The Pathology is in the Place, Not the People[1]: the Establishment of a Greenspace in the Hollywood-Springdale Community

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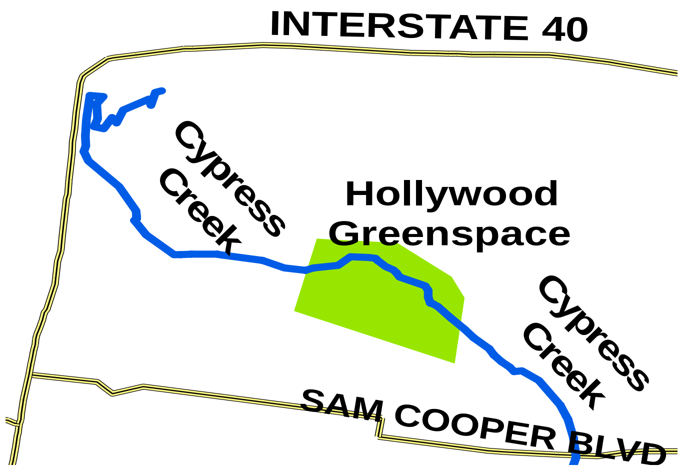

Introduction

The rapid increase in the world's urban population over the past century has significantly impacted the functioning of the earth's ecosystems and the services they provide. Urbanization "fragments, isolates, and degrades natural habitats; simplifies and homogenizes species composition; disrupts hydrological systems; and modifies energy flow and nutrient cycling" (Alberti 2005). While urban areas only comprise a small percent (approximately 1% to 6 %) of the earth's surface the ecological footprint of these areas can be large and pervasive (Alberti 2005, Paul & Meyer 2001). Cities are said to "appropriate a large share of earth's carrying capacity in terms of resource input and

[1] Kuo F. E., Sullivan W.C. 2001.Environment and Crime in the Inner City Does Vegetation Reduce Crime. Environment and Behavior 33; 343-367.

waste sinks" by requiring products and services from other regions and causing ecological changes to take place on a global scale (Alberti & Marzluff 2004).

The environmental degradation caused by development as well as "the dynamic interaction between social and natural systems in urban environments have resulted in urban forestry being increasingly recognized as a viable policy vehicle for improving the overall quality of life in urban regions, promoting economic well-being, and mitigating some of the environmental impacts of urbanization" (McLean & Jensen 2004). Urban forests and greenspaces provide benefits on both the individual and community level and are spaces that are actively and constantly challenging the damaging effects of urbanization.

Urban Ecosystems and the Benefits of Urban Greenspaces

"Although urban ecosystems are governed by the same ecological 'laws' as rural ecosystems, the relative importance of certain ecological patterns and processes differs between the two types of ecosystems(McKinney 2002)" due to the strong influence of humans on urban areas. Ecological processes such as the replacement of native species with invasive species are becoming more frequent in urban landscapes and threaten to begin the process of biological homogenization. Deforestation and fragmentation that normally occur with urban development reduce the populations of native plants and animals while allowing for an increase in the number of invasive species. While diversity in an area may increase through urbanization this is to the detriment of a healthy and natural ecosystem. Habitat loss and fragmentation also results in the reduction and isolation of natural populations and an increase in the amount of local extinctions. Vegetation that is in early successional stages characterizes urban habitats as these areas are subject to local extinctions as well as disturbance events. Human-induced disturbances can lead to mass colonization events which result in monospecific stands of vegetation where most of the area is in the same stage (Niemela 1999). Greenspaces maintain natural biodiversity by providing habitats for a variety of plant and animal species. Additionally, ecological networks and wildlife corridors can be established through the linking of greenspaces throughout the community, allowing for even greater biodiversity (Knee 2001).

Greenspaces provide an opportunity to reverse some of the detrimental ecological processes connected with urbanization. Changes in the local climate and hydrological cycle often accompany the process of urbanization. The urban heat island effect describes the climate modification that occurs with urban land cover. An increase in the amount of impervious surfaces in an area corresponds to a temperature differential increase with urban centers being warmer than their suburban or rural surroundings. Such climate modification can have biological consequences as flowering times are earlier and leaf drop is later for vegetation in urban areas. Urban forests help to lessen the urban heat island effect by moderating the climate through shade provided by trees. Due to the abundance of impervious surfaces in urban areas, greenspaces can help to improve drainage through the prevention of soil erosion and absorption of rainwater, both factors which will help alleviate flood hazards (Galvin et al. 2000). While urban areas often contribute to increased air pollution and decreased water infiltration and storage urban forests can help mitigate these effects by absorbing airborne pollutants and increasing underground water supplies through soil absorption (Smith & Smith 2006).

Ecological systems in urban environments represent complex interactions between economic, institutional, and social variables (Alberti 2005).In addition to the ecological benefits of urban greenspaces, "natural areas provide social and psychological services, which are of crucial significance for the livability of modern cities and the well being of urban dwellers"(Chiesura 2004). Environmental enhancement of urban areas through the creation of greenspaces helps encourage societal investment in a region and promotes social inclusion by providing free and equal access to facilities for every member of the community, features which are especially vital in lower income urban areas (Rishbeth 2001). Out of all the sectors of the population, children in particular benefit from the establishment of greenspaces. In the urban environment, greenspaces are some children's only connection with nature and a visit to a park can be an educational experience. In some areas, schools have reduced or even eliminated recess and physical education programs. Therefore, local parks may provide the only opportunity children have to engage in play and physical activity which is why playgrounds in urban areas tend to have the most heavily utilized play equipment (Spencer 2005).

