25-Year Scranton Tree Plan

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Introduction

Trees contribute to a healthy ecosystem that in turn supports communities. Factors such as location of the tree, height and canopy diameter were measured by researchers in the study *Tree Ecosystem Services, for Everyone? A Compositional Analysis Approach to Assess the Distribution of Urban Trees as an Indicator of Environmental Justice.* Their research shows the importance that urban trees hold in cities. Urban trees provide benefits to their communities by improving air quality, mitigating heat health-related problems, providing filtration and reduction of water runoffs, moderating temperatures, aiding in the reduction of noise pollution, and providing habitats for different species. These benefits add to the economic viability of the community, the health of its residents and the long-term sustainability of the region.

Figure 1.I, *Benefits of Urban Trees*, https://treeboston.org/tree-equity/benefits-of-urban-trees/

Introduction

There are also benefits trees provide to mitigating injustices produced in the past. Redlining, a discriminatory practice that withheld investments into communities considered “hazardous”, was banned through the Fair Housing Act of 1968. However, many communities with lower socioeconomic status and higher numbers of people of color still feel the effects through unequal access and distribution of shade.

A connection found between tree canopy disparity in wealthy, mostly white neighborhoods versus low-income, minority communities can be traced back to the 1930’s and this process of redlining. Disparities therefore place low socioeconomic groups and people of color as a disadvantage, making it extremely hard to build and maintain tree covered urban spaces.

The effects of redlining continue to be perpetuated, holding these communities back from healthy and just neighborhoods. Redlining is now banned, but these neighborhoods still feel the heavy effects. With trees being an important resource linked to the economic development and health of an area, it’s important to explore the equity of this natural resource and the impact political and social structures play in this distribution.

Scranton, PA is lacking in tree canopy cover. There are many neighborhoods within this city that are disproportionately affected by the lack in green spaces. The health, air quality, beauty, and equity of such communities are at risk. This needs to be addressed.

Redlining and Relation to Climate Change

Urban Areas are Feeling the Impacts

Urbanized areas typically experience higher temperatures than rural communities. Structures such as buildings, roads, and other types of infrastructure absorb, and help to re-emit heat from the sun's energy. In specific, "Cities occupy 2% of the earth's surface but their inhabitants consume 75% of the world's energy resources. Under certain conditions, the heat from solar radiation and different urban activities can make city temperatures rise in certain areas, simply because of the way in which a city is structured." (Gago, E. J., Roldan, J., Pacheco-Torres, R., & Ordóñez, J. 2013)This is also statistically found due to the lack of greenery and other natural resources in cities. By implementing trees in other areas, it is essential to add vegetation to reduce the effects of these islands. With this, technology will be critical in the analysis of a solution, for instance, "The use of dynamical-model-based re-analyses to estimate urban influences has been hindered by the heterogeneity of the data input to the reanalyses and by biases in the models. However, improvements in re-analyses are increasing their utility for assessing the surface air temperature record. High-resolution climate models and data on changing land use offer potential for future assessment of worldwide urban warming influences."(Parker, D. E. 2010)

Redlining and Relation to Climate Change

Redlining is Reproduced

Extreme heat kills more people than any other type of hazardous weather. This heat is getting even worse and deadlier due to climate change. Although this heat is affecting the United States the heat is not affecting all the people equally. Temperatures in different neighborhoods and communities within a city can vary up to 20 degrees (F)" (Portland University). This makes low socioeconomic predominantly minority neighborhoods to be the target of this heat. Urban heat varies block by block. Areas with more trees and vegetation are cooler than those with low-lying buildings and expanses of bare pavement. It has been 90 years since redlining and the year is 2023 and the country and the world are still seeing the effects of racism today through trees. Unequal access to where the countries spend government funding on trees has corrupted the system. Low socioeconomic groups and people of color are disadvantaged making it extremely hard to build and maintain tree covered urban spaces.

Redlining and Relation to Climate Change

A Study on the Intersection of POC and HPLC

In urban areas, trees are unevenly distributed across racial and socioeconomic groups. For example, the study: *The Racial/Ethnic Distribution of Heat Risk–Related Land Cover in Relation to Residential Segregation,* sought to research how heat risk-related land cover was distributed throughout different segregated areas according to people's race and ethnicity. This was done by cross-referencing the census data and the national land coverage data in the United States and Puerto Rico. After conducting this research, it was found that Black people were 52% more likely to live in HPLC (heat risk–related land cover) conditions than White people. In addition, Asian and Hispanic people were also more likely to live in HPLC conditions than White people. According to where each racial or ethnic group is populated in a highly concentrated area, the land cover is associated with these groups and segregation.

