Trees in All Policies: Intersectoral Action for Equity Among Worcester Neighborhoods

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WORCESTER TREE INITIATIVE

TOWER HILL

Abstract

Cities are paying increasing attention to urban tree cover because of the multiple health, environment, economic, and social benefits it offers. This paper examines the potential to improve tree cover all over cities by means of intersectoral policy. Through the results found in my literature and document review, transect walking, and expert interviews, I developed a framework for the implementation of intersectoral action for trees, branded as Trees in All Policies. Trees in All Policies works to address the unequal access and distribution of the benefits that trees provide among environmental justice neighborhoods. Tree cover becomes an environmental justice issue when socioeconomics and immigrant status, for example, correlate with the absence of trees. Such is the case in Worcester, MA, where the Union Hill neighborhood has high rates of renters versus owners and minority communities, and low rates of tree cover. Therefore, this study focused on the city of Worcester, MA to analyze the current policies and practices that included and addressed the urban tree canopy in Worcester, and specifically used the neighborhood of Union Hill as a case study to evaluate the effectiveness of these policies. From a planning perspective, this analysis emphasizes the need for intersectoral action to take a role in the planning and policies surrounding trees, specifically making a case for Trees in All Policies in Worcester, MA.

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Executive Summary

Urban trees bring many environmental, economic, social, and health benefits to communities, including higher property values, climate change mitigation, lower crime rates, and improved mental and physical health, among others. However, these benefits cannot be realized when there is a lack of urban trees in a canopy. Studies show that low-income and minority communities are the most likely to suffer from a lack of trees, often leaving them to be classified as environmental justice neighborhoods. Environmental justice neighborhoods in this sense highlight areas within a municipality that receive little to no recognition or aid from the government to improve or properly manage the urban tree canopy.

The implementation and planting of trees in communities is an act that requires an immense amount of planning and resources, something that is not always evenly distributed among communities. Proper management of trees involves caring for, maintaining, and implementing new tree plantings. New tree plantings that are not best suited for the environment, or that are not diverse, can negatively affect the community. Diversity in trees promotes public support for urban trees, leading to an increase in the public's involvement in planning efforts, and it protects against infestation or disease that can destroy trees in large quantities.

Intersectoral policy has the potential to adequately address and improve the policy landscape surrounding trees and their benefits to communities. Intersectoral policy requires that two or more departments within a government work together to create a policy that addresses and incorporates multiple viewpoints on an issue. The health sector has set the precedent for intersectoral action with "Health in All Policies," where they collaborate with multiple sectors of government, such as water, education, and forestry, among others, to take the health impacts of a policy into account, and do their best to incorporate beneficial health practices into their decision-making. Health in All Policies has laid the groundwork for a new approach that can make improvements on the ways trees are perceived in policymaking; Trees in All Policies.

Through document reviews and expert interviews, this study analyzed the current policies and practices that included and addressed the urban tree canopy in Worcester, and specifically used the neighborhood of Union Hill as a case study to evaluate the effectiveness of these policies. Using the research compiled into the benefits of trees, tree diversity, and intersectoral policy, I examined the potential to improve tree cover in environmental justice neighborhoods through policies that involve multiple sectors of governance, similar to the example of Health in All Policies.

The result of this study showed that the city of Worcester has environmental justice neighborhoods that suffer from a lack of urban trees, with Union Hill being one of them. There are few policies in place that incorporate trees into their planning to address this situation. One such policy is the "Complete Streets Policy" that outlines the need for a safe, walkable city,

including street trees as one of the guidelines to meet that goal. However, trees do not always take priority in the city's policies, as even in the "Complete Streets Policy," trees take a back seat to other criteria in an effort to save money. This point is supported by a former city official, who stated that oftentimes, members of other municipal departments would disagree that resources should be allocated for trees, seeing them as unimportant to the overall landscape of the city.

Based on this research I created a framework to plot out the best course of action to implement intersectoral policy. The framework incorporates four main steps: (1) Develop Logistics, (2) Develop Connections Between Sectors, (3) Develop Relationships, and (4) Develop Incentives. Each step focuses on a specific aspect of intersectoral policy that is necessary for effective collaboration to improve environmental justice neighborhoods.

