of 39 to 59 degrees Fahrenheit. As The Bat House is a structure that was originally built for human occupancy, it is equipped with a HVAC (heating, ventilation, and air conditioning) system. By using this HVAC system the conditions within the structure can be controlled and set to a range that both the bats find hospitable and the fungus struggles to grow in. One debate that comes out of this asks the question of if it is better to have a single roost with a large population, or if it is better to have multiple roosts with smaller populations. Each style has its own pros and cons. The multiple roost style limits the chance of losing an entire colony at once by spreading out the population, however it creates more ground to cover when it comes to checking for signs of the fungus and actually increases the odds of a single roost contracting the fungus. The single roost style runs the risk of losing the entire colony, but if caught it is easier to evacuate and quarantine that colony until the fungus can be removed. It ultimately is a toss up as to which style is more valuable, but in regards to this project the single roost style was chosen because of how the structure operates and the alternative precautions that are used to severely limit the potential of an outbreak. The structure itself is quite simple in that the existing interior is stripped out until all that remains is the foundation, blank walls, and ceiling. Wire Mesh is then ran along the ceiling which the bats will use to hang from. Portions of the foundation are then removed and replaced with limestone slabs, which act as a guano collection device. The limestone is used because when it combines with guano, it creates rock phosphate. Both rock phosphate and guano are valuable fertilizers that will be harvested and used to support the bat gardens within the city. If enough rock phosphate and guano is produced, then excess amount can be sold by the city to consumers looking for organic fertilizers. One of the larger features of The Bat House is the viewing tube in which pedestrians are granted access inside the house to view the bats whilst remaining isolated by a glass wall for the safety of both parties. The most unique aspect of The Bat House is the use of ultraviolet lighting throughout. This UV lighting is a newly discovered but effective way of identifying any presence of the white nose fungus in a way that is completely safe for the bats. By combining the use of the UV lighting with the pedestrian viewing tube, a connection and emotional bond can be formed between the residents of the city and the bat population. This allows the residents to play a significant role in the observation and study of the bats and lets them have a sense of pride that we as humans feel when we look out for others.

3,150 Sq. Feet

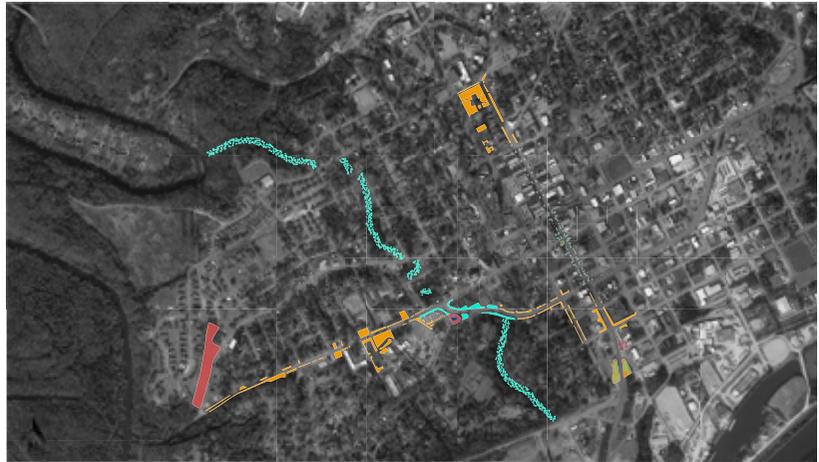
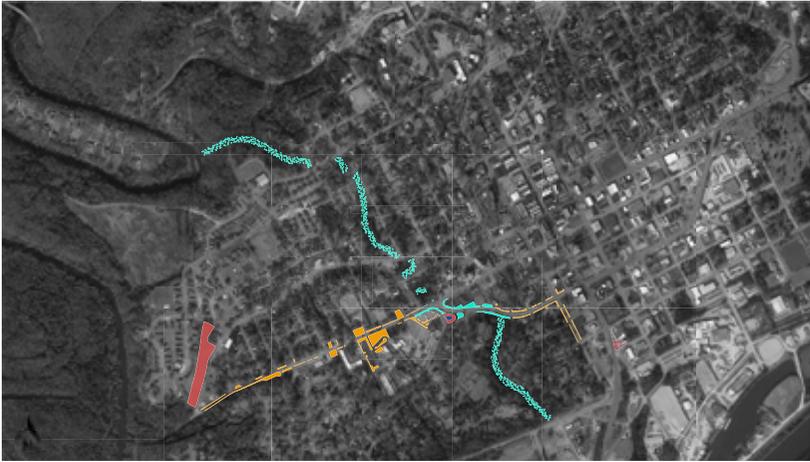
≈ 200,00 Bats