There is an important emphasis placed on environmental justice in the context of how we should move forward and adapt to climate change. One of the main strategies they suggest combatting this is planting trees in urban areas, especially for racial and ethnic groups that face disparities in heat risk-related land cover. The study: "*Canopy of Advantage: Who benefits most from city trees?",* sought to find the connection between the spatial distribution of urban tree canopy and median household income in the largest city in Canada, Toronto. This research is part of a larger movement to quantify and recognize the overall value of tree benefits to combat urban deforestation. To conduct this research, researchers used a bivariate local indicator to see if there was spatial autocorrelation. This method showed researchers where there was an overall significant overlap in the high and low urban canopy with high and low household income status.

Redlining and Relations to Climate Change

With trees being an important resource linked to the economic development and health of an area, it's important to explore the equity of this natural resource and the impact political and social structures play in this distribution. The same study, "*Canopy of Advantage: Who benefits most from city trees?,"* set out to research the spatial distribution of green infrastructure and environmental injustice related to different socio-economic groups through various statistical analyses. The research used data from the census of trees conducted in 2018 in Guadalajara. The question was whether urban trees were evenly distributed among different urban neighborhoods and if the communities had relationships with socioeconomic status. They found the distributional patterns of trees, location type, height, and canopy diameter in the city of Guadalajara, Mexico were unequally distributed within the city.

Redlining and Relations to Climate Change: Scranton

These maps demonstrate different demographics that make up the city of Scranton. To the top right (*Figure 1*), this map shows the areas that are the majority of the white populations within Scranton, Pennsylvania. To the bottom right *(Figure 2)*, this map displays the Hispanic sections of the city of Scranton, Pennsylvania. This understanding of the location of demographics throughout Scranton is crucial to understanding where the underserved communities lie.

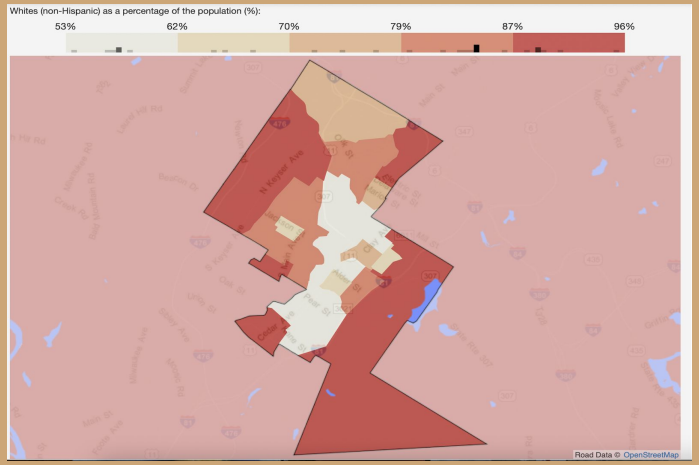


Figure 1.R

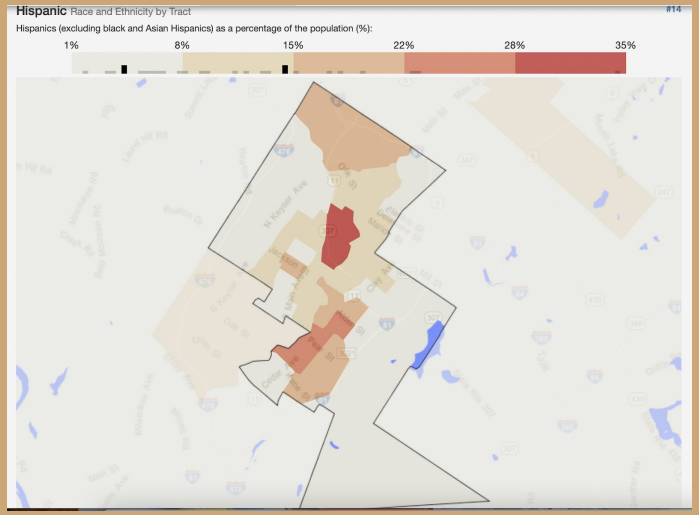


Figure 2

Source: *Race and ethnicity in Scranton, Pennsylvania (city)*. The Demographic Statistical Atlas of the United States - Statistical Atlas. (n.d.). Retrieved April 17, 2023, from https://statisticalatlas.com/place/Pennsylvania/Scranton/Race-and-Ethnicity

Redlining and Relations to Climate Change: Scranton

These maps demonstrate different demographics that make up the city of Scranton. To the top right *(Figure 3)*, this map shows the Black populations of Scranton, Pennsylvania. To the bottom right (*Figure 4)*, this map displays the mixed sections of the city of Scranton, Pennsylvania.