Step One of this framework, develop logistics, calls for a street tree inventory and the identification of the maintenance and care needed for the current trees. It also includes proper management of trees and their selection. Step Two, develop connections, emphasizes the importance of the connections between departments to showcase the importance of trees to all sectors of government. It demonstrates the need for proper education on the benefits of trees and their cross-sector impacts. Step Three, develop relationships, recognizes the significance of relationships, both personal and between the government and its communities. This step focuses on the improvement of these relationships to best understand the other individual, their job, and their points of view on these issues. Step Four, develop incentives, highlights the need for government to incentivize intersectoral action. This can be achieved in the way it commonly its being done now, through collaborative city plans like a sustainability plan, or through the creation of task forces involving multiple sectors to focus on a major goal.

Future work in this subject involves the implementation of the framework, which begins with the continued identification of environmental justice neighborhoods in Worcester. The identification of these neighborhoods will only further emphasize the need for an awareness campaign into the benefits of trees and the implementation of Trees in All Policies.

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Introduction

Urban trees bring many environmental, economic, social, and health benefits to communities, including higher property values, climate change mitigation, lower crime rates, and improved mental and physical health, among many others. Studies show that low-income and minority communities are the most likely to suffer from a lack of trees within their urban canopy. These socio-demographic factors mixed with the tree inequality is what often leads to these neighborhoods being classified as environmental justice neighborhoods. Environmental justice neighborhoods in this sense highlight areas within a municipality that receive little to no recognition or aid from the government to improve the urban tree canopy. The city of Worcester has environmental justice neighborhoods that suffer from a lack of urban trees, with Union Hill being one of them. There are few policies in place that incorporate trees into their planning to address this situation and oftentimes trees do not take priority in these policies. Policies must become intersectoral to adequately address and improve the policy landscape surrounding trees and their benefits to communities. Intersectoral policy requires that two or more departments within a government work together to create a policy that addresses and incorporates multiple viewpoints on an issue. This study analyzed the current policies and practices that included and addressed the urban tree canopy in Worcester, and specifically used the neighborhood of Union Hill as a case study to evaluate the effectiveness of these policies. Using the research compiled into the benefits of trees, tree diversity, and intersectoral policy, I examined the potential to improve tree cover in environmental justice neighborhoods through policies that involve multiple sectors of governance.

Chapter 1: Background on tree benefits, management, and their relevance to environmental justice

Urban trees provide a multitude of benefits to communities that can be associated with the environmental, economic, social, and health sectors. These benefits can include a reduction of the urban heat island effect, higher property values, reduced levels of crime, and improved mental and physical health, among many others. Studies show that a diversity of tree species within a community can amplify the effects of these benefits. Proper care and management of the urban tree canopy is needed to properly facilitate a diversity of tree species. With proper care and management, many communities are left without or with a lack of trees that classify them as environmental justice neighborhoods. These neighborhoods require a greater importance to be put on trees to address their lack of associated benefits.

1.1 Benefits of Urban Trees

Many environmental benefits of urban trees are known. Their ability to reduce the effects of urban heat islands is one of the most significant. Urban heat islands are a result of the removal of natural land to be replaced with concrete, buildings, and other sources that hold onto heat. The urban heat island effect results in higher energy costs, higher air pollution, and higher heat-related illnesses (Reduce Urban Heat Island Effect, 2019). Urban trees can mitigate these effects with their ability to provide shade for cooling, and through evapotranspiration that brings more water to the atmosphere. One study conducted into trees as a way to reduce urban heat island effects used a model to determine the changes in temperature. They reduced the width of streets in the model to make room for soil planting areas and trees. A ten percent decrease in the width of a street was shown to be correlated with a 4.1K decrease in surface air temperature (Loughner, 2012). The study also showed that temperatures were 2.2 – 3.3 K hotter in developments with no trees than in suburban areas with mature trees (Loughner, 2012).

Urban street trees provide stormwater runoff/rainfall mitigation through their ability to slow and filter stormwater runoff. Studies show that a 2% decrease in runoff is associated with a 5% increase in tree cover (Department of Environmental Conservation, 2014). They do so by taking in rainfall and releasing it slowly to reduce runoff, which helps protect the water quality. Trees also have the ability to improve the quality of water, not just maintain it. They act as filters for pollutants, such as nitrogen and phosphorus, as their roots take in and retain the nutrients (Department of Environmental Conservation, 2014).