Through greater social interaction, greenspaces can act as catalysts for larger community initiatives like no other public facility seems to be able to (Davis 2007). Through urban greenspaces, neighborhood social ties can develop that lead to a greater sense of community. It has been demonstrated that the presence of trees and other vegetation in urban spaces greatly increases casual social encounters leading to the formation of strong community ties, which are especially beneficial to urban low-income communities. Neighbors who have strong relationships have more vested interests in the maintenance of their common spaces and are more effective at gaining social control over unwanted behavior such as criminal activities as well as feeling more safe and adjusted in their neighborhoods (Kuo et al. 1998). In a study it was found that overall, people who live near greenspaces "enjoyed more social activities, had more visitors, knew more of their neighbors, and reported committing fewer acts of aggression toward household members than those living near barren spaces" (Davis 2007).

Attention Restoration Theory is a concept that has been cited in many studies that claims that the "resource underlying our capacity to direct attention can be renewed by contact with nature" (Taylor et al. 2001). More specifically the theory states that the "information-processing demands of everyday life-traffic, phones, conversations, problems at work, and complex decisions-all take their toll, resulting in mental fatigue" but "nature provides a respite from deliberately directing one's attention" (Kuo & Sullivan 2001). Since self-discipline draws on the same resources as directing attention it is expected that self-discipline would improve with exposure to nature. Forms of self-discipline that are often challenged in an urban environment include the ability to "concentrate, inhibit initial impulses, and delay gratification" which can have serious consequences if not followed including "academic underachievement, juvenile delinquency, teenage pregnancy, and other negative outcomes"(Taylor et al. 2001). In particular girl's self-discipline is affected by access to nature which suggests that "the barrenness of inner city neighborhoods may contribute to lower levels of self-discipline and, potentially to higher rates of negative outcomes in inner city children" (Taylor et al. 2001).

Aggression and violence in inner cities were also linked to mental fatigue which could possibly be mitigated through exposure to nature. Mental fatigue might increase a person’s tendency to react to a situation with “outbursts of anger and potentially…violence.” The everyday demands of living with poverty and in an urban environment put residents at a heightened risk for developing mental fatigue and subsequently responding with anger and aggression to situations. Economic, social, and environmental issues combine to place high demands on urban residents’ attention and it is often this sector of the population that lacks the natural settings needed to recover from mental fatigue. Violence scores for both mild and severe forms of violence were lower for residents that were living near greenspaces. Aggression against children was also significantly lower for study participants that lived near greenspaces (Kuo& Sullivan 2001).

Maintained greenspaces suggest, to residents and outsiders, a community’s strength, stability, and overall appeal (Davis 2007). The favorable perception of neighborhoods with greenspaces can renew economic interest in urban areas that are typically overlooked (Drescher & Franco-Wills 1997). Greenspaces can increase property values and attract and retain businesses to urban areas. Recent research suggests that people are willing to pay 3-7% more for residential properties that contain trees than those with little to no vegetation and consumers will shop more often in business districts that contain trees (Davis 2007). Lowered utility costs due to the mitigation of the heat island effect are another direct economic benefit associated with urban greenspaces. While difficult to measure, the indirect savings due to greenspaces may be significant and include savings in the areas of “road maintenance, health care, flood control, water treatment and a community’s overall water consumption” (Gatrell 2002). Greenspaces could play a major role in a movement towards urban revitalization in areas that are in desperate need of it (Drescher & Franco-Wills 1997).

Urbanization also affects the health and well-being of city residents through both indirect and direct factors. Indirectly the urban environment provides "the socio-economic, cultural and environmental determinants of health." Directly the health of urban residents is affected by the "poor urban environmental quality, air pollution, inadequate waste management, excessive noise, toxic effects of chemicals and heavy metals (e.g. lead, mercury)" (Tzoulas & James 2003).While the urban environment can negatively affect an individual's well being, experiences with greenspaces can help improve overall health and improve pre-existing conditions. Urban green spaces can contribute to community health through "improvements in ambient environmental quality, more opportunity for healthy lifestyles, and opportunities to come in contact with nature." There have been numerous studies that provide explicit links between physical health and exposure to greenspaces including a reduction in the severity of respiratory, cardiovascular, and circulatory diseases (Tzoulas & James 2003). Contact with natural settings also "positively impacts blood pressure, cholesterol, outlook on life and stress-reduction" (Maller et al. 2005)

The health benefits of greenspaces have been shown to be particularly effective for the elderly. The strong social ties that accompany urban greenspaces are connected with "lower levels of mortality, reduced suicide rates, less fear of crime, and better physical health" in elderly populations(Kweon et al. 1998). The psychological health of elderly people has also been demonstrated to be positively impacted by stronger community ties through exposure to greenspaces (Kweon et al. 1998). The restorative effects of a natural view “are being increasingly understood in stressful environments such as hospitals, nursing homes, remote military sites, space ships and space stations” as recent studies have shown that hospital patients that have a view of nature require less medication and have quicker recoveries from surgery (Maller et al. 2005, Davis 2007). Studies suggest that “the individual and community benefits arising from contact with nature include biological, mental, social, environmental and economic outcomes. Nature can be seen therefore as an under-utilized public resource in terms of human health and well-being” (Maller et al. 2005).

Study Site: The Hollywood-Springdale Community

The Hollywood-Springdale Community is an area of northern Memphis found directly northeast of Rhodes College which is an example of a community that could benefit greatly from the establishment of a greenspace. The social and institutional issues found in the area are similar to the study sites in literature that emphasize the benefits of contact with nature for urban residents.

Historically an African American working class community the area has declined in recent years due to a variety of factors. In a 2004 Community Outreach Partnership Center (COPC) grant application the Hollywood-Springdale area was described as an community, “whose residents are affected by poverty, poor health, extraordinarily high infant mortality rates, violent crime and pervasive physical and environmental degradation” with a populace where “most lack the education, support systems, and capacity to improve their lives” (Rhodes College 2005).