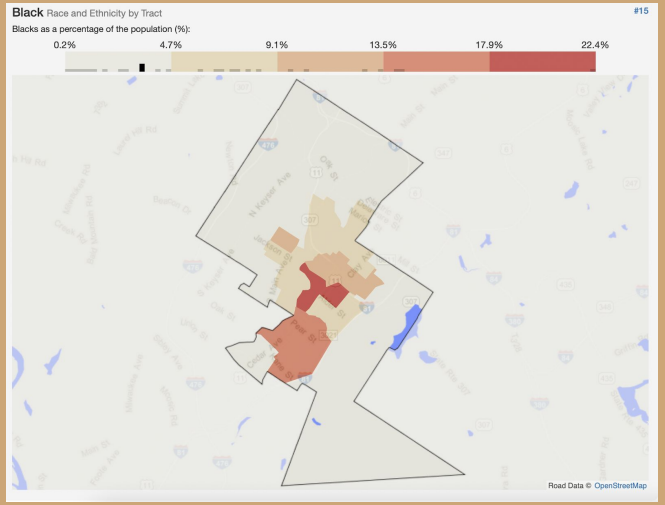


Figure 3.R

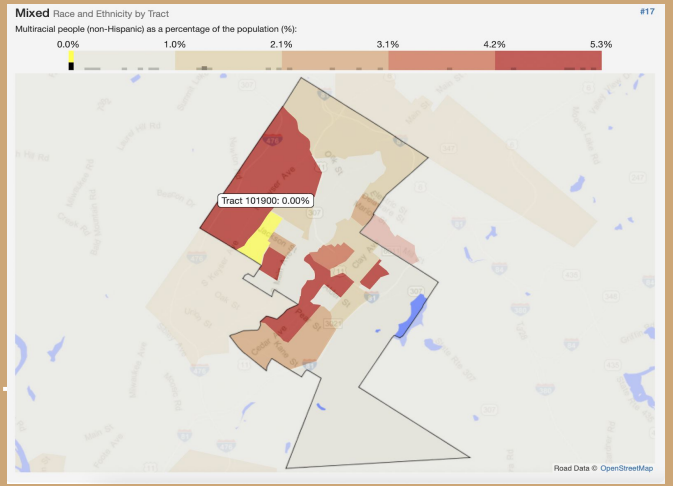


Figure 4.R

Source: *Race and ethnicity in Scranton, Pennsylvania (city)*. The Demographic Statistical Atlas of the United States - Statistical Atlas. (n.d.). Retrieved April 17, 2023, from https://statisticalatlas.com/place/Pennsylvania/Scranton/Race-and-Ethnicity

Redlining and Relations to Climate Change: Scranton

These maps demonstrate different demographics that make up the city of Scranton. To the top right *(Figure 5)*, this map shows the Asian populations of Scranton, Pennsylvania. To the bottom right *(Figure 6)*, this map displays the other races and ethnicities of the city of Scranton, Pennsylvania.