Along with improved water quality, urban trees also improve air quality through carbon sequestration and offsetting the greenhouse gas effect. Trees are able to absorb carbon dioxide in the atmosphere through the process of photosynthesis, Carbon dioxide is one of the biggest contributors to the greenhouse gas effect and the U.S. Forest Service estimated that all forests within the U.S. sequestered around 309 million tons of carbon each year from 1952-1992 (Trees Improve Our Air Quality). However, carbon dioxide is not the only particulate matter that trees

are able to remove from the air. There are many other pollutants trees are able to remove, whether it be through absorption or retention on the plant's surface. The removal of multiple pollutants allows for the improvements to our air quality. New York City's air quality drastically improved because of trees. In 1994 alone, trees removed over 1800 metric tons of air pollutants, having an estimated value of over nine million U.S. dollars (Nowak, 2002). While the air pollutant removal rate varies among cities and trees, and depends on many factors including the amount of air pollution, precipitation, and other factors, evidence shows trees play a major role in improving air quality (Nowak, 2002).

Economic benefits of greenspace can range from personal to community wide. Individuals can personally benefit from greenspace through a reduction in energy costs resulting from the shade provided by street trees, which can result in a reduction of air conditioner use by almost 30% (Trees Improve Our Air Quality). They can also benefit economically through the value of their property increasing with an increase in greenspace and urban tree cover in their neighborhood. An increase in urban tree cover has been associated with a reduction in crime, further increasing property values. One study in 2016 showed that a 10% increase in tree canopy was associated with a 12% decrease in crime (Mulaney, et al., 2014). This decrease in crime could be attributed to the increase in outdoor activity that is associated with higher levels of greenspace and urban trees (Troy, Grove, and O'Neil-Dunne, 2012).

Social benefits of greenspace are vast and affect many areas of individuals' lives. There is a greater sense of community and improved cooperation between members in communities with access to greenspace and urban trees (Van Dillen et al., 2013). These communities' likelihood of visiting outdoor common areas increased, leading to more social activities, such as children who were more likely to play more outside and more creatively. People in neighborhoods with greenspace knew more people, were more helpful, and had a positive attitude toward living in that community, creating a better experience of living in that neighborhood (Van Dillen et al., 2013). Community individuals also benefit academically. Greenspace helps to alleviate symptoms of ADHD/ADD and leads to an increased attention span. When in a school that allowed exposure to greenspace during a lunch period, children's academic performance rose, and the graduation rates and college expectancy increased (Hanson, 2016). Street trees can also help to increase community safety. Along with the decrease in crime associated with an increase in tree cover, street trees that line the roads create a barrier between pedestrians and vehicles. This "wall" helps motorists evaluate and adjust their driving performance and creates a physical protection against motor vehicle injuries (Mulaney, et al., 2014).

Health benefits are perhaps the most significant benefit of urban trees and greenspace more generally. Residents in communities with access to urban trees and greenspace benefited from improved mental and physical health because of the increased likelihood of individuals going outside. This helps individuals mentally, as it reduces their stress, while also encouraging

them to be more physically active (Kabisch, et al, 2013). This leads to fewer deaths from cardiovascular and lower-respiratory tract illnesses and an increased life expectancy (Donovan, et al., 2013). Communities with greenspace also showed lower rates of asthma in their residents. This can also be attributed to the improved air quality provided through greenspace's environmental benefits (Hanson, 2016). One study looked at the effects of improved air quality combined with improved mental and physical health, and found that urban trees filter enough particulate matter to save New York City $60.1 million in health care costs (Governing Content Studio, 2017).

The benefits of urban trees and greenspace do come with some tradeoffs. While the addition of urban trees to low-income neighborhoods can provide all of the aforementioned benefits, one of the tradeoffs is the increase in housing demand in that community, which leads to the increase in housing prices. While this is touted as an economic benefit, it leads to undesirable results, such as gentrification, where the community could be overrun by richer people and alter the community's average income (The Effect of Urban Tree Canopy on Residential Property Value and Gentrification). Intersectoral policies between government agencies can work to address problems like this. In this situation, a policy between both the forestry department and the housing department could work to increase urban tree cover without gentrifying the neighborhood. One example of this is through the creation of affordable housing in East Lake, Atlanta, Georgia. Affordable housing includes the redeveloping and redesign of low-income neighborhoods and streets. The land was redeveloped to include public-housing and market-price units. The ratio of the two was much higher on average compared to other mixed-income redevelopments. This allowed lower-income residents to live in a community with urban greenspace, reducing the environmental justice area and accounting for gentrification (Jennings et.al).

Urban trees tout many benefits, but their benefits are not always realized when they are not properly managed and cared for. Tree selection and management is an important factor in the inclusion of trees to communities. Without it, monocultures can arise, leaving the urban tree canopy susceptible to disease and infestation that can devastate neighborhoods and kill off or lead to the removal of all of their trees. An in-depth knowledge of tree species, their proper climates, their care, and the site where they are to be planted are all required for these benefits of trees to reach their full potential.