The population of the Hollywood-Springdale area was estimated to be around 4,000 people in 2000 which represents a population decline of approximately 27 percent from the previous decade. It is estimated that 16% to 25% of Hollywood Springdale residents are under the age of 18 while 16% of the populace is comprised of persons over the age of 65. The community has a high percentage of female heads of households (39.4%) when compared to city, county, state, and national averages as well as a high percentage of the population living below the poverty level (37.4 %). A high percent of unemployment as well as a low percentage of high school graduates also characterize the area.

Pervasive crime and numerous community health needs have plagued the Hollywood-Springdale community for many years. Violent crimes, property crimes, and drug related arrests are serious problems in the community and a main concern for the area's residents. The Hollywood-Springdale community is located in the 38108 ZIP code and out of the 32 ZIP codes for Shelby County, "38108 is first in infant mortality, second in teen births, third in heart disease and suicide, fourth in low birth weights, fifth in adult obesity and breast cancer, and eighth in AIDS and syphilis." Health concerns also stem from a history of environmental pollution in the area. Cypress Creek, which bisects the community, was polluted by the release of wastewater containing organic pesticides from 1940 until 1980. When the channelization of the creek was completed in the mid-1960s contaminated soil from the creek bed had been placed in residential backyards exposing the community directly to the contaminants.

Schools in the Hollywood-Springdale community are also an area of concern as both the local elementary school and middle school are failing all academic areas except writing based on national standards. Springdale Elementary School and Cypress Middle School have a large percentage of students that come from economically disadvantaged backgrounds as well as students that are deemed “problem students” by the community, meaning children that have behavioral problems or severe disabilities. Cypress Middle School has received a failing score in grade promotion, has low student attendance, a high suspension rate, and has experienced serious incidents of violence in the past.

While faced with numerous problems, the Hollywood-Springdale area is often characterized as a viable community with concerned residents that are willing to take the needed steps towards revitalizing the region. The social and institutional problems found in the Hollywood-Springdale area offer an opportunity to see a large amount of improvement in the community . The Hollywood-Springdale community is plagued with many of the same issues other urban areas face and could potentially benefit immensely from the establishment of a greenspace. A preliminary study by Kate Key and Rosanna Cappellato laid the foundations for the creation of greenspaces in the Hollywood-Springdale community. The study located 6 acres of adjoining vacant land south of Cypress Creek that has the potential to be developed into an urban greenspace. Possibly by addressing the environmental concerns in the area the greenspace could be a catalyst for a larger social change in the area (Rhodes College 2005).

Materials and Methods

An environmental assessment of the Hollywood-Springdale greenspace is the initial step in determining the ecological value of the site as well as determining future plans for the site. A vegetation survey as well as several soil measurements can aid in giving a comprehensive view of the health of the greenspace as well as what benefits the greenspace can provide to the residents of the Hollywood-Springdale community.

Vegetation Survey

A survey of the vegetation in the Hollywood-Springdale greenspace was conducted to collect general data on the structure and composition of plant species in the area. Overall ecosystem health and balance can be inferred through measures of biodiversity such as species richness and evenness.

The part of the Hollywood-Springdale greenspace south of Brown Avenue (see attached map) comprised only 2 acres of the approximately 6 acre total for the area allowing for a comprehensive vegetation survey to be conducted. The land parcels that comprise the greenspace were surveyed and the diameter breast height (D.B.H.) for each tree was measured with a diameter tape. Trees that had a D.B.H. of 10 centimeters were recorded and used in the survey and the species of tree was recorded. Using a Garmin™ handheld GPS unit the GPS coordinates of each tree were recorded for later use in GIS mapping.

The part of the greenspace north of Brown Avenue comprised of approximately 4 acres of land required an alternate surveying technique be used to try and cover as much area as possible. Utilizing a protocol for vegetation analysis published by Florida State University the area was surveyed using circular quadrats to minimize any edge effects. To try and obtain a representative sample of the 4 acres I used an area to radius relationship given in the protocol of 1/100 hectare: 5.64 meters meaning the radius of the quadrat measured 5.64 meters in length. The transect line was walked with stops at every 22.56 meters along the line which marked the center of another quadrat. The location of the center of the quadrat would be marked with the GPS unit and then a measuring tape which represented the radius of that quadrat would be laid down. Another measuring tape marked at 5.64 meters was used to create a wedge out of the transect circle and the species and D.B.H. of any tree within the wedge that had a D.B.H. of 10 centimeters or more was recorded. More wedges were created and the species within that section of the quadrat were recorded until every tree in the circle had been documented. These steps were repeated for every quadrat on the transect line. The data from the quadrats was extrapolated to be representative of the entire northern side of the greenspace to be able to quantify biodiversity through species richness and evenness. I also took measurements of how far away the center of the quadrat was from the fence along the edge of Cypress Creek to make sure that a straight line was being followed and a consistent distance from the creek was established.

To get quantitative data about the composition of the greenspace the species relative density and the species relative dominance, which is sometimes called the basal dominance, were calculated. Again using the Florida State University protocol the number of trees of each species was determined. The sum of all the tree species was calculated to get a total number of trees and then the number of trees for each species was divided by the total number of trees. This data was then multiplied by one-hundred to get the species relative density expressed as a percent. To calculate the species relative dominance the D.B.H. measurements had to be converted to the basal area for each tree using the equation below

$$\textbf{Basal area} = (\pi\ (\text{D.B.H.})^2)/4$$

The result of using the equation above gives the basal area in square centimeters. The basal are for each species could then be summed to get the total basal area. The total basal area for each individual species was divided by the value of the total basal area for all the species to obtain the species relative dominance which was then multiplied by one hundred. The result of these calculations was the species relative dominance expressed as a percent. By graphing the results of both the species relative density as well as the species relative dominance the two measurements could be compared to try get an overall picture of species composition in the greenspace (FSU 2007).

