Austin Urban Trails

Amber Bennett- GIS Analyst & Cartographer

Jason Hinojosa- GIS & Remote Sensing Analyst

Neliralda da Silva- GIS Analyst, Web Developer

Tree Canopy Shade Analysis of Austin Trails

Prepared by:

Austin Urban Trails

Prepared for:

URBAN FORESTRY
CITY OF AUSTIN

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Introduction

Summary

The value of a tree canopy can often go underappreciated in a growing urbanized city. The City of Austin's Urban Forestry Program & Board (UFP) is interested in the maintenance, protection, and amount of tree coverage available. The team, Austin Urban Trails, is equipped with analysts in Geographic Information Systems (GIS) who will help identifying shade distributions as it relates to the trails in the Austin area.

Purpose & Objectives

The purpose of this study is to help the Urban Forest Program meet their goals as presented in the comprehensive plan for the city. The objective is to create green corridors that have the trails covered with the tree canopy. Some possible benefits of having this canopy are more shade, cleaner air, better aesthetics, and a reduction in urban temperatures. Once shade distribution has been determined, we will be able to develop a shade index to show a range of values that represent the available coverage. This analysis can also be used for future evaluations and planning projects.

Scope

The study region includes the entire city of Austin, including the extra territorial jurisdiction (ETJ). See Figure 1. The area of interest will encompass tree canopy connections between the neighborhoods, watersheds, and trails. This analysis will be performed over a three month period, from September to December 2011.

