Twin Cities Urban Tree Canopy: Exploring Canopy Gaps in Disadvantaged Areas

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Introduction-

The best time to plant a tree was 20 years ago, the second best time is now. Studies show that the Twin Cities stand to benefit greatly from an improved urban tree canopy. Minnesota is getting warmer, and wetter. Higher temperatures and more precipitation presents some unique problems that will influence how we deal with the inevitable change that will impact the land of 10,000 lakes. It goes without saying that there's no cookbook approach to handling these problems. The Met Council has expressed interest in obtaining more research on urban tree canopy renewal projects. In our project, we sought to examine a few key aspects that we found to be most important in an urban tree canopy. We found several tree species that would be resilient to future climate change in the twin cities area as well as species to replace current problem-species that are susceptible to invasive species and diseases. We also found areas in the Twin Cities of low income where poorer health is a correlation to the problem of health. A healthy urban tree canopy in these areas could potentially improve health of those that are without a tree canopy. The results that we obtained can provide valuable insights and guidance for future urban planners and other entities that seek to improve the Twin Cities tree canopy.

Future Climate Change in Minnesota-

Minnesota's average temperatures since 1900 have rose about 1/10th of a degree every decade. However, that warming rate is accelerating. In the last two decades the average temperature has risen about half a degree.[2] The average minimum January temperature is rising at an alarming rate. An area around Hibbing and Grand Rapids has experienced an average temperature increase greater than that seen almost anywhere else in the nation.[2] The general trend of northern Minnesota heating more

quickly than southern Minnesota reflects a global pattern in which the Arctic and northern latitudes

warm faster. Rainfall varies across Minnesota, but the state now gets an average of at least 20 inches a

year, something that wasn't true in the last century. "Mega Rains" are also more frequent than before.

Far more really big storms, those in which at least 6 inches of rain fall over an area of 1,000 or more

square miles and the core of the storm generates at least 8 inches of rain, have hit in recent years.[5]

Examples of Cities with Impressive Urban Tree Canopies-

When coming up with strategies to improve the quality of urban life, urban planners often find it

helpful to see what other successful cities are doing. The first city we evaluated with a particularly

impressive urban tree canopy was Portland, Oregon. In 2012, as part of the "Portland Plan", the city

made an effort to providing trees to low-canopy, low-income, and high diversity neighborhoods.[13] One

strategy included planting trees in unconventional open spaces such as highway on-ramps or

commercial and mixed-use corridors.[14] Portland is also at the forefront of cities that replace

conventional roofing with "ecoroofs," which is a layer of vegetation growing on top of a synthetic,

waterproof membrane.[15] These "ecoroofs" provide much needed greenspace for urban dwellers,

especially low-income residents that may lack access to parks, open space, and greenery.[15] To remove

the barriers of the time, money, and energy of planting trees, Portland has created the "Free Tree

Neighborhood" program.[13] It prioritizes and rotates neighborhoods that are suffering the most. The city

uses on-call contractors to plant trees at no cost. All the residents have to do is water these trees for the

first two summers, which turns out to be about $0.83 per tree.[13]

Sometimes in light of a disaster or hardship comes creative thinking that leads to unexpected

success. That is exactly what happened to Austin, Texas- the second city we evaluated with an

impressive urban tree canopy. In response to an on-going drought that began in 2010, Austin has

adopted a new urban forest plan that has increased their tree cover to 37%, the second most urban tree

cover in the U.S.[7] Austin has been able to save one million gallons of water per year by watering trees with reclaimed and filtered municipal wastewater.[7] Planting crews and local non-profits are also making smarter choices on where to plant with the development of the "Tree Planting Priority Map Tool."[16] This interactive tool serves to prioritize which areas should receive tree planting in the near future. Examples of categories include where in the city to plant to help mitigate environmental justice, air quality, water quality, and addressing development impacts.

Tree Canopy in Low-Income Areas-

In regards to tree canopy and environmental injustice, one study performed in Tampa, Florida supports the disproportionate distribution of tree cover and where certain groups of citizens live. Researchers found a significantly lower proportion of tree cover on public right-of-ways (trees along sidewalks) in neighborhoods with a higher proportion of African Americans, low income residents, and renters.[4] Surprisingly, the data suggests that these existing areas of low tree cover may not be due to a lack of available planting areas in Tampa.[4] This means urban planners and city officials could develop the urban tree canopy in these disadvantaged areas, but choose not to. This trend is not just unique to Tampa. Other major cities such as Baltimore, L.A, New York City, Philadelphia, Raleigh, Sacramento, and Washington D.C had a similar positive correlation- as the amount of trees in a neighborhood increases, the higher the average incomes increase.[9] More importantly, where you find low-income residents, you find fewer trees.