As another measure of the area's composition a diversity index was also used which considers the number and relative abundance of species within an area. The Simpson's index was the chosen measure of biodiversity which measures the probability that two individuals selected from a sample randomly will be the same species. The formula below is how the Simpson's index (D) was calculated

$$D=\Sigma (n_i / N)^2$$

n_i= Number of individuals of species i

N= Total number of individuals of all species

The value of D will range between 0 and 1 with 1 representing little diversity. Since as the value of the index approaches 0 with increased species richness and evenness D was subtracted from 1 to give

Simpson's index of diversity= 1-D

This value also ranges between 0 and 1 but with this index increased diversity corresponds to an increased value of the index. This is the value of the index which is utilized in the results section (Smith & Smith 2006). In the results section the index of diversity for the greenspace is broken down into two categories as well as calculated for the entire area. The area of the greenspace south of Brown Avenue and the area north of Brown Avenue are the two categories.

Using ArcMap Version 9.2 the GPS coordinates obtained by walking a transect line on the northern side of the greenspace were attempted to be plotted. The map would have allowed for a visual display of how much area was covered by the transect line as well as displaying the data from a previous tree survey completed by Kate Key. Unfortunately, ArcMap could not project the coordinates taken so utilizing the recorded distance from the creek at each quadrat the locations were plotted by hand on the GIS map.

Soil Respiration and soil temperature

Soil respiration is a measurement of biological activity occurring in the soil from microbes and plant roots which can help indicate the health and stability of an ecosystem. To conduct soil respiration measurements three sample plots were chosen, two in a forested section of the greenspace and one in a non-forested section. Following the USDA protocol for soil respiration tests the sample area was cleared of debris and surface residue. A hand sledge was then used to drive a coffee can, which acted as the carbon chamber, into the soil as far as possible. The height of the coffee can above the soil was measured (in centimeters) for three points on the side of the can. The average of these values was the height measurement used in the respiration calculation (USDA 2007).

The time that the can was placed in the ground was recorded and a waiting period of 30 minutes allowed for the CO_2 to accumulate in the chamber. Before the end of the 30-minute time period the Draeger tube apparatus was assembled. A needle was then connected to one section of plastic tubing and both ends of a CO_2 Draeger tube were broken open using scissors. The Draeger tube was connected to the other end of the needle's plastic tubing with the arrow on the Draeger tube pointed away from the needle.

A syringe was attached to a second piece of tubing which was connected to the other end of the Draeger tube. After 30 minutes, the needle for the Draeger tube apparatus was inserted into one of the three rubber stoppers embedded in the top of the can. In another one of the stoppers a second needle was inserted to allow air flow into the chamber while sampling (USDA 2007).

Over a 15-second span the syringe handle was drawn back to the 100cc reading. This process was repeated four times, with the tube being disconnected from the syringe to remove the air between each measurement. Looking at the Draeger tube after disconnecting it from the rest of the apparatus, the "n=5" column was read as the carbon respiration measurement since 500cc was sampled and estimated the highest point the purple color could be detected was estimated, which corresponds to the percent CO_2 for the sample. This procedure was repeated for the two other plots to have three sample plots total. Additionally, in each of the plots a soil thermometer was used to measure soil temperature at a depth of approximately one inch since temperature is a necessary component for the soil respiration equation.

To obtain soil respiration in (lb CO_2-C/acre/day) the formula below, given in the USDA protocol, was utilized

Soil Respiration (lb CO2-C/acre/day) = PF x TF x (%CO2 - 0.035) x 22.91 x H

PF = pressure factor = 1

TF = temperature factor = (soil temperature in Celsius + 273) ÷ 273

H = average height of the can above the soil

To obtain soil respiration measurements in a form that was more widely used the value for soil respiration that was calculated in lb CO2-C/acre/day was converted to mg CO2-

C/m^2/hr. The values calculated in mg CO_2-C/m^2/hr could then be used to compare the results that were obtained with studies on carbon respiration in other urban greenspaces.

Soil Fertility

Soil fertility is a measurement that is indicative of the physical, chemical, and biological processes that are interacting to support microorganisms and plant life. To assess the biological aspect of soil fertility a Solvita® soil quality test was utilized, which measures respiration from microorganisms in the soil. Since microorganisms aid in soil tillage, the release of nutrients, and resistance to soil-borne diseases this measurement could be an accurate indicator of overall soil quality.

Following the Solvita® protocol two samples were taken at each of the three plots where the carbon respiration measurements were obtained. Each sample was mixed until homogenous while large stones and debris were removed and then put into the sample jar. The indicator paddle was then placed in the soil and the time was recorded. The jars were kept at room temperature and out of sunlight for 24 hours at which time the paddle could be compared to a color key to evaluate the results (WERL).

Soil Moisture

Soil serves as a border between aquatic resources belowground and aboveground terrestrial processes including water that is obtainable for plant uptake. Soil moisture analysis can indicate the type of resources available for vegetation and signify the overall health of an area of land. To obtain the soil moisture content a Dynamax TH_2O soil moisture meter was utilized. During the 30 minute intervals for the carbon respiration tests the TH_2O probe was inserted into the soil in the same sample plot and a reading was taken for the soil moisture percentage.

Results

As a way of quantifying the results found of the ecological assessment of the greenspace some of the measurements are compared to a similar study conducted by K. Adam Bohnert under the guidance of Rosanna Cappellato. His study "The Carbon Dynamics of an Urban Forest in Memphis, TN" uses Overton Park as the sample site. While Overton Park is a long established and protected park it is subject to some of the same urban influences that affect the Hollywood-Springdale greenspace and could prove to be a comparable site. Conversely, Overton Park is free from some of the problems the Hollywood-Springdale greenspace faces such as dumping and so comparing the two sites could evaluate the influence of urbanization on the greenspace as compared to an established park.