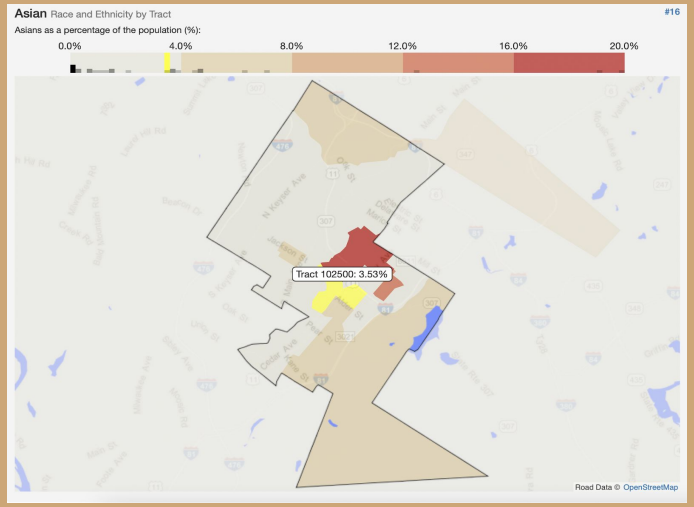


Figure 5.R

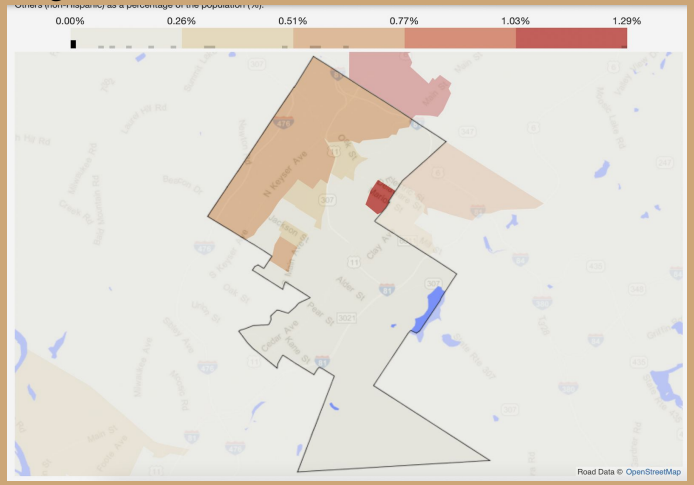


Figure 6.R

Source: *Race and ethnicity in Scranton, Pennsylvania (city)*. The Demographic Statistical Atlas of the United States - Statistical Atlas. (n.d.). Retrieved April 17, 2023, from https://statisticalatlas.com/place/Pennsylvania/Scranton/Race-and-Ethnicity

Redlining and Relations to Climate Change Ctd.

Adding on to the unequal distribution, the research also found an association between urban trees and households with high socioeconomic status. Neighborhoods within high-income districts have higher-quality tree coverage because the trees have more extensive canopies and are taller. The researchers found that the characteristics of the trees impact the quality of ecosystems within the specific districts in the cities. The researchers concluded that trees in fact are unequally distributed. Overall, the unequal distribution of trees in the city could be traced back to the different social and economic forces during the foundation of the city and the weak urban policies that do not protect environmental justice.

Redlining and Relations to Climate Change

The uneven distribution that is occurring is also a form of environmental justice. The study: "*Canopy of advantage: Who benefits most from city trees?",* also showed researchers that there was an overall significant spatial relationship between fractional coverage of tree canopy and median household income in Toronto, Canada, meaning that there was a significant inequality of access to tree canopy depending on your median household income. Linked with the benefits that tree canopy provides, this shows that the inequality can negatively impact poorer people in Canada's largest cities. Researchers suggest that new government efforts need to be made to resolve this ongoing ecological injustice. The South Carolina Forest Industry (S.C.F.C.) states that "The loss of trees in our urban areas not only intensifies the urban "heat-island" effect from loss of shade and evaporation, but we lose a principal absorber of carbon dioxide and trapper of other air pollutants as well." Trees are essential to a community's health physically, mentally, and socially.

Redlining and Relations to Climate Change: Demographic Percentages of Scranton, Pennsylvania

Race/Ethnicity	Percentages
White	78.1 %
Black or African American	5.60%
American Indian or Alaska Native	0.0%
Asian alone	5.0 %
Native Hawaiian and Other Pacific Islanders	0.20%
Two or More Races	8.0 %
Hispanic or Latino	16.0 %
White alone, No Latino or Hispanic:	69.90%
Other	8.0 %

Figure 7.R, *U.S. Census Bureau quickfacts: Scranton City, Pennsylvania*. (n.d.). Retrieved April 18, 2023, from https://www.census.gov/quickfacts/scrantoncitypennsylvania

Redlining and Relations to Climate Change

American cities were also impacted by tree disparities in the low-income neighborhood but it was by the process of redlining. Long-term effects of redlining continue to strike the United States poorer neighborhoods, and you can literally feel the effects. In the 1930's the Federal One Owners' Loan Corporation made maps and shaded neighborhoods red deeming them hazardous. That risk level was based on the number of African Americans and immigrants living there. This practice is still impacting communities today through the old segregationist housing policies of the time with lasting effects of poverty and lack of urban trees. It has been close to 90 years since the maps have been created and those neighborhoods redlined are hotter than the highest-rated neighborhoods by an average of almost 5 degrees, according to research from Portland State University, the Science Museum of Virginia, and Virginia Commonwealth University.

