**Growing Shade: Scientific Studies and Resources for Narrative**

Compiled by Maggie Morin, June 2021

(Studies can be found in separate folder called “Final Studies”)

Note that these studies and resources were selected based on these criteria:

* Relevance to goals and message of Growing Shade project
* Looking at tree canopy from many human and environmental angles
* Relevance to Twin Cities metro
* More recent studies
* With relatively high number of citations

**Trees and formerly red-lined neighborhoods**

“The Effects of Historical Housing Policies on Resident Exposure to Intra-Urban Heat: A Study of 108 US Urban Areas”

* This study looks at 108 urban areas in the United States trying to answer the questions how do historically redlined neighborhoods relate to current patterns of intra-urban heat and do these patterns vary or stay consistent by US Census Bureau region?
* In 94 percent of the areas studied, there was a higher land surface temperature in the areas that were formerly redlined compared to the areas that were not formerly redlined. This study argues that areas that were controlled by historical housing policies are more affected by intra-urban heat.
  + Nationally, the average difference was 2.6 degrees Celsius higher but in some areas it was 7 degrees Celsius.
* Reasserts other studies by showing that at a national and regional scale there is a lack of tree canopy in underserved areas/formerly redlined areas. Many formerly redlined neighborhoods were places of major industrial and roadway construction making these areas have high concentrations of impervious surfaces.
* Minneapolis, MN is one of three cities listed as having one of the largest land surface temperature differences between formerly redlined areas and areas that were not formerly redlined.

**Trees and socioeconomic factors**

“Are Street Tree Inequalities Growing or Diminishing Over Time? The Inequity Remediation Potential of the MillionTreesNYC Initiative”

* This study analyzes street tree inequalities from 1995-2015 to understand if these inequalities vary in different street tree structure measures, if these inequalities are diminishing or growing over time, and how the inequalities are affected by street tree planting programs.
* Overall, racial minorities, those who are less educated, those who are lower income, and younger people are more likely to have inequitable access to street trees. Overall, those who identify with one of the previous listed groups have access to a lower percentage of tree canopy and have the largest percent of trees classified as having poor structure and health conditions.
* Income and education were the top determining factors of street tree inequalities however, these inequalities decreased over time.

**Trees and physical health**

“The Relationship Between Trees and Human Health: Evidence from the Spread of the Emerald Ash Borer”

* This study looks at how human health was impacted by the loss of one million ash trees to the Emerald Ash Borer by investigating trends in the mortality rates of residents diagnosed with cardiovascular and lower-respiratory-tract diseases.
* Overall, the study’s findings provide evidence that the physical health of humans is connected to the natural environment and that this is a causal relationship. Mainly, the mortality rate increased in areas that were of median income or higher presumably because these areas suffered more ash tree loss due to a higher percentage of tree canopy cover.

**Anti-Physical Health (Trees, air quality and asthma rates)**

“Urban Trees, Air Quality, and Asthma: An Interdisciplinary Study”

* This study focuses on the relationship of urban trees, air quality, and asthma rates arguing that past studies fail to look at the full picture when describing the benefits of trees.
* By analyzing various studies, theories, and models, this specific study aims to prove that there is a lack of consensus as to whether trees reduce city wide pollution levels.
* The authors conclude that there is ample evidence proving that pollen from trees, interactions between pollen and air pollution, and trees and other vegetation’s roles in ozone pollution actually have negative impacts on air quality and asthma rates.
* This study does not suggest that trees should not be planted, merely that it is unclear in data analyzed whether trees can be confidently labeled as helpful to mitigating air pollution and asthma rates.

**Trees and mental health**

“Exposure to Neighborhood Green Space and Mental Health: Evidence from the Survey of the Health of Wisconsin”

* This study examines the relationship between green space and mental health in both urban and rural areas in Wisconsin.
* Findings showed that those living in areas with higher amounts of green space were associated with lower levels of stress, depression, and anxiety.

**Trees and stormwater capture**

“The role of trees in urban stormwater management”

* This article explains the various roles (interception, evapotranspiration, and infiltration) that trees can play in stormwater management and how these roles can differ depending on size, species, location, and concentration of the urban forests.
* The article concludes that it is very difficult to gather exact measurements regarding urban trees’ role with controlling stormwater management, but overall considering all of the factors, they help to reduce and manage stormwater.

**Trees and pollution**

“US Urban Forest Statistics, Values, and Projections”

* This study examines the benefits that urban tree canopies currently provide and in what ways they can continue to provide, especially as the trend of urbanization continues.
* The authors explain how urban tree canopy deeply impacts the removal of pollutants from the atmosphere and helps to mitigate air pollution like removing ozone, nitrogen dioxide, sulfur dioxide, and particulate matter, the sequestration of carbon, and the ability to shade nearby buildings decreasing their energy usage and corresponding emissions from power plants.
* Data includes predicted and actual amounts of pollution removed as well as monetary savings from urban forests state by state.

**Trees and Urban Heat Islands**

“Scale-dependent Interactions Between Tree Canopy Cover and Impervious Surfaces Reduce Daytime Urban Heat During Summer”

* This study examines the relationship between tree canopy cover and impervious surfaces while looking at how well tree canopy can help regulate daytime temperatures.
* Results show that when urban tree canopy is higher than forty percent, it has a significant impact on land surface temperatures proving that urban tree canopy can play a large role in the urban heat island effect.

**Community**

“Community Stories: Explaining Resistance to Street Tree-Planting Programs in Detroit, Michigan, USA”

* This study focuses on the greening initiative in Detroit, Michigan and reviews interviews with and surveys taken by residents and community members.
* The data shows that residents want more involvement with the decision-making in the location and species of trees. Residents are also concerned that the burdens of stewardship would be their responsibility.
* The greening initiative failed to incorporate meaningful involvement with residents and community members, not allowing their voices and ideas to be heard or have a seat at the table.
* It is important for forestry workers to engage in dialogue with residents, especially as they themselves do not live in these areas so they really need to listen to understand the history and culture of the area and attend to their views, wants, and needs.

“Sharing in the Benefits of a Greening City: A Policy Toolkit in Pursuit of Economic, Environmental, and Racial Justice”

* Provides tangible steps for local government, organizations, and community groups to move forward and carry out their work in a just way.
* Job Training on page 29, Cultural Corridors on page 31, Equity Scorecards on page 33, Community Benefits Agreements on page 51, and Section III starting on page 56 are the most helpful.
* Reflection after reading toolkit: There are so many working parts to community forestry. This is a starting point to recruit young people to get involved, employed, feel supported, and funding to continue to do this work through an equity and racial lens.