1.2 Tree Selection and Management

Monocultures in urban tree cover occur when only one type of species is planted within a community. Monocultures often arise as a result of planting for aesthetic value, which leads to the same species of tree lining the streets throughout the city (Summit & Sommer, 1998). They can also be a result of a lack of knowledge or research into proper tree care and management. In fact, many of these trees are small-rooted and planted into unprepared soil that is not fertilized or

prepared for irrigation (Paileit, et. al, 2002). These practices do not aid in disaster protection nor do they provide the full potential of benefits that urban trees can provide, and they show the importance of proper management of an urban forest.

One step in urban forest management is tree selection. Tree species need to be carefully chosen. The urban forest manager must be knowledgeable on the many factors that affect trees in the urban environment. Trees that are non-native to an area can be disastrous to the urban forest, as they can bring new diseases or infestations that the current population of trees is not prepared for (Sjoman et al. 2011). They can also overtake the native trees, leading to a loss of biodiversity. Another factor is the stress levels associated with the urban environment, which are not always the best environment for some trees that are susceptible to pollution or ones with a low stress tolerance **(**Sjoman et al. 2011**)**. These factors can reduce the native tree species to choose from.

Biodiversity in the urban tree population is one way to maximize the benefits of trees. New studies have been conducted into how to plan for planting, and the results show a recommendation that a single species of tree should make up no more than ten percent of an urban forest (Santamour, 2004). This strategy was developed in an attempt to reduce the threats to uniform urban tree populations (Santamour, 2004). Protecting biodiversity comes with many benefits aside from threat reduction. Not only does biodiversity amplify the environmental, economic, social, and health benefits provided by urban trees, it also works to stimulate the public's support for conservation efforts by providing space for them to recognize and appreciate these benefits (Goddard, et al. 2009). Studies also show that the psychological benefits of urban greenspace increase as the diversity and species richness of that space increases, as the time spent reflecting positively correlates with diversity (Fuller, et. al, 2007). Biodiverse tree populations have also been shown to improve recreational activities, as visitors and viewers of the trees have different aesthetic preferences and are more likely to go out if there is a tree they prefer (Norman, et al. 2010).

Monocultures in urban tree populations are shown to be more susceptible to disease and other population damaging infestations. While planting a tree such as an American elm can be aesthetically pleasing and has a high adaptability to its native environment, they are susceptible to Dutch elm disease. Due to the large number of American elm trees in U.S. cities, the disease wiped out millions of trees, leaving a large gap in the urban forest (Santamour, 2004). The American elm is not the only tree that suffers from a susceptibility to population damaging factors. They, along with another popular species in the U.S., the maple tree, are preferred host trees for the Asian Longhorned Beetle, an insect who feeds on trees, creating large, hollow tunnels throughout the tree that cause death and removal (Parker, 2012). These tree species are not alone in their vulnerabilities. There is no one species of tree that is the solution to this problem.

While monocultures that are properly managed can mitigate the severity of these problems (Chou, 1981), it is important to understand how to recover after they fail. The creation of a reforestation plan is the first step in recovery. Urban forest managers work together to create site-specific that prioritizes planting sites, recommends species, ensures proper maintenance, and coordinates with outside actors to conduct plantings (Parker, 2012). First, the planting site must be properly assessed to establish that the site does not have any aspects that may harm the trees, including proximity to buildings and competing trees. Then, the tree species to be planted are chosen to best fit the site, as well as being based on what service the tree will provide; shade, aesthetics, or privacy. Afterwards, the urban forest manager coordinates with local groups and volunteers to plant the trees, ensuring that it is done properly to allow the tree to grow to its full potential (Parker, 2012). Proper planning and implementation are important parts of creating an urban forest, and recovering when monocultures fail.