Research Question-

Where in the Twin Cities are the optimal locations to increase the tree canopy that will best benefit the overall health of the community, and which species are most resilient to disease and future climate change in these areas?

Methods/GIS Model-
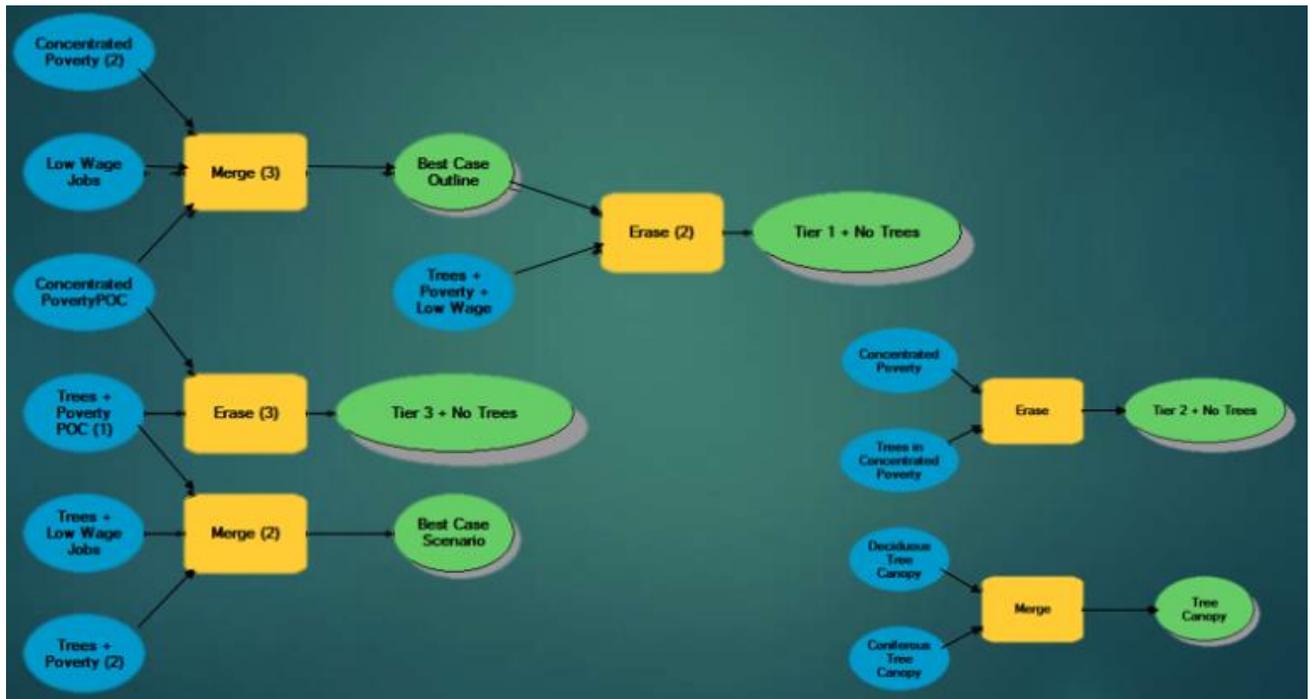
The intention of our model was to provide three separate plans of attack that the Met Council could

utilize, based on their needs. The first and most ambitious, was intended to provide the most heroic

scenario. If money was not an issue and we had a surplus of free trees, this would be the solution. We

also provided a most economical solution, which is most practical for financial issues, as well as a

compromising medium-tiered solution. This was done by utilizing data layers that highlighted

impoverished areas and minority areas, as well as areas without tree cover. We merged areas of

poverty with areas lacking tree canopy to find the best areas to target for development.


Results-

In addition to the GIS work which provided the pertinent areas for tree canopy development, we

also researched over two dozen tree species, in search of a handful of the best for a Twin Cities tree

canopy. The following is a table that summarizes our findings.