Redlining and Relations to Climate Change

In the US extreme heat kills more people than any other type of hazardous weather. This heat is getting even worse and deadlier due to climate change. Although this heat is affecting the United States the heat is not affecting all the people equally. Temperatures in different neighborhoods and communities within a city can vary up to “20 degrees (F)” (Portland University). This makes low socioeconomic predominantly minority neighborhoods to be the target of this heat. Urban heat varies block by block. Areas with more trees and vegetation are cooler than those with low-lying buildings and expanses of bare pavement. It has been 90 years since Redlining and the year is 2021 and the country and the world are still seeing the heat of racism today through trees. Unequal access to where the countries spend government funding on trees has corrupted the system. Low socioeconomic groups and people of color are extremely disadvantaged making it extremely hard to build and maintain tree covered urban spaces. The effects of redlining continue to allow the loop of an unequal standard of living gap, not allowing these less well-off places to get out of the loop.

Beauty of the City and an Intersection with Air Quality

Define Beauty of the City

The beauty of a city is ambiguous and complex. A city is a man made modification to a landscape to fit human needs and expectations. Cities are constantly evolving to fit and exceed these expectations.

"Living in a city is an unnatural state for human beings"

- Colin Ellard, a cognitive neuroscientist at Canada's University of Waterloo, who studies the impact of places on the brain and body (Ellard, C. (2021, May 9)).

Natural beauty is something that needs to be reintroduced to urban planning. Having a harmonious relationship with our surrounding landscapes that both benefits us and the environment we are living off of should be included in our urban areas and is why prioritizing beauty in our cities is important. The benefits of bringing natural beauty to urban planning will allow cities like Scranton, PA to flourish in social, economic, and environmental benefits. Our tree plan will allow for Scranton to gain off of the copious benefits and make up for lost potential within the city.

Beauty of the City and an Intersection with Air Quality

Social-Economic Benefits

The benefits of boosting curb appeal through increasing tree canopies will in turn help social and economic factors within a city. To begin, several studies have shown that urban spaces promote social interactions. In one particular study it was shown that, “the presence of urban green spaces can encourage positive social interactions that cultivate social cohesion in ways that enhance health and well-being” (Jennings, V., & Bamkole, O. (2019, February 4)). Through the inclusion of more walkways, parks, and recreational space- which all hold potential of increasing tree canopies- the use and need of outdoor spaces will increase.

According to the United States Environmental Protection Agency (USEPA), with more outside spaces to congregate, this can drive tourism and even attract people to cities. Not only that, these spaces can be used by the community to hold events and profit off of. Events such as festivals, concerts, and markets (increasing money flow) boosting the sense of community within the city. With this draw to the outdoors and it fostering social interactions, both social and economic factors will be satisfied (United States Environmental Protection Agency. (n.d.)).

Beauty of the City and an Intersection with Air Quality

Air Quality and its Effects on People

Air pollution is a growing concern in many cities around the world. Scranton, Pennsylvania, is no exception. Poor air quality can have severe health effects, including respiratory problems, heart disease, and stroke. One solution to this problem is to increase tree cover in the city. Trees absorb pollutants from the air and release oxygen, which can help to improve air quality. This is one of the many reasons we should increase tree cover in Scranton. Air pollution is a significant problem in many cities around the world. In the United States, air pollution causes thousands of premature deaths each year and costs billions of dollars in healthcare expenses and lost productivity (EPA, 2018). Scranton, Pennsylvania, is no exception to this problem. Poor air quality can cause respiratory problems, heart disease, and stroke, among other health issues. Trees are natural air filters that absorb pollutants from the air and release oxygen. Increasing tree cover in urban areas can help to reduce air pollution and improve air quality (Nowak et al., 2013). This section of the report focuses on the air quality aspect and how trees will improve air quality in Scranton.