1.3 Unequal Access to Urban Trees as an Environmental Justice Issue

Given the myriad of benefits, it is clear that greenspace and urban trees are an important aspect to life. However, the proper management and care of greenspaces and urban trees is not always taken, as it requires high levels of resources and expertise, leaving some areas without either. The unequal distribution of and access to greenspace is an environmental justice problem, specifically in urban areas, where it is not always equitably distributed. Environmental justice focuses on the issue of unequal distribution of environmental burdens on minority communities. Studies show that greenspace and urban trees are often distributed based on income, race, ethnicity, or education level **(**Perez, 2015**).**

To demonstrate this problem, one study examined five different neighborhoods of ranging incomes in Denver, Colorado. The neighborhoods ranged from high access to low access to greenspace. The study found that the high-income neighborhood had an even 100% distribution of greenspace, the medium-income neighborhood had around a 50% distribution of greenspace, and the low-income neighborhood had only approximately 25% distribution of greenspace. These percentages represent the levels of community members who lived in area that had access to greenspace and urban trees. High levels of access, or 100% distribution, represents a neighborhood where all community members lived within an accessible distance to greenspace or urban trees. Low levels of access, or 25% distribution, represents a neighborhood where only a quarter of the community members live within an accessible distance to greenspace. When the residents of the neighborhoods were presented with this data, it was well-received, but no residents seemed concerned with the findings. This data suggests that many residents are unaware of the benefits of greenspace and that they do not see the issue as an environmental justice issue (Rigolon, 2014).

Los Angeles is another major city that suffers from this problem. LA has a median of only 3.3 acres of park space per 1,000 people compared to the median of 6.8 acres per 1,000 people in other high-density U.S. cities (Shoen, 2018). To showcase this the Trust for Public Land Use gives a “park score” to the top 100 largest cities in the U.S. This score is based on park acres, facilities and investments, and resident access to local parks. The park score for Los

Angeles is a 41 out of 100 possible points. They rank 74th on the list of 100 cities. However, the neighborhoods with less than 1 acre of parks per 1,000 people are spread evenly throughout the income brackets. This may be considered as a positive thing until you analyze the quality of the neighborhoods. In wealthier neighborhoods, the residents have large yards that provide opportunities for outdoor recreation, so they still have access to greenspace without it being public. In lower income neighborhoods, the buildings are often close together with no public greenspaces available (Shoen, 2018).

As demonstrated in this chapter, urban trees provide a multitude of benefits to the communities in which they reside. But the issue is, trees do not reside in all communities with an equal amount of care, or in an equally distributed fashion. The next chapter of this paper will examine an innovative approach that could help redistribute the benefits of trees more equitably by increasing the level of importance in which they are regarded in policymaking.

Chapter 2: Intersectoral Policy

Urban trees provide these multitude of benefits for the environment, the economy, and citizen's social life and health. Yet, trees are often underrated because, in part, both citizens and government actors are unaware of these benefits, and underestimate how important they are. There is also the issue of proper management, which not only includes planting the correct species, but allowing for ample space to plant those trees correctly. This creates the need to recreate streets and sidewalks that properly incorporate trees into their design. This is just one example of many where the need for trees and their proper implementation call for action from multiple sectors of government.

The creation of intersectoral policy for trees is one way to address these challenges in establishing and managing a comprehensive urban forest. Intersectoral policies require that two or more departments within a government work together to create a policy that addresses and incorporates multiple viewpoints on an issue. An example of intersectoral policy is a city's comprehensive plan. This plan incorporates perspectives and areas of improvement from all communities and sectors of government to guide further policy decisions. Another example of intersectoral policy is a city's sustainability or climate change plan. These plans often incorporate multiple sectors of governments because the effects of climate change are not solely related to just one department. Its effects and ways to combat or mitigate climate change requite inter-agency collaboration. In this policy, most departments and agencies come together to address how they can reduce their climate impact in their city (Vibrant Cities Lab). Collaborative, intersectoral action like this has the potential to transform the policy landscape by promoting consensus between departments, leading to a more efficient use of resources and a more streamlined way of operating.

2.1 Health in All Policies

The health sector leads the way in intersectoral policy and action. It has achieved collaboration from the local level all the way up to the global stage, setting an example for how to successfully implement collaboration to maximize benefits. It's biggest success is the creation of "Health in All Policies" (HIAP) and the lasting effects this approach has had on municipalities worldwide. Health in All Policies is a novel approach to improving population health through the consideration of the impacts policy decisions have across sectors (Leppo et. al, 2013). This emphasis on impacts across sectors prioritizes collaboration in policy-making, as the stakeholders need to recognize that all sectors of government have an effect on the health of the population. HIAP creates a framework where all government departments, such as water, education, and forestry, among others, must take the health impacts of a policy into account, and do their best to incorporate beneficial health practices into their decision-making. These decisions not only create a healthy environment, but encourage healthy choices (Leppo et. al, 2013).