Tree Species	Shade Tolerant	Flood Tolerant	Drought Tolerant	Street Use	Average Lifespan (Years)	Pros	Cons
Hackberry	√	√	√	√	150-200	Windbreak, cheap, Disease/insect resistant, Attract pollinators Does better than many other trees in alkaline soils.	Sensitive to spray salt.
Bur Oak	√		√	√	200	Windbreak, Drought resistant; Adapt diverse environments More oak wilt resistant than red oaks.	Limit intolerance to flooding.
River Birch	√	√	√	√	50	Windbreak, Heat resistant, Adaptable to varying weather, Disease resistant.	Susceptible to Birch leaf miner. Needs water management.
Allegheny Serviceberry	√	√	√	√	50	Edible fruit, Attract pollinators, Wildlife habitat Ideal in urban settings (boulevards, parks, and under utility lines) Tolerant of spray salt.	No known diseases/pests
Red Cedar	√		√		150	Good for landscaping, Heat and high drought tolerance, Spread canopy (blocks sunlight).	Cedar-apple rust near apple trees.
Bicolor Oak	√	√		√	150-300	Native to all of SE Minnesota.	Prefers acidic soils.

|					More oak wilt resistant than red oaks.	

Table 1- Recommended tree species for planting in the Twin Cities area[3]
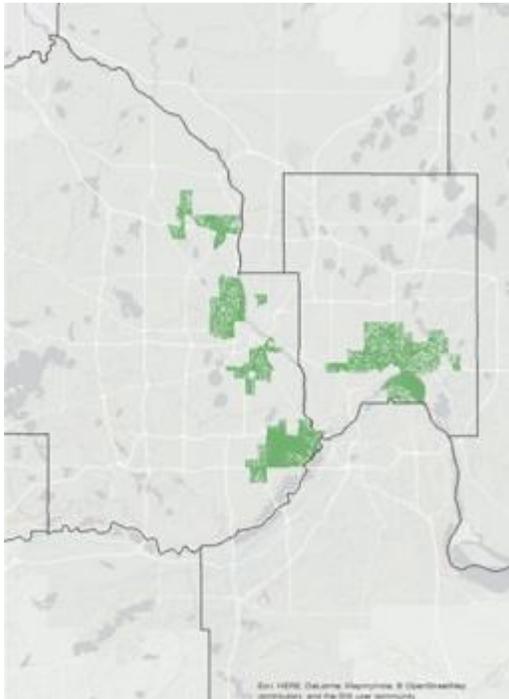
Map 1 (High Priority)- Gaps in current Twin Cities urban tree canopy and areas of concentrated poverty where minorities make up at least 50% of the population.
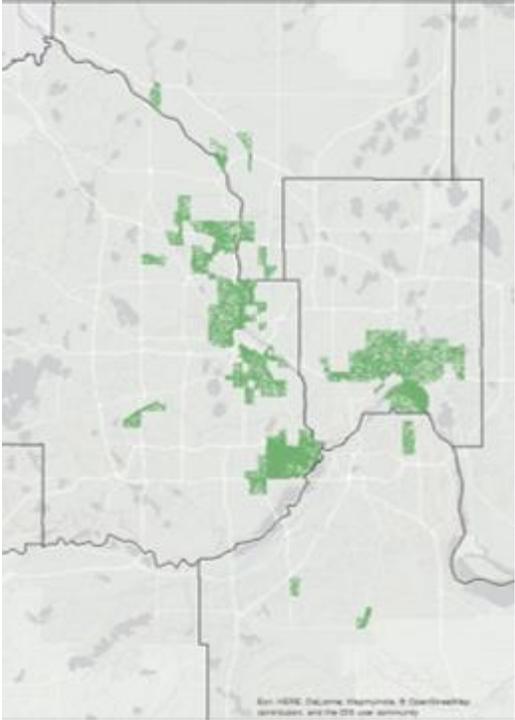
Map 2 (Medium Priority)- Gaps in current Twin Cities urban tree canopy and areas of concentrated poverty.
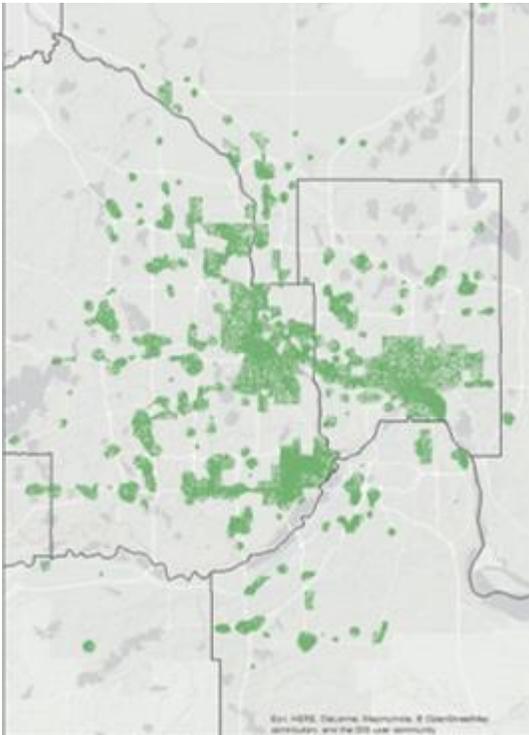
Map 3 (Best Case)- Gaps in current Twin Cities urban tree canopy and areas of concentrated poverty combined with areas that have a large density of low wage jobs (<$40,000).