Vegetation Survey

A previous vegetation survey conducted in the area by Kate Key listed a remarkable variety of trees found on the property including willow oak, water oak, cottonwood, elm, cherry, blackberry, and pine (Key 2006). These old growth trees are a rarity in an urban area and would provide significant environmental and aesthetic benefits to the local residents.

The goal of this vegetation survey was to get quantitative data of the vegetation at the greenspace which consisted of the calculation of the Species Relative Density as well as the Species Relative Dominance for the area. The results of the Species Relative Density show a wide variety of tree species are found in the area however Elm and

Willow Oak seem to have the highest density in the greenspace (Figure 1). However, when the D.B.H. of the trees is added to the calculation to gauge the Species Relative Dominance, the Willow Oak is the dominant species in the greenspace (Figure 2).

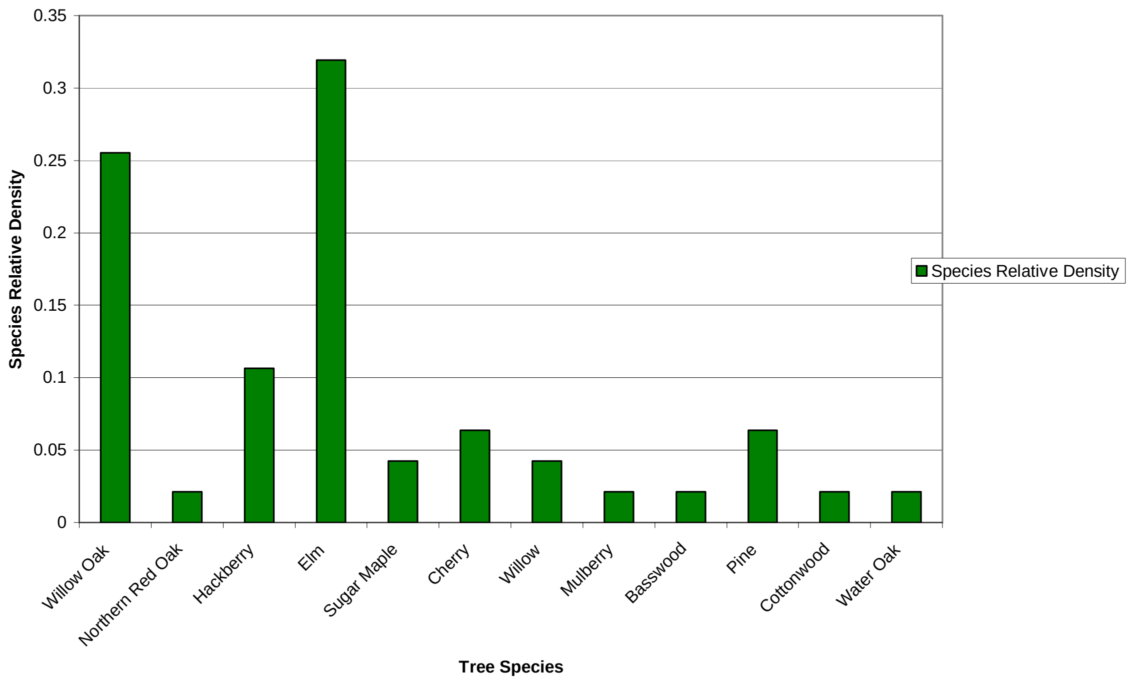

Figure 1: Species Relative Density for the Hollywood-Springdale greenspace

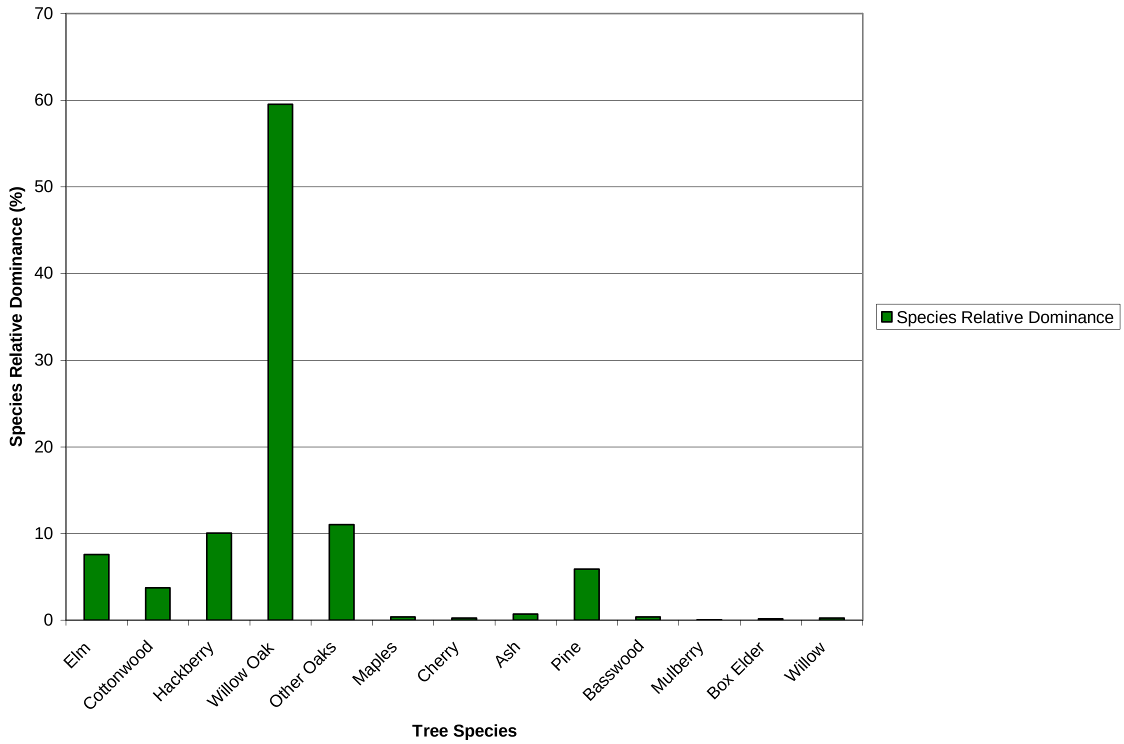

Figure 2: Species Relative Dominance for the Hollywood-Springdale greenspace

The Simpson's index of diversity was also calculated for the greenspace investigating the values of the greenspace area south of Brown Avenue and north of Brown Avenue as well as for the greenspace as a whole. For the area south of Brown Avenue the greenspace had a Simpson's index of diversity value of 