A general framework outlined by Leppo et. al that HIAP typically follows involves three main objectives: establish the importance of health, make connections between sectors, and analyze the health impacts of other sectors' planning and policies. First, the importance of health needs to be established. Policymakers need to understand why it is worth caring about and considering in their policies. In this case, health is important because it is the base for all things in life. It is required to live a full and happy life, which is how policymakers recognize its importance. When its importance is established, those policymakers can then begin to make connections between health and their own sectors. These connections can lead to sectors identifying and correcting the impacts their policies have on health (Leppo et. al, 2013).

One example of HIAP comes from the state government of California. California created a Health in All Policies Task Force in 2010 to address concerns on obesity and healthy living. The group was assigned many goals, with the main outcomes being the identification and report of recommendations for the best programs and policies to improve health, a description of the resulting benefits of these recommendations, and obtaining feedback on their work and report from the public and their stakeholders (Rudolph, et al, 2013). Through meetings held with stakeholders, the task force was able to identify over 1,200 ideas for action, which they then analyzed the impacts and benefits of, to eventually narrow it down to a list of 11 recommendations. Each recommendation addressed these four main concerns: interagency collaboration, equity, community engagement, and data (Rudolph, et al, 2013).

The task force has specifically led to HIAP initiatives across California, with some initiatives even implementing intersectoral action into their everyday policy making. They continue to work on and implement their recommendations. They rely on collaboration between departments to fund and provide resources for these projects, which has created an environment where personal relationships and connections have thrived, enabling even more effective collaboration (Rudolph, et al, 2013). One major result of the task force in California was collaboration between health, environment, and transportation departments to create new ways to promote active transportation, which increases physical activity and reduces greenhouse gas emissions. It was evident to the task force that benefits could be accrued to environmental and forestry sectors of the government. The support for higher rates of physical activity leads to the planting of more trees to create walkable cities, because, as evidenced in the background section of this paper, urban trees promote physical activity. The reduction of greenhouse gas emissions alone from this measure was able to achieve two goals: improve air quality, and provide chronic disease prevention (Rudolph, et al, 2013).

However, HIAP is not easy to implement. While there are some sectors of government that align with health policies easily, there are others that clash with their interests. This conflict often results in policy changes and implementation taking long periods of time before a compromise is reached or until one side concedes. One example cited by Stahl et.al mentions the fight to control smoking in public areas, and mentions that it is the result of long campaigning

(Stahl, et al, 2006). This leads into the economic aspect of implementation to consider. The costs of recognizing health can be detrimental to other sectors, such as the restaurant industry as a result of the ban on smoking. Therefore, the individuals affected by this are less likely to want to contribute when it is not in their best interest to do so. However, some economic impacts from promoting health have been overestimated, and are often less harmful than once thought. Many believed there would be a significant impact on the restaurant industry resulting from the ban on smoking in restaurants, but they were proved to be incorrect (Stahl, et al, 2006).

Another issue that arises with HIAP is determining how improvements can be made in other sectors. While it can be obvious in a health policy standpoint that eating healthier is better for children, other sectors do not have such an easy time determining how to implement a policy that complements this, as there are often outside factors that affect the situation, such as not being able to police an individual's choice. Other outside factors include policies in other sectors that are not related to food, such as working times, employment conditions, and parental leave. If parents are not able to be around to encourage or make their children eat healthier, then a health policy based around encouraging children to eat healthier would be difficult. This is one of many factors that can go unrecognized until the different perspectives that intersectoral action encourages are brought into the solution of the problem. While connections between sectors are not obvious, they can be identified and addressed through intersectoral action to create a more efficient outcome (Stahl, et al, 2006).

It is often in the best interest of the public to take action as well, but when they are not taking meaningful action to include themselves in policy planning, a major piece of information and point of view will be missing from the implementation. This leads to equity issues and leaves room for improvement. Other areas of improvement in this implementation problem is the creation of a more universal policy or standard. Different areas can have different standards set, allowing corporations to continue to exploit one area because of how easy it is for them to adapt their product to different standards. When public action and collaboration is taken into consideration not only on the local level, but on the state and national level as well, this situation can be avoided (Stahl, et al, 2006).

Lastly, there are some issues that cannot be fixed quickly. They require continuing efforts and long-term collaboration to effectively handle, which can lead to intra-departmental conflicts. This situation is often the result of a health issue that requires a new approach. First, they must determine a long-term approach, and then begin to educate themselves on the issue in order to further develop the policy solution. These problems show that implementation of intersectoral policy is not an easy solution, but with a knowledge of how to overcome these problems, it is possible (Stahl, et al, 2006).