Discussion-

Through our research we were able to provide possible solutions on where to develop the urban tree canopy in the Minneapolis/St. Paul metro area. It is important to remember that climate change will cause some habitat changes locally, and tree ranges may differ drastically from what they are today, allowing for new trees to enter our urban forests. This recognition of a changing climate is crucial as cities begin to think about the right trees to plant that are able to survive the next 60-70 years. These variables lead to many questions, however ultimately lead to two significant paths that our research needed to focus on: what hot spot areas to target for tree canopy renewal, and what tree species to utilize for pragmatic reasons related to climate change.

An increase in urban tree canopy offers a variety of benefits that may often go unnoticed. A plentiful tree canopy is helpful in mitigating pollution in urban centers, helping sequester carbon, trapping small particulate matter from the air, and also providing economic benefits, like an increase in properties values. Hedonic price models show that trees increase the sale prices of homes from up to 250 meters away.[5] While tree canopies may provide increased home values and other monetary benefits, for some it is hard to see past the cost of improving the urban tree canopy. Many times an economic evaluation of an increase in the urban tree canopy in a certain city can demonstrate that planting more trees can be cost-effective, while seeing returns on investment through the added benefits given by the tree canopy. However, the benefits of root systems to capture stormwater and flooding problems provides a major benefit to emergency management. What incentivizes a homeowner to provide a home landscaped with trees is a 5-15% increase in value. What incentivizes an entity like the Met Council to provide an area with an increased tree canopy is things like reduced cost in emergency management and improved air quality.

The list above of selected tree species are not the only choices for the Twin Cities canopy. There are more tree species that are suitable and fill the criteria that we set out. The species that were selected reflect a varied choice of trees that will survive different locations based on the criteria as well. There is no one tree that will fulfill all of the criteria to perfection, for if one did, it would already likely be planted or be a larger part of the canopy. Taking into consideration of the locations that are to be forested is a process of study and is a case by case problem. Also different choices will allow for the building of resilience within the canopy so as to mitigate or eliminate problems that we are experiencing now with the current crop of ash tree species. Just as there are favorable choices, there are also poor choices, for example Linden trees, which have very little to no resistance to any kind of road salt and salt spray, making them despite other positives, unfavorable.[3]

Finding a way to increase the urban tree canopy in a more equitable way will be a major factor in the Twin Cities ability to combat the upcoming impact of climate change on trees. Coming up with strategies that give an equal opportunity for disadvantaged residents to receive the benefits, environmentally and economically, of trees need to be a priority for Minneapolis/St. Paul urban planners and foresters. If a city has X amount of dollars to spend towards a tree canopy, they need to know X, Y, and Z locations that will give them the most benefit. We feel that the impoverished areas that are currently lacking a tree canopy in the Twin Cities stand to benefit not only those communities themselves, but the Twin Cities as a whole.

Conclusion-

Threats from Emerald Ash Borer, Dutch Elm's disease, and climate change present a unique problem for the Twin Cities. The Twin Cities area could benefit greatly from an improved and properly repaired tree canopy. Our research solved many problems and answered many questions regarding this issue. We first sought where to plant trees for the greatest benefit. Studies show that impoverished

areas suffer from health problems that could be reversed with an improved tree canopy. We were able

to pinpoint areas of poverty and minority areas that are largely lacking in tree canopy. The tangible

benefits that a tree canopy could provide to these areas could boost the overall health and could be a

catalyst for a domino effect towards improving the well-being of these areas. Things like community

engagement towards beautification and the reduction of crime. The climate disruption problem

creeping upon the Twin Cities means that we cannot simply replant the trees that may no longer thrive

here. We researched tree species and the variables surrounding their ability to thrive to find species that

would benefit the Twin Cities the best. Our work is meant to be used as a guide for any entity that seeks

to replenish the benefits that a tree canopy can provide. We provide the areas in the Twin Cities most

needing of canopy improvement and the species that will best weather the changes in climate the Twin

Cities face.

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