0.808 while the area north of Brown Avenue had a Simpson's index of diversity value of 0.757. For the whole greenspace encompassing the areas on both sides of Brown Avenue the area had a diversity index value of 0.802 in the possible range of values from 0 to 1.

The results of a previous vegetation study conducted by Kate Key are shown on the GIS map in Figure 3 below. The D.B.H. scale on the map clearly displays the size which is correlated with the age range of the trees in the greenspace.

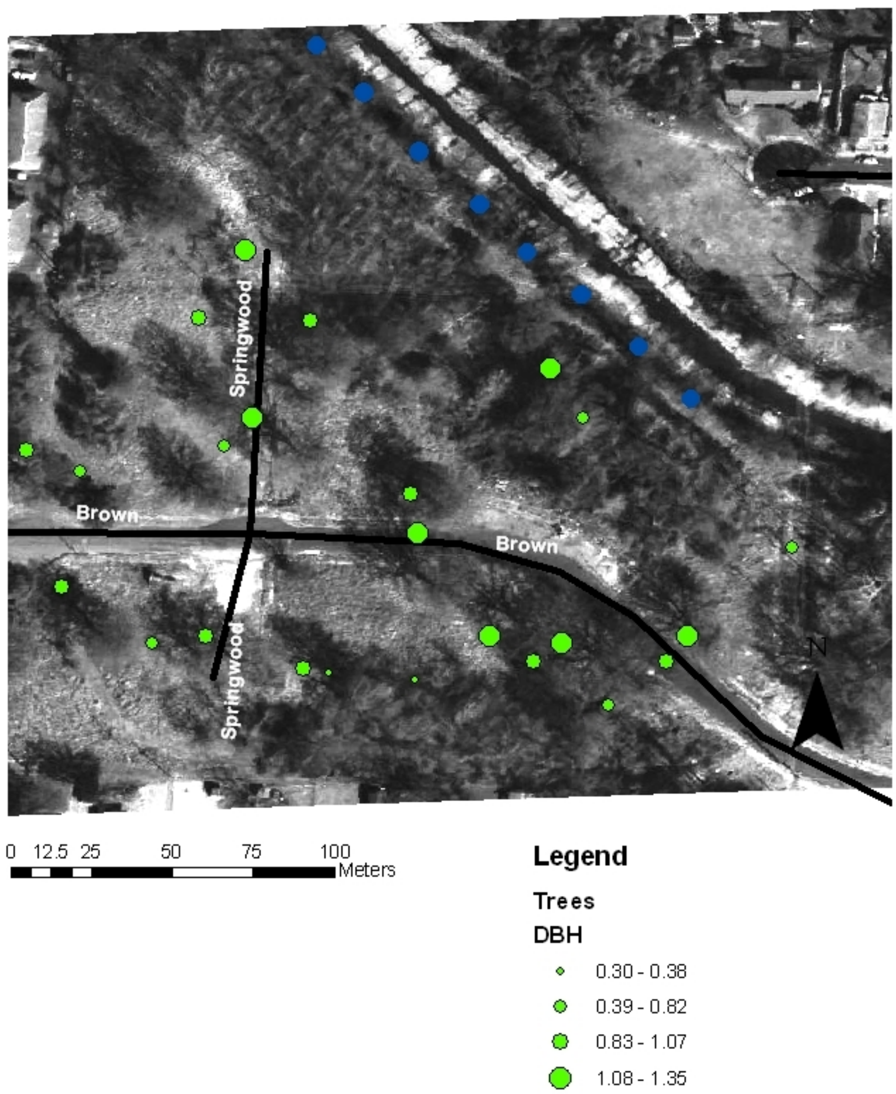

Figure 3: Map of Hollywood-Springdale greenspace with preliminary tree survey. The blue dots mark quadrats along the transect line.

Soil Respiration and soil temperature

Soil respiration was 185.21 mg CO_2 –C/m^^{2}/hr in the forest plot of the Hollywood-Springdale greenspace while the non-forest section had a respiration measurement of 94.36 mg CO_2 –C/m^^{2}/hr (Figure 4). Measurements from Overton Park displayed the opposite trend as the forest had a respiration value of 42. 62 CO_2 –C/m^^{2}/hr and the non-forest section had a value of 119.92 CO_2 –C/m^^{2}/hr (Bohnert & Cappellato 2006).

The average soil temperature for the forest plots in the greenspace was approximately 75.5 degrees while the non-forest section was 84 degrees. Since the Overton Park measurements were taken in fall and not summer there was quite a difference in the soil temperature as the average soil temperature inside the forest and in the non-forest plots was around 59 degrees.