Due to the scale of this system, the trails are to be implemented in phases. The phases are ordered by each trail's ability to act as a bat attractor with the intent of putting the most effective trails in first in order to establish a bat colony as quick as possible. The first phase is all about the creation of The Bat House as it is to be the primary roosting structure for the colony. The second phase sees the implementation of the Garden Trail. This trail links together what is currently the primary active zone in Cypress Creek, with what is to be the primary roost in The Bat House. The third phase adds in the Light Trail as it forms the connection between Cypress Creek, the city of Florence, and the Tennessee River. The fourth phase then sees the addition of the final trail, the Court Street Trail, which serves as the connection between The Bat House and the downtown core of the city. The final phase looks at filling the gaps throughout the city with bat gardens located on a variety of city-owned properties. The overall goal for this trail system is for it to be self-sustaining. The flow would look like this. The bats eat the insects within the city and produce guano, which is then used to fertilize the gardens, which attract more insects, which the bats then eat again, and so on. When it comes to sustaining the lighting features it is a little more difficult, but the goal is that the economic benefits associated with the bats (be that pest control, fertilizer sales, or tourism) would in turn pay for the cost of powering both the new and existing lights. The success of this project will ultimately be judged on its ability to make visible the presence and value of bats to the people of Florence, and to get them rethinking what they consider a pest.



Various stages of implementation for the Bat Trails



# Reflections

Going Forward

Common Questions

## Going Forward

While this thesis primarily focused on bats, its greater importance stems from the theoretical underpinning on the value of species and how as landscape architects we can make significant impacts on the systems in which we live. This is not to discount the work done with bats in this thesis as it actually offers a fair representation of the level of impact that can be made, as seen by the efforts to combat white nose syndrome, potentially saving a species from extinction. Going forward it is tough to say if bats will ever be the primary focus of my work again, as I think that the species chosen depends heavily upon the site. I will however carry forward the same framework and criteria that was used throughout this research project and continue to address what I see as the gap with design that incorporates animal species. I think what has me excited the most is to continue working with misunderstood and unappreciated forces because there is this moment of pure satisfaction that occurs when you uncover a hidden gem and share it with the world.

## Common Questions

*Why did you choose bats, and how do you plan on picking species in the future?*

The process used in this thesis differed substantially from how I foresee it unfolding in future projects due to the fact that my framework was being created and formed throughout my research. Somewhat early on I realized that I wanted to work with animal species, but it was by pure happenstance of my first two design tests that bats were the species I chose. As mentioned in the design strategies section, I then used bats, and the variables associated with them, to select my site location. In future projects I see this process happening in reverse, because in practice the site is generally given to you. With this format I would attempt to find a native species that really fits in to the fabric of the city in a way that allows it to become an icon like the bat is for Florence.

*What makes this work best suited for a landscape architect instead of a biologist or conservationist?*

I think the key component here is that the field of landscape architecture really pushes for interdisciplinary work. Even though the project may be listed as landscape architecture, the wisdom and influence of these other disciplines are present throughout. Efforts would have to be coordinated with the appropriate fields because there is a plethora of knowledge which exists beyond that of a landscape architect's ability. When you combine the outside expertise of a biologist, conservationist, and ecologist with the integrated systems based thinking of a landscape architect you create a level of possibility that cannot exist within any single discipline.

### *How do you know if the bats actually benefit from this and like it?*

As this is a project both for and about bats, creating a design which they find enjoyable was a pretty important goal. The unfortunate truth is that as this is a research project that may never get built, we may never actually know if it succeeds in this matter. I can however say that if this was a built project, then the effectiveness of the design would simply be judged by the population of bats. If the bats found the design to be desirable then they would let that be known through an increase in their presence. Like many creatures the bats are not going to hang around (literally and figuratively) in an area that is not hospitable to them.





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