Beauty of the City and an Intersection with Air Quality

Scranton is a city in northeastern Pennsylvania with a population of approximately 77,000 people. Scranton has a long history of industrialization, which has contributed to air pollution in the area. The city has high levels of fine particulate matter (PM2.5), which is a type of air pollution that can cause respiratory problems and other health issues (EPA, 2018). Trees can help to reduce air pollution by absorbing pollutants from the air and releasing oxygen. Trees can also help to cool urban areas, reduce energy consumption, and improve mental health (Nowak et al., 2013). Trees can provide a range of benefits to urban areas, including improved air quality, which can help to reduce the health risks associated with air pollution.

Beauty of the City and an Intersection with Air Quality

Increasing tree cover in Scranton can provide a range of benefits to the city and its residents. One of the most significant benefits is the improvement in air quality. Trees can absorb pollutants from the air, including nitrogen dioxide (NO2), sulfur dioxide (SO2), and PM2.5, which are all common air pollutants in urban areas (Nowak et al., 2013). A study conducted in Philadelphia found that increasing tree cover in the city could reduce fine particulate matter (PM2.5) concentrations by up to 10% (McDonald et al., 2007).

Beauty of the City and an Intersection with Air Quality

The following studies provide evidence that increasing tree cover in urban areas can provide a range of benefits, including improving air quality, reducing the urban heat island effect, improving mental health and well-being, and providing economic benefits. This is just some of the ways that trees could improve quality of life in Scranton:

- A study conducted in New York City found that increasing tree cover in the city could reduce fine particulate matter (PM2.5) concentrations by up to 24% in some areas (Nowak et al., 2006).
- Another study conducted in Chicago found that increasing tree cover in the city could reduce nitrogen dioxide (NO2) concentrations by up to 30% (McDonald et al., 2008).
- A study conducted in Toronto found that increasing tree cover in the city could provide significant economic benefits. The study estimated that the value of the air pollution removal and carbon storage provided by the city's trees was approximately $36 million per year (Nowak et al., 2002).
- A study conducted in Sacramento, California, found that increasing tree cover in the city could reduce energy consumption by up to 5% (McPherson et al., 1994). Trees can provide shade and reduce the need for air conditioning in buildings, which can lead to significant energy savings.

Solutions/Plan

25 Year Plan: Our strategy seeks to create a tree plan that implements characteristics of increasing tree canopy in select impacted communities to mitigate the heat island effect and prompt ecological, social and economic advancements. Not only will this improve quality of life for residents in Scranton, it will provide motivation for the continuation of environmental improvements.

Environmental Changes for Good

Scranton Pennsylvania is centered around an industrial urban outlay that dates back to the 1800s coal and iron industry. However, PA is home to some of the most lush and prominent agriculture and nature in the country. Scranton is nestled in the Pocono Mountains where vast opportunity for green space is present. In our proposal, we are introducing the idea of increasing the use of Ginkgo biloba (better known as the Maidenhair trees) that are heat resistant, low maintenance, and can stand against invasive species in Scranton.

Figure 1.S, *Ginkgo biloba (Maidenhair Tree) Practicality Brown*. Practicality Brown. (2021, November 5). Retrieved April 17, 2023, from https://www.pracbrown.co.uk/product/ginkgo-biloba-maidenhair-tree/

Solutions/Plan

Ginkgo biloba -- Maidenhair Tree

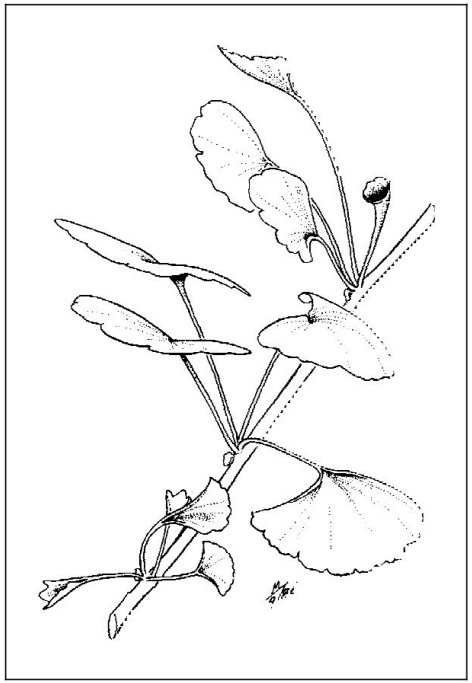


Figure 2.S, Gilman Forest Ser, E. F., & Watson, D. G. (1993, November). *Ginkgo biloba* . University of Florida. Retrieved April 18, 2023, from https://hort.ifas.ufl.edu/database/documents/pdf/tree_fact_sheets/ginbila.pdf

Ginkgo biloba (Maidenhair trees)

The Ginkgo biloba tree is beautiful with large fan-shaped leaves and has a copious amount of environmental benefits that will further its use in our 25 year plan. Seen prodemently on the east coast, the Ginkgo biloba is found in a large amount of cities!