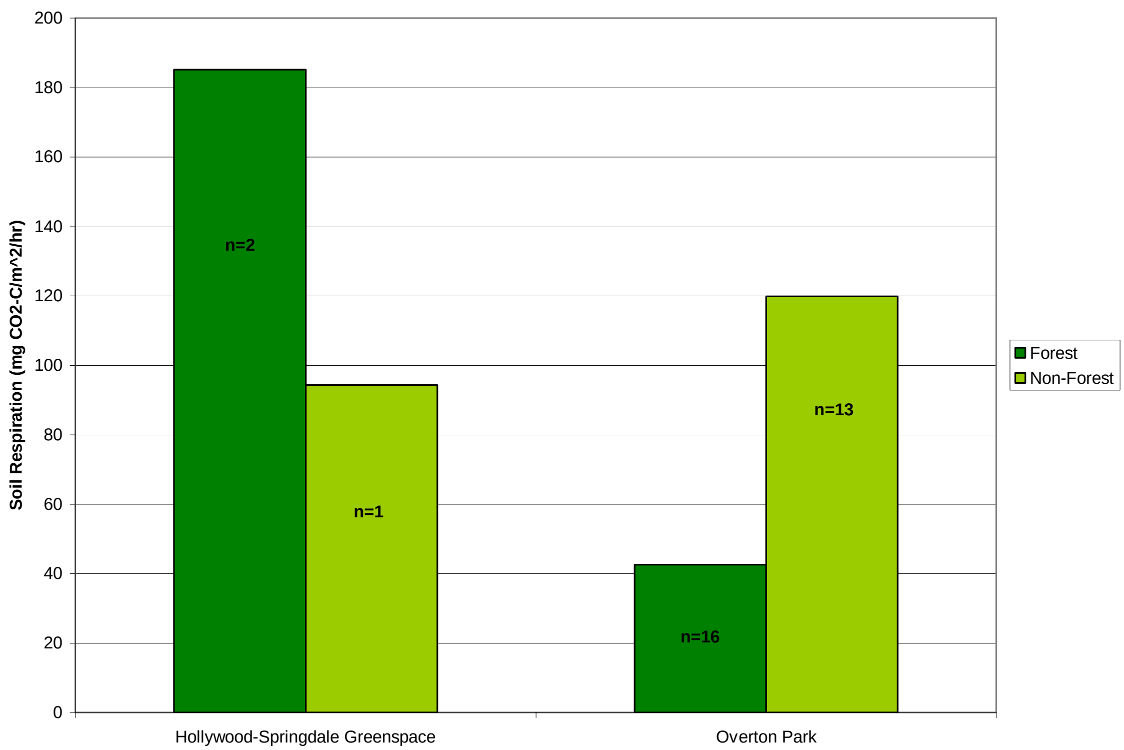

Figure 4: Soil Respiration measurements for two urban greenspaces

Soil Fertility

The Solvita® test determined soil health in the Hollywood-Springdale greenspace by measuring the amount of active micoflora in the soil. The color key used to evaluate the results corresponded to a numerical scale with 1 representing very low soil activity and 5 representing unusually high soil activity. The average reading for the forest plots was 4.75 while the one non-forest plot was a 5 on the soil quality curve.

To evaluate the results I compared the soil activity score from the Hollywood-Springdale greenspace to the soil activity score from samples obtained from Overton Park last fall (Figure 5). The average soil activity score in the forested section of Overton Park was 3.7 while the non-forest average was 2.6 (Bohnert & Cappellato 2006). The Solvita® test also estimated the amount of CO_2 respiration as well as the approximate quantity of nitrogen released per year based on the soil samples. Corresponding to a 5 on the soil quality curve the respiration would be greater than 33.6 lbs CO_2 –C/acre/day and Nitrogen release of greater than 100 lbs/acre.