2.2 HIAP Advocacy for Trees

Health in All Policies has the potential to promote the planting and benefits of urban trees. Scandinavian countries are a prime example of intersectoral health and environment policies. Scandinavians have begun to put more emphasis on the environment, which has been recognized by the health departments, who stepped in to examine the effects of detrimental environmental habits on citizen health. It was found that health was adversely affected, which increased money needing to be spent on health procedures and practices, a cost borne by the health sector. The two departments began working together to split the cost and raise benefits for the citizens (Stahl, et al, 2006).

In the U.S., urban tree planting initiatives are being supported as a means of improving public health and well-being. This has led to one program in New York City known as the "Million Trees" program, which has achieved its goal of planting one million trees in New York City. The program planted 220,000 street trees alone in its efforts to improve public health by creating an environment where its citizens are more physically active. "Million Trees" also supported the plantings as a way to improve access to the multitude of other benefits that trees provide and were successful in their efforts (Million Trees NYC, 2015).

2.3 From Health in All Policies to Trees in All Policies

It is evident that there is a link between health and forestry departments. Some have already begun to work together on intersectoral policies to improve the situation for both departments. However, in the U.S., it is rare that trees are considered in other sectors outside of health. Health in All Policies has laid the groundwork for a new approach that can make improvements on the ways trees are perceived in policymaking; Trees in All Policies.

Trees in All Policies (TIAP) can create an increased awareness into the benefits of trees and result in higher levels of consideration in policy making. A collaboration between government sectors is needed to be able to plant trees. For example, forestry departments will need to work with public works and transportation departments to set up the streets to specifically include trees in their design. This could mean making the street slightly thinner to widen the sidewalks and make room for planting cutouts. This process could be easier with TIAP because it will create an environment where trees are valued in planning and policymaking, resulting in little or less than average protests against allocating resources for trees.

Vibrant Cities Labs has created an approach to TIAP for policymakers that outlines how to promote trees and involves multiple different stages that range from assessment, prioritization, organization and planning, building, and sustaining. These stages involve many steps that can be adapted to best fit policymakers' own communities and create a long-lasting, efficient outcome. The steps from Vibrant Cities Labs outline specific ways to improve trees in all policies, but do not address the ways in which intersectoral action works, or how to facilitate it.

This can leave policy makers and government actors unsure of how to get TIAP started. One organization in Worcester, MA is wondering the same thing. The Worcester Tree Initiative at Tower Hill (WTI) has recognized the benefits of trees since their inception in 2009, when they were created with the goal of replacing the trees lost to the Asian Longhorned Beetle infestation that caused Worcester to lose over 30,000 trees. They conduct street tree inventories in multiple Worcester neighborhoods, making sure to note the health and necessary care of each tree. The WTI is now looking for new ways to improve tree cover in Worcester, and specifically improve the situation in environmental justice neighborhoods, like the neighborhood of Union Hill.

In order to help them, I conducted research into intersectoral policy and how to implement it, with the goal of articulating the benefits of trees, the broad range of their contributions to environmental justice, and intersectoral means of increasing tree cover and benefits through policies. I began with the objective of conducting a street tree inventory in Union Hill to be able to identify it as an environmental justice neighborhood lacking street trees. I then assessed the policy landscape and identified potential stakeholders relevant to incorporating trees in policies. Finally, I developed a framework for the implementation of intersectoral policy as a means of addressing the situation in environmental justice neighborhoods.

Chapter 3: Methods Towards Creating a Framework

The goal of this project was to articulate the benefits of trees, the broad range of their contributions to environmental justice, and intersectoral means of increasing tree cover and benefits through policies. To achieve this goal, I identified three main objectives: (1) to assess the current state of the urban trees in Union Hill and compare with other Worcester neighborhoods; (2) to assess the policy landscape and identify potential stakeholders; (3) to develop a framework to improve the incorporation of trees in policies as a means of addressing environmental justice neighborhoods. In order to complete these objectives, a variety of methods was used, including data collection, document analysis, and interviews.

3.1. Objective 1: Assess the current state of the urban trees in Union Hill and compare with other Worcester neighborhoods.

To complete this objective, I undertook transect walking and mapping throughout the study area. The study area was determined through collaboration with Worcester Tree Initiative and used that criteria…. While out in the field, I examined each street tree using the Worcester Tree Initiative at Tower Hill criteria for assessing tree condition, as well as the location and address of each tree. The data collected was then entered into Worcester Tree Initiative's online database. This information was used to create a map of tree locations and diameter size in the surveyed area. This database was also used to determine the current state of the urban tree canopy in other Worcester neighborhoods that have been surveyed previously.