The list is the following studied advantages (by the USDA & the University of Florida) of the Ginkgo biloba making it the optimal tree species for Scranton:

- Pest-free (resistant to gypsy/spongy moth)
- Resistant to storm damage
- Light to moderate shade
- Adapted specifically for street tree use
- High drought tolerance
- Highly resistant to air pollution
- Male trees are low maintenance and do not bear fruits (females produce highly potent fruit that leave a strong odor)

Gilman Forest Ser, E. F., & Watson, D. G. (1993, November) / Shepperd, W. D. (2008)

Solutions/Plan

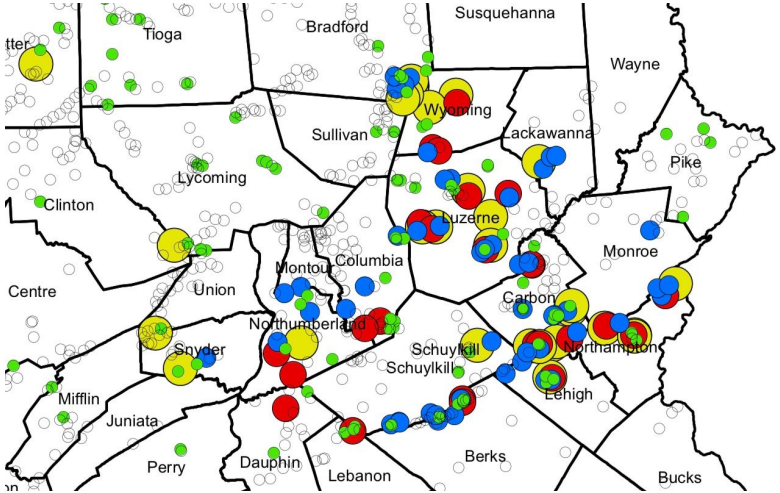


Figure 3.S, Hess, D. E. (n.d.). *DCNR begins gypsy moth suppression spraying in 8 counties*. PA Environment Digest Blog. Retrieved April 17, 2023, from http://paenvironmentdaily.blogspot.com/2018/05/dcnr-begins-gypsy-moth-suppression.html

Invasive Species vs. Ginkgo biloba

Scranton is located in Lackawanna County and is vulnerable to invasive species like the gypsy moth/spongy moths (seen in Figure 3.S). Spraying is needed during the spring season in forestlands to combat these invasive species outbreaks.

However, in a study done by the University of Redlands, they found that Ginkgo trees are “able to resist almost any pest or insect (including the gypsy/spongy moth) because of two acids found in the tree that are lethal to insect larvae. This resistance was tested in an experiment by Matsumoto et al. (1986) who extracted an antifeedant from the leaves which caused Cabbage Butterfly larvae to feed on it less than other leaves; its leaves also produce an aldehyde when damaged in the presence of oxygen that repels insects” (Burchett, N. (2018)). Not only that, but Ginkgo biloba have been around for millions of years and are an existing species today proving there adaptability and resistance to survive.

Solutions/Plan

Prioritization of Impacted communities

Benefits of increased tree canopy are seen in lower socioeconomic communities. Trees offset the disproportionate effects of the heat island effect in these areas. In Scranton, there are a copious amount of underserved communities that are lacking green space. These neighborhoods correlate with communities of color and poverty. The following neighborhoods convey such correlation in Scranton. They will be the areas we place focus on first regarding tree cover:

- Downtown
- Iron district
- Park place
- Riverfront
- Medical district
- University district

These particular neighborhoods have a Tree Equity Score of 63 or lower which means they have a tree canopy cover of 20% or less. Tree Equity Scores are based on a 0-to-100-point system. They take into consideration tree canopy, surface temperature, income, employment, race, age and health factors. (cite the website)

Figure 4.S from treeequityscore.org conveys the lack in tree canopy in the neighborhoods listed. This is represented by orange colors. Figure 5.S conveys the percentage of people of color. Darker brown represents a higher concentration. There is a clear and visual correlation between the two.