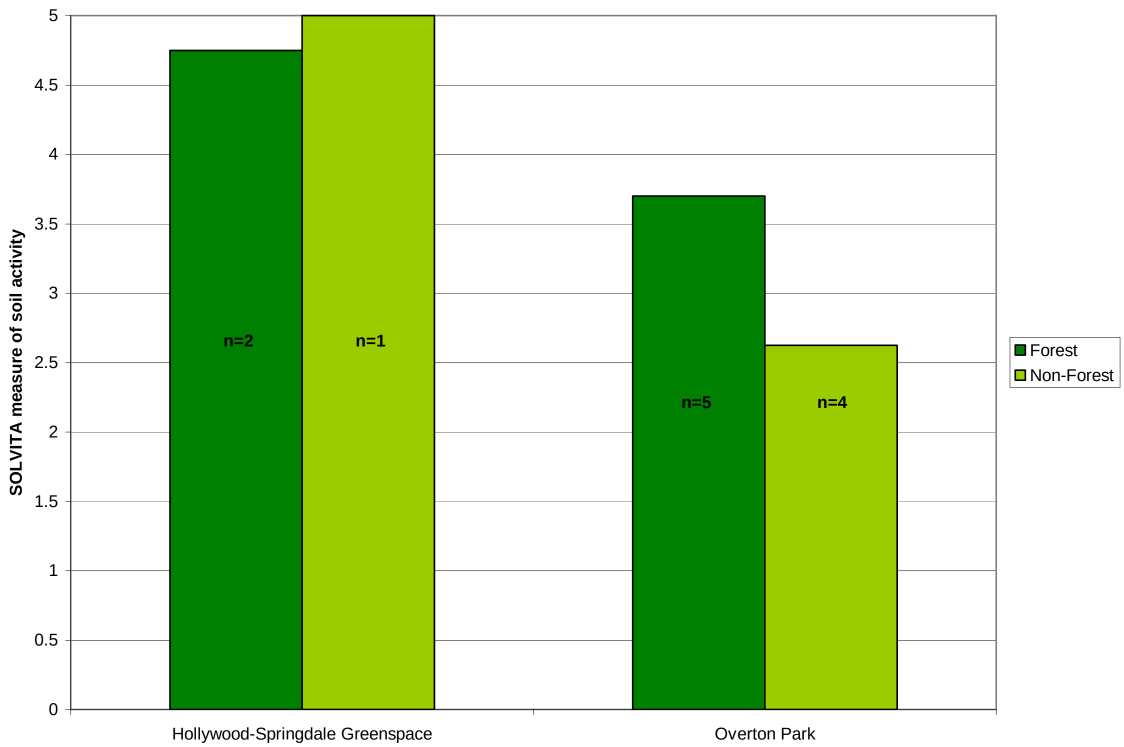

Figure 5: Soil microbial activity measurements for two urban greenspaces

Soil Moisture

For the Hollywood-Springdale greenspace the average value for soil moisture was 13.30% for forest plots and 15.80% for non-forest plots. Measurements taken in Overton Park in the fall averaged 29.52% for forest plots and 37.58% for non-forest plots (Bohnert & Cappellato 2006).

DISCUSSION

Ecological Assessment

Together the individual different aspects of the ecological assessment of the greenspace help to obtain a comprehensive look at the environmental condition of the greenspace. The species relative density, species relative dominance, and Simpson's index of diversity value all suggest a relatively healthy ecosystem in the Hollywood-Springdale greenspace. While the Willow Oak has a high relative density as well as high relative importance in the area, this species is native to the state of Tennessee and therefore provides vital ecosystem services as well as preventing the disruption of the ecological community by invasive species (**Tankersley 1984**). Several other species found in the vegetation survey such as Water Oak, Northern Red Oak, Hackberry, and Sugar Maple are also native species. The Simpson's index of diversity for the site was high with a value of 0.802 in a range of 0 to 1 with 1 representing high diversity as well as high species evenness. Biodiversity, especially with species native to the region, is important for maintaining the goods and services an ecosystem provides such as water and air purification, decomposition, and nutrient cycling which contribute to a healthy and more productive ecosystem. Though urban areas are often characterized by a large number of invasive species that often dominate the local ecosystem as well as low site diversity which was not what the findings from the Hollywood-Springdale greenspace suggest. A possible explanation for this is the Intermediate Disturbance hypothesis which suggests that species richness is often high for communities that experience an intermediate level of disturbance (Orians & Groom 2006). The transformation of the Hollywood-Springdale greenspace from a residential community to the vacant lots it is now comprised of may have been the right amount of disturbance for the area to support the wide range of tree species it currently does.

Soil measurements can also signify the ecological health of an area. Soil moisture, soil temperature, soil activity, and soil respiration are all factors that are interconnected and influence each other. The unusually high soil activity indicated by the Solvita test is expected with the high level of carbon respiration that was obtained in other tests. Studies also suggest that "increased mean soil temperature, will lead to faster decay, enhancing CO_2 release from decomposers" (Eliasson et al. 2005). The increase in the soil activity and soil respiration with increased soil temperature solidifies the interrelated nature of all of these factors. The high rate of soil activity and carbon respiration suggest a large amount of microbial activity as well as fertile soil that could be useful for the vegetation found in the area.

While the soil measures taken in the Hollywood-Springdale community varied greatly from those taken in Overton Park this may have been due to the small sampling size for the tests conducted at the Hollywood-Springdale greenspace. More samples are needed to determine if the difference between the soil measures obtained at the Hollywood-Springdale greenspace and those from Overton Park are statistically significant. The discrepancy in soil moisture values taken in the Hollywood-Springdale greenspace and those taken at Overton Park is could also be due to variation in sampling periods. Sampling in Overton Park occurred during the fall while sampling at the Hollywood-Springdale greenspace occurred during the summer when soil temperatures were higher. The Hollywood-Springdale greenspace had soil temperatures that were approximately 25 degrees warmer than the soil temperatures when the Overton Park samples were taken. While this temperature differential could explain the variation in moisture values between the sampling locations, variation within the sampling sites seemed to more predictable with non-forest plots having greater soil moisture than forested plots in both the Hollywood-Springdale greenspace and Overton Park.

The Hollywood-Springdale Community

Currently there are no parks, official greenspaces, or communal common areas inside the Hollywood-Springdale boundary so hopefully this study can act as a step towards making the greenspace initiative a reality with the understanding that the establishment of a greenspace in the Hollywood-Springdale community could be a catalyst for urban renewal of the area.

Studies that focus on the various psychological and behavioral changes that occur in populations that have regular contact with nature suggest that former theories on the source of urban blight may have been misleading. "Theories regarding ineffective patterns of behavior and functioning in the inner city focus on people: on individuals, on the social context, and on such concepts as 'a culture of poverty'" which may be the wrong approach as "perhaps the pathology is in the place, not the people" (Kuo 2001). The Hollywood-Springdale community could be an example of an area where the pathology is in the location and the establishment of a greenspace could initiate a process of urban renewal in the area. The residents of Hollywood-Springdale historically have not always been in control of their surrounding environment. Until the mid-1980s, Velsicol Chemical Corporation released substantial amounts of chemical by-products into the nearby Cypress Creek (which the greenspace is next to), and the negative effects of that practice continue to affect the lives of Hollywood Springdale residents to this day.

Due to soil contamination near the streambed, several sizable tracts of land have remained undeveloped since it is no longer safe to build on them. These vacant lots have been poorly maintained and have become sites of illegal dumping (Driscoll 2004). Resident participation and support will be needed to show that members of the Hollywood-Springdale community will no longer be victims of their own environment.

Future Studies

A more comprehensive vegetation survey comprised of more sampling sites may be necessary to obtain an accurate evaluation of the greenspace and what the area has to offer. With the area's history of environmental pollution chemical testing for contamination in the soil might be beneficial as well. Support for the greenspace initiative may be greater after more is known about the site and its potential to provide people with the benefits that come from exposure to nature.

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