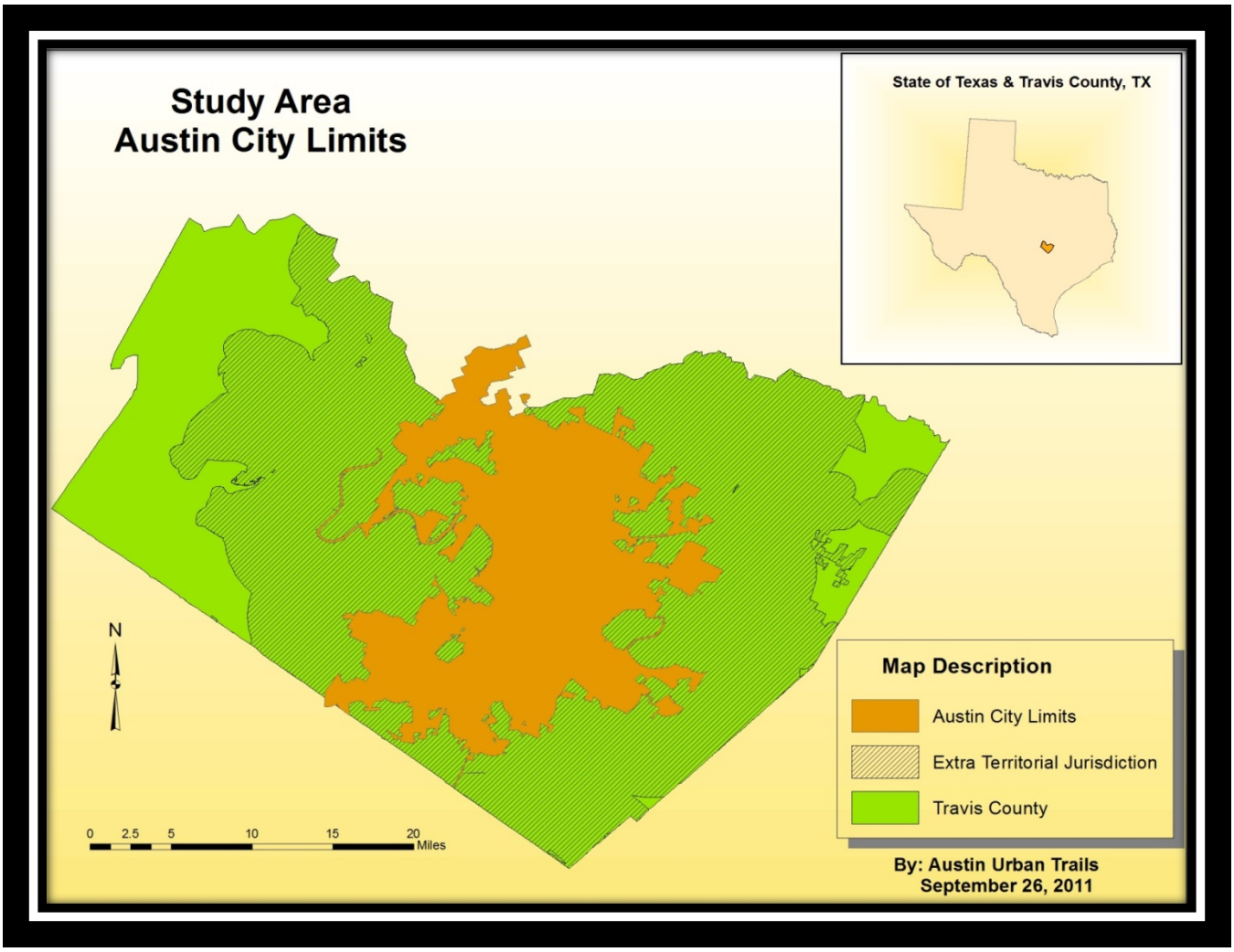

Study Area
Austin City Limits
State of Texas & Travis County, TX
N
0 2.5 5 10 15 20
Miles
Map Description
Austin City Limits
Extra Territorial Jurisdiction
Travis County
By: Austin Urban Trails
September 26, 2011

Figure 1.

Literature Review

Benefits of Urban Forestry

"The term 'heat island' describes built up areas that are hotter than nearby rural areas. The annual mean air temperature of a city with 1 million people or more can be 1.8–5.4°F (1–3°C) warmer than its surroundings. In the evening, the difference can be as high as 22°F (12°C). Heat islands can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality" (U.S. Environmental Protection Agency). Some urban communities want to know how forestry affects their heat islands as well as how the trees might possibly affect crime rates, and other quality of life issues. This literature review will provide some results from the studies of the heat island effect.

Benefits of Trees on Heat Islands

Energy consumption, pollution, and impaired water quality are some of the negative effects warmer temperatures can have on the environment. Excessive heat can also compromise human quality health and comfort. As the demands go up for cooling down during peak times during the hottest summer months, the sources used (fossil fuel plants) to create the energy will release more pollutants into the atmosphere. Sometimes citywide power outages occur due to over demand of this energy. Elevated temperatures will cause more ground level ozone to form thus making it even sunnier and hotter. Since raised temperatures on heat islands can have such negative impacts, the shading from the tree canopy in the urban environment is needed to aid in reducing the ambient air temperature (Heat Island Impacts, 2011).

Trees can improve water quality because their root systems act as filters. The roots keep the soil in place, thus reducing more pollutants from getting into the water system. Tree roots help slow down and reduce storm water runoff, flooding, and erosion. A study done for Dayton, Ohio estimated that its current tree canopy reduced potential runoff by 7% and even a modest increase in the canopy could produce almost twice that amount (Dwyer, McPherson, Schroeder, & Rowntree, 1992). When trees and plants are not present to collect some of the water runoff, elevated temperatures in our water sources occur and can have a negative effect on the aquatic habitat. The rapid temperature changes can cause stress and even be fatal to the natural aquatic life (Heat Island Impacts, 2011).

Community forests not only effect heat islands' temperatures and pollutions; they also contribute to the noise levels, and attractiveness of the urban area. Trees take in carbon dioxide and produce oxygen thus reducing smog and other pollutants. Trees work as a natural air filters that cut down on pollution. "Planting 500,000 trees in Tucson was projected to reduce air-borne particulates by 6,500 tons per year city" (Dwyer, McPherson, Schroeder, & Rowntree, 1992).

Real Estate

Studies have shown that buyers place more value on properties that contain good tree coverage on the residence as well as along the streets and park areas. Buyers know this will help reduce energy costs on their property over time. Trees look good visually as well as add a sense of privacy. While several studies have estimated higher values, even a conservative estimate of five percent increase on property values due to trees and forests on residential properties on heat islands can mean that $25 per year on a property tax of $500 can go back to the community. When multiplied by all the residential properties in the city, that benefit is well into millions of dollars (Dwyer, McPherson, Schroeder, & Rowntree, 1992).

Crime Rates

Studies show that trees and other vegetation might reduce inner city violence. Professors Francis Kuo and William Sullivan, co-directors of The Human-Environment Research Laboratory from the University of Illinois at Urbana-Champaign, examined the crime rates for 98 inner city apartment buildings of various sizes, occupancy rates, and vegetation levels. Kuo and Sullivan used these reports to examine the relationship between vegetation and inner city crime. The properties where more vegetation existed, fewer property and violent crimes were reported. This pattern may suggest that growing more trees in Austin might reduce some of the crime level for the city (Kuo & Sullivan, 2001).

