

## Hill Top Tree Analysis

The Hill Top Neighborhood is a small, vibrant nook located in the Central district of Tacoma, Washington. This historic community once peppered with working class families and civic value, now finds it self pushing against disinvestment and financial struggle. It was this general geographic and demographic location that I found to meet certain pieces of criteria, which would help in my analysis. I was fortunate to have a clearly defined purpose going into this final quarter of what my hopeful outcome would be. In this paper I will discuss how I was able to define this purpose and what this purpose was, my objective, methods, results and lastly weaknesses which could be improved upon.

### Purpose

To give some back history, I chose to coordinate my final GIS project with the City of Tacoma's Urban Forestry Department under the tutelage of Urban Forester Ramie Pierce per the recommendation of Professor Matthew Kelly. I felt that working with the city on a project would not only be interesting and engaging but an opportunity to gain knowledge and life experience within an active municipality where my skills might be needed in the future.

As a UWT Urban Studies student, I often find my self analyzing the urban form and seeing inequalities both social and environmental. One aspect that I found interesting about Tacoma is that it is a highly urbanized city with a long history of development and industry. Yet, there are major pockets found in the city having little to no tree coverage

with the exception of the North End. The lack of tree coverage has created a need to develop a plan of action to change this problem.

There is a renaissance regarding urban forestry in the US and I believe that the City of Tacoma has the ability to be an intricate part of this movement. There are movements such as the “Urban Forest Project,” in San Francisco, which is incorporating artistic and cultural elements in order to organize and influence the urban forest (UFP, 2010). This movement that is quickly spreading across the country is bringing legitimacy to the argument for increased green space as well as more environmentally focused policy. Currently there are plans to do the same type of project in order to organize the community and rally the city together and promote tree planting and preservation in the Tacoma area.

In addition to the broader public desiring an increased focus on green space and urban forestry, academics are arguing for it with the utilization of technology as its driver. Looking at land management and environmental policy we see that it is and has been predominantly development driven with little to no thought of open green space, forestry or sustainable development policy (Vejre, 2009). However, GIS has the ability to take many if not all of these environmental inequalities and develop a data driven, geospatially engaging map to inform policy makers and move the goal of sustainable development forward.

In more micro-purpose, I desired to look at how the urban forest is different in varying degrees in relation to more well off or depressed areas of the city. Taking such examples as Fanhua Kong, who discusses the relation of urban green space and connection to natural environment to land value impact (Kong, 2007). Tree coverage has

the ability to increase the social and economic value of a geographic region based off of GIS theory and analysis and my purpose was to work towards and support this movement.

### Objective

Tacoma is a highly urbanized environment, with a long history entrenched with development and industry. Though the latter has played as a major contributor to Tacoma's success and attraction as a major regional hub city the natural environment such as local tree coverage has been destroyed and covered with impervious surface. The loss of trees was once looked at as a good way to create new economic space for capital to develop, however as technology, science, and environmental consciousness has increased this viewpoint has drastically changed.

Thus my original thought was to analyze the tree coverage in the city of Tacoma and relate it to home and business values. By doing this I hoped to create a geospatial landscape, which identified areas where trees were improving home and business values in order to provide new places to plant trees. However in meeting with Ramie (Urban Forester) I found out that there was no hard data in digital form regarding city owned trees. Furthermore, there was a great need by the city to evaluate tree impact on streets, sidewalks and surrounding elements because of liability held by the city regarding trees in the right-of-way.

It was from these needs that I found my self having to slightly redefine the direction of my project in order to tailor the purpose of my work to the needs of the City. Thus my purpose shifted from identifying value of trees in relation to business and residential areas, to identifying risk, removal and replacement pockets. There is certain

risk associated with trees in the urban form that the City is held liable for if there is any injury or damage done by those trees or related pieces. The only way that the City can skirt liability is by have an adaptive and foundational policy or plan of action in place to fix or improve the condition of those trees and associated pieces (side walks, roads, curbs ect.). It is from this point that we are able to identify such aspects as sidewalk lift from trees, interference with power lines, intrusion of roadways or any other aspects which could be identified as liability. Identifying these liabilities allowed me to accumulate a list of pieces to weigh out whether or not trees should be removed or not, identifying gaps and places to simply remove or remove and replace.

I felt that developing a geospatial map identifying the risk, removal and replacement of all city owned trees and trees in the right-of-way was a bit daunting and realized that I needed to bring my project down to a test area which could be used as an example for future analysis. I knew that I wanted to have an area of the city with a good mix of both residential and commercial development. Additionally, I wanted to have a test area that was known for being considered a lower income community because I wanted to analyze trees in relation to disinvestment. I ended up choosing to analyze the Hill Top community because of its demographic makeup and diverse clustering of business and residential streets. My goals are to identify city owned trees through the interpretation of current institutional knowledge, collect those tree points and update associated attributes (DBH, sidewalk lift), and map those points along with conflicting data to create a landscape of risk, removal and replacement. By mapping this information, I will be able to propose new planting strategies, which have the ability to “reduce urban traffic speeds, create safer walking environments, increase security,

improve businesses, and cut down on environmental degradation” (Urban Designer, 2008).