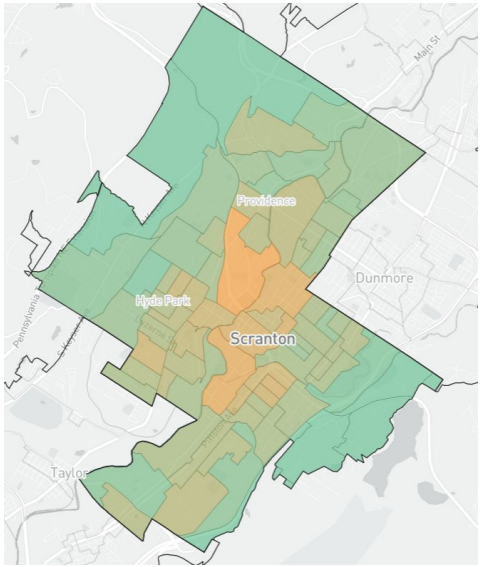


Figure 4.S, *Tree equity score*. Tree Equity Score. (n.d.). Retrieved April 18, 2023, from https://treeequityscore.org/

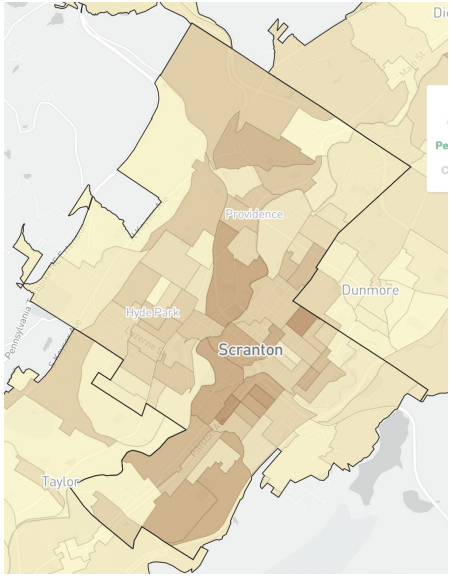


Figure 5.S, *Tree equity score*. Tree Equity Score. (n.d.). Retrieved April 18, 2023, from https://treeequityscore.org/

25 Year Tree Plan Timeline

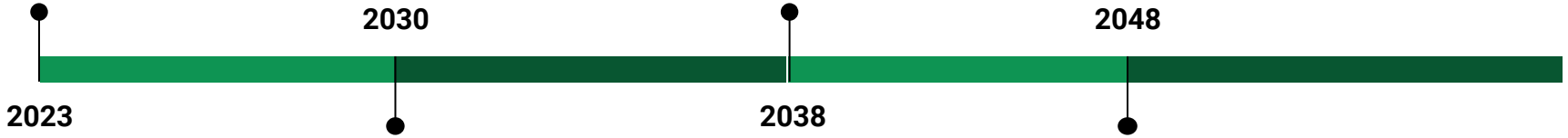
Figure 6.S, Scranton Tree Plan Timeline

Gather Data and Feedback

After our initial research and findings of the 6 neighborhoods correlating in low tree canopy cover and low socioeconomic status, gather feedback from voices of the communities.

Begin Plantings in other Neighborhoods of Scranton

After focusing on neighborhoods with low socioeconomic status and low tree canopy, begin plantings and revitalization in remaining neighborhoods of Scranton.



Implement Plantings and Maintenance

After the identification of the 6 neighborhoods and the confirmed cooperation of public and private relationships, proactive maintenance and tree plantings will commence.

Compilation of Current Data and a Push for Continued Green Movements.

Re-analyze tree canopy data and its intersection with poverty, race, and economics. Analyze trends and improvements from first analysis in 2023.Further progress made in both areas of environment and equality.

Conclusion

Space and place are a window into a broader social, political, economic, and cultural structures. Through the analysis of tree cover in Scranton, PA, disparities regarding race, poverty, and income are uncovered. Past injustices such as redlining remain and are reproduced through time. With a 25-Year tree plan like ours that addresses both injustices and environmental disproportions, true change can occur as we redefine space and place.

Figure 7.S, Scranton Tree Plan Logo, *Free design tool: Presentations, video, social media | CANVA*. (n.d.). Retrieved April 18, 2023, from https://www.canva.com/

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