Summary

The benefits of the urban tree canopy are numerous. Trees are natural environment cleaners as they produce oxygen and filter rainwater. The shade from the canopy coverage has several benefits including lowering urban island temperatures, which leads to less energy consumption and fewer toxins released into the atmosphere. Some studies suggest that urban areas with good tree shade have higher real estate values and lower violent crime rates. These benefits can be important while considering how to maintain the urban canopy.

Proposal

Data

The data layers necessary to create a shade index for the canopy coverage will be provided by the City of Austin's Urban Forestry Program (UFP), additional require data will be obtained from Austin GIS Datasets website.

Layer	Source
Tree Canopy	COA
Trails	COA
Parks	COA
Watersheds	COA
Neighborhoods	COA
Austin City Limits	COA
ETJ	COA
200ft Grid	Austin GIS Dataset

Methodology

The procedures necessary for developing the final project are data gathering and preparation, analyze available data, and create the final product. The software we will be using is ESRI (Environmental Systems Research Institute) ArcGIS-10. The initial step is to collect the data files from the UFP, which include the tree canopy, trails, parks, watersheds, and neighborhoods. The tree canopy layer will serve as the primary source for extracting the canopy data that is within the three sections: parks, watersheds and neighborhoods. Our next step is to extract the trails' data from each of the three individual sections. From these sections we will create a 20ft buffer around the trails which will help display the adjacent trees that cover the trails. This extraction will result in three separate illustrations; each having a 20ft buffer and the tree canopy within each section. After we create the buffer, we will divide the trails into smaller 200ft segments. In the last step we are going to develop a shade index according to a range of values that represent the available shade.

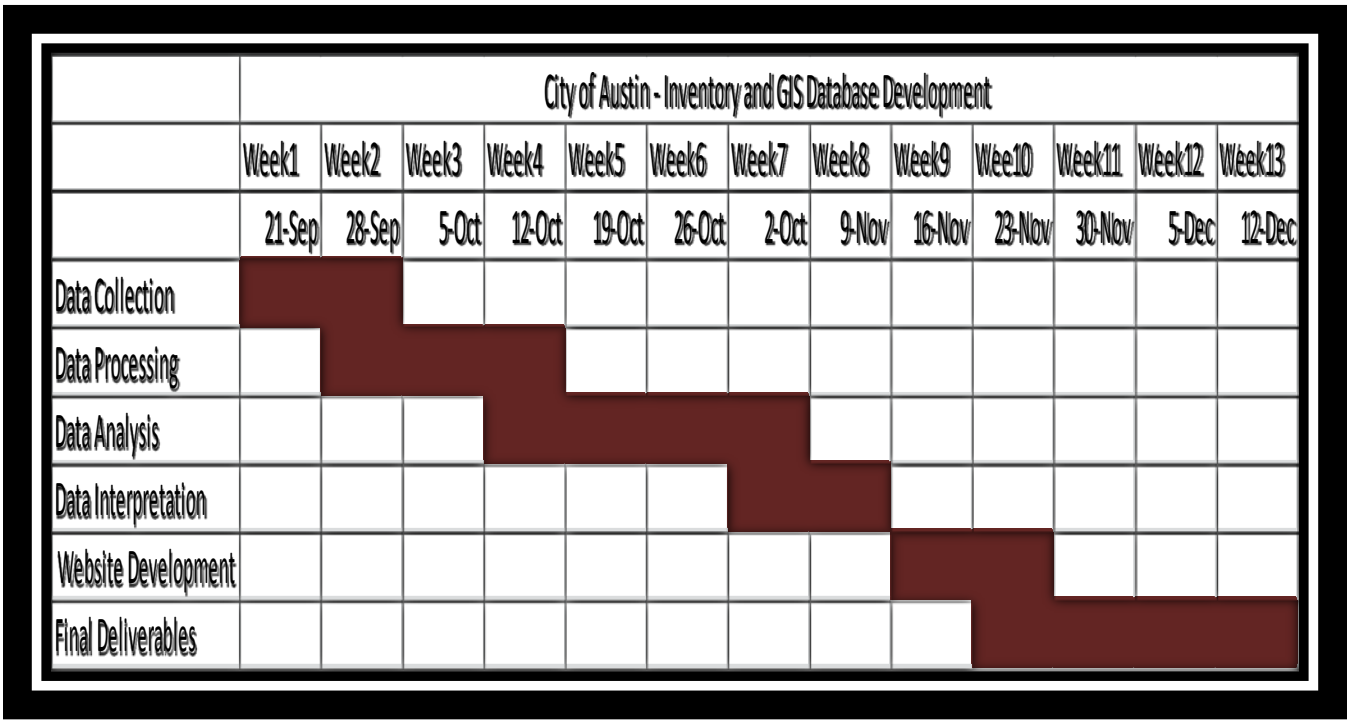
Implications

The project will meet the needs of the City of Austin to create a shade index for the canopy coverage along the trails. The data will help coordinate other existing programs to combine tree planting projects in areas missing trees. It can be used as a resource for planning projects within