3.2. Objective 2: To assess the policy landscape and identify potential stakeholders

The objective aimed to identify how policies and strategies employed by the Worcester government and other outside actors have contributed to the current state of the urban landscape in Union Hill, with particular reference to urban tree cover. To complete this objective, I identified relevant stakeholders who can potentially be involved in policy making in the future, as well as using the methods of document analysis and interviews.

3.2.1. Document Analysis

Document analysis was first completed through the identification and attainment of relevant documents. Documents were located through internet searches and through contact with the City of Worcester officials who may have full copies of the documents. Once the documents were attained, the documents were analyzed based on whether or not there was an explicit mention of trees and the level of importance that was placed on their value. Also through the analysis, I identified potential stakeholders to see who is currently involved in Worcester policymaking, and combined that with my knowledge from the literature to determine who else could be involved in the future to make the process and policy more effective.

3.2.2. Interviews

Open-ended interviews were conducted to evaluate the importance of urban tree cover in policy planning in Worcester. Interviewees were identified through discussions with the project sponsor. An interview was conducted with the sponsor liaison as well. These members were identified to be important actors in the creation and implementation of policies and strategies that contribute to the current state of urban landscape in Union Hill. Preliminary research was conducted on each actor and combined with the knowledge from the background research to create a relevant set of questions for each interview. I reached out to the identified interviewees to find the best way to conduct the interviews. The interviews were conducted over the phone and oral consent was sought before the interview. I explained both the purpose of the research and the respondents right to review the final report before publication. I developed a preamble explaining this to the interviewees. I asked them for permission to record the conversation in addition to taking notes. After the interview was completed, I went back and read through our notes to gather important information from the interview. This helped to identify the key themes and information to include in the final recommendations. The potential interviewees and the general themes for their questions are found below:

3.2.3. Government Actors and Community Activists:

1. What are your experiences with intersectorality and Health in All Policies?
    1. What have been the benefits and challenges of these experiences?
    2. Who has been involved?
2. What role do personal relationships play in this kind of collaboration?
    1. How can these relationships be improved?
3. What kind of conflicts have you encountered when creating intersectoral policies, specifically in ones that involve trees?
4. Why do you think the nonpriority of trees plays a role in the inequalities of Worcester neighborhoods?

3.3. Objective 3: Develop a framework to improve the incorporation of trees in policies as a means of addressing environmental justice neighborhoods.

Insights from the literature review, document analysis, and interviews, aided in the development of a framework for intersectoral policy that will help the Worcester Tree Initiative at Tower Hill promote Trees in All Policies and as a result, improve urban tree cover situations in environmental justice neighborhoods.

Chapter 4: Results

4.1 Benefits and the Connections between Sectors

The benefits of urban trees are numerous. Social benefits of urban trees create a connection between the forestry sector and the education sector, as an increase in trees has been associated with increased attention span and weakened symptoms of ADD/ADHD. It has also been shown that academic performance rises significantly in schools that have greenspace exposure throughout the school day. Social benefits of trees are also tied to the health benefits, as an increase in social activity from access to trees leads to more residents spending time outside within their community, which can improve both their physical and mental health.

Other connections between the forestry and health sector are urban trees' ability to reduce pollutants, resulting in improved air and water quality, which can benefit citizen health by reducing rates of asthma, heart disease, and lower-respiratory illnesses. Trees also aid in the promotion of physical activity and the creation of walkable cities that improve the physical health of residents by motivating residents to be more active, while also providing shaded areas that they can stop and rest in while outside. The improved health of residents has the ability to save municipalities' health care costs for their residents, further tying these sectors together under trees.

Trees are known to increase property values in neighborhoods that have high levels of tree cover, which further emphasizes its connections to the economic sector. Tree cover can also provide shade for cooling, which can reduce household energy usage and costs. High levels of urban trees in neighborhoods have also been known to reduce crime, which raises property values, not to mention the social benefits associated with a reduction in crime, and the benefits to a city's police or crime prevention departments. Another way trees can make a city safer is through collaboration with the transportation department. Urban trees that line the streets act as barriers to motor vehicles and can protect the residents walking along the sidewalks in the event of a crash, reducing the amount of crash victims sent to a hospital and further reducing the municipalities' health care costs. A picture representation of these benefits and their connections between sectors can be found in Figure 1 below.