## Methods

My first endeavor in the process of developing my project and analysis was to collect tree points utilizing a GPS Trimble unit and imputing associated attributes relevant to evaluating the risk and removal of city owned trees (per the guidance of The City of Tacoma’s Urban Forester Ramie Pierce). The attributes, which I impute, that were relevant to my analysis were as followed: City Owned, DBH (Diameter Breast Height) and Sidewalk Lift (in inches-as a numeric value). Once I had fully collected the points I needed within my test area in the Hill Top neighborhood I then exported the data into Pathfinder Office which is the data management system to convert collected points into shape files, allowing me to then project the data in ArcGIS.

It was at this point Professor Matthew Kelly was able to acquire sensitive utility data from Tacoma Public Utilities such as power lines, sewer lines, storm drains, and water lines. Unfortunately, the data came in the form of CAD (Computer-Aided Design) which was semi-compatible with ArcMap however not able to interact with GIS data, thus I had to navigate through the CAD data and interpret what was relevant or not. Once I compiled what data within the CAD files were relevant to my project, I was able to export the information and convert them into shape files to be used in my analysis. It was this utility data that was needed in order to primarily identify what trees were in need of removal and secondly to eliminate bad areas for replanting.

Once I was able to bring in my tree data and utility data, my next step was to create buffers around my utilities per City of Tacoma municipal code regarding tree-

planting practices (City of Tacoma, 2010). By doing this it allowed me to then overlay my tree data and intersect the trees that interfered with the utilities and their associated buffers, creating a spatial landscape of bad trees in need of eventual removal. I did this intersection with each layer (electrical, sewer, storm drain, water). As I intersected and identified all of my “bad trees” and “good trees,” I added the information into the original Hill Top tree data attribute table.

My next step was to take all of my trees intersecting with utilities “bad trees,” and assign a number to them. So I assigned the number “1” to all of my “bad trees” and the number “0” to all of my “good trees”. By doing this, I was able to create a weighted scale based on the trees that that need to be removed. For example, the trees that intersected with the most attributes would have a higher removal rating. Lastly, I used sidewalk lift as a standard of removal and combined it with all other attributes by calculating and adding all of my attributes together. I then created a new field in the attributes field which was the ‘Aggregate Total’ field and brought those calculations in, representing my landscape of weighted tree removal. An example of what this looks like can be seen in Example A. below:

Example A.

OBJECTID	DBH	Sidewalk I	Res_Com Tr	sewerline	StormD_goo	WaterLine	WaterPoint	Electrical	Tree Remov	Aggregate
1	12	0	Commercial	0	0	1	0	0	Remove	1
2	7	0	Commercial	0	0	1	0	0	Remove	1
3	8	1	Commercial	0	0	1	0	1	Remove	3
4	12	2	Commercial	0	0	1	0	0	Remove	3

\*Here we see the Aggregate Removal total, which is representing the total 1's added up between Sidewalk, Sewer line, Storm Drain, Water Line, Water Point, and Electrical.

Once I was able to calculate all of the layers together, all that needed to be done was to symbolize the final map based off of the Aggregate Tree Removal field on a green → red color scale, green representing least critical and red representing most critical.

Additionally, I overlaid all of my other layers to visualize the full landscape of the Hill Top community including residential and commercial parcels to see their relation to existing trees.

## Results

Through my analysis of the Hill Top neighborhood I was able to collect 176 trees that otherwise did not exist regarding City owned trees and trees in the right-of-way. Secondly, I created a landscape of trees that could be deemed for removal because of their inconsistency with City policy, regulation and liability factors. The total of trees considered for removal is 94 of the 176 that were collected 2 of which are of the highest priority removal. Furthermore, I was able to visually display pockets within the community where future tree planting and replanting could occur in order to bring environmental vitality to an otherwise disenfranchised neighborhood.

## Improvement

Though I would like to think that I have done a good job regarding data collection, data management, process, evaluation and analysis I have realized some other attributes which should be considered if I was to continue with this project. The attributes are as followed:

- Impervious Surface cover
- Fire Hydrant locations
- Future planting points (which would require me to gather points with the Trimble Unit and create attached attributes such as future tree species).

- This would allow me to develop a more comprehensive action plan for strategic planting of trees to improve and maximize the livability of the area through community input and professional guidance.
- Taking into consideration (walkability, businesses improvement, residential street safety and environmental factors).
- Rout analysis for Public Works crews regarding maintenance and removal for most efficient rout, considering such factors as drive time, work time, hourly rate and number of employees).

## Works Cited

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