the watersheds and neighborhoods, as reference for future decisions that may impact the quality of those areas. This study can be used by the COA Transportation Department and CAMPO (Capital Area Metropolitan Planning Organization) in their efforts to develop alternative transportation. This plan is to develop an interconnected network of trails with canopy coverage. This study can also be used to relate information of coverage with air quality assessments, home prices, and crime rate.

Timetable

Week one and two will be used for the data collecting phase. We have the data from the Urban Forestry Program & Urban Forestry Board, City of Austin, Texas and will determine if we need any more and where to obtain it. Weeks three through six will be spent processing and analyzing the data. Weeks seven through eight will be used for final interpretations and further analysis if needed to arrive at the best answers. Weeks nine through twelve will be spent on the presentation part of this project where we create a website, a CD and a final poster to display on the geography department's wall. All of this will be presented to Urban Forestry Program and they will be given the CD.



Budget

Data Collection	
Total Hours	40
20 hours/ week 3 weeks*	
Hourly Pay	$30.00
Total	**$1,200.00**
Data Analysis	
Total Hours	60
*20 hours/ week * 3 weeks*	
Hourly Pay	$45.00
Total	**$2,700.00**
System Management	
Project Manager	
Total Hours	50
Hourly Pay	$80.00
Total Pay	$4,000.00
Assistant Project Manager	
Total Hours	50
Hourly Pay	$60.00
Total Pay	$3,000.00
GIS Analyst	
Hourly Pay	$45.00
Total Pay	$2,500.00
Total	**$9,500.00**
Equipment Costs (for 10 weeks)	
Supplies	$200.00
*$200.00/ workstation * 3 workstations*	
Maintenance	$100.00
*$200/ workstation * 3 workstations*	
Depreciation	$200.00
$15,000 [total value of equipment]/ 30 [equipment life in months]	
**3 [months equipment will be in exclusive use for project]*	
Total	**$1,800.00**
Data	**$0.00**
Total Costs	**$15,200.00**

Final Deliverables

1. CDs
    - All data
    - Metadata
    - Power Point presentations
    - Proposal, Progress, and Final reports
2. Website
3. Final Report
    - Data
    - Maps
    - Metadata
    -References
4. Instructions on how to use the CD (readme file)
5. Professional Poster to be displayed in Evans Liberal Arts Building

Conclusions

This proposal describes the techniques we will use to identify and quantify the areas in Austin that need more trees planted to offer optimum canopy benefits. The literature review contains information and case studies that show the benefits of urban forestry. The data was given to us by the City of Austin Urban Forestry Program and the City of Austin GIS files. The analysis for this project should offer some answers as to how the current canopy in Austin relates to the trails and what might be done to improve the coverage. This proposal includes a timetable and budget. This canopy project will include a final poster and CD presentation.

Participation

All team members contributed to thoughts and ideas put into this proposal including the budget and timeline. Amber Bennett, project manager, composed the literature review, conclusions, references sections, and participated in the editing process. Jason Hinojosa, project assistant manager, composed the summary, purpose, scope methodology, and implications sections. Neliralda da Silva, GIS analyst, designed the logo and composed the data, timetable, and final deliverable sections of the proposal. Neliralda also participated in editing and design style of proposal.

References

Dwyer, J. F., Mcpherson, E. G., Schroeder, H. W., & Rowntree, R. A. (1992, September). Assessing the benefits and costs of the urban forest. *Journal of arboriculture*, *18*(5), 227-234.

Heat island impacts. (n.d.). In *heat island effect*. Retrieved March 16, 2011, from http://www.epa.gov/heatisland/impacts/index.htm

Kuo, F. E., & Sullivan, W. C. (2001, May). Environment and crime in the inner city : Does vegetation reduce crime? *Environment and behavior*, *33*(3), 343-367. doi:10.1177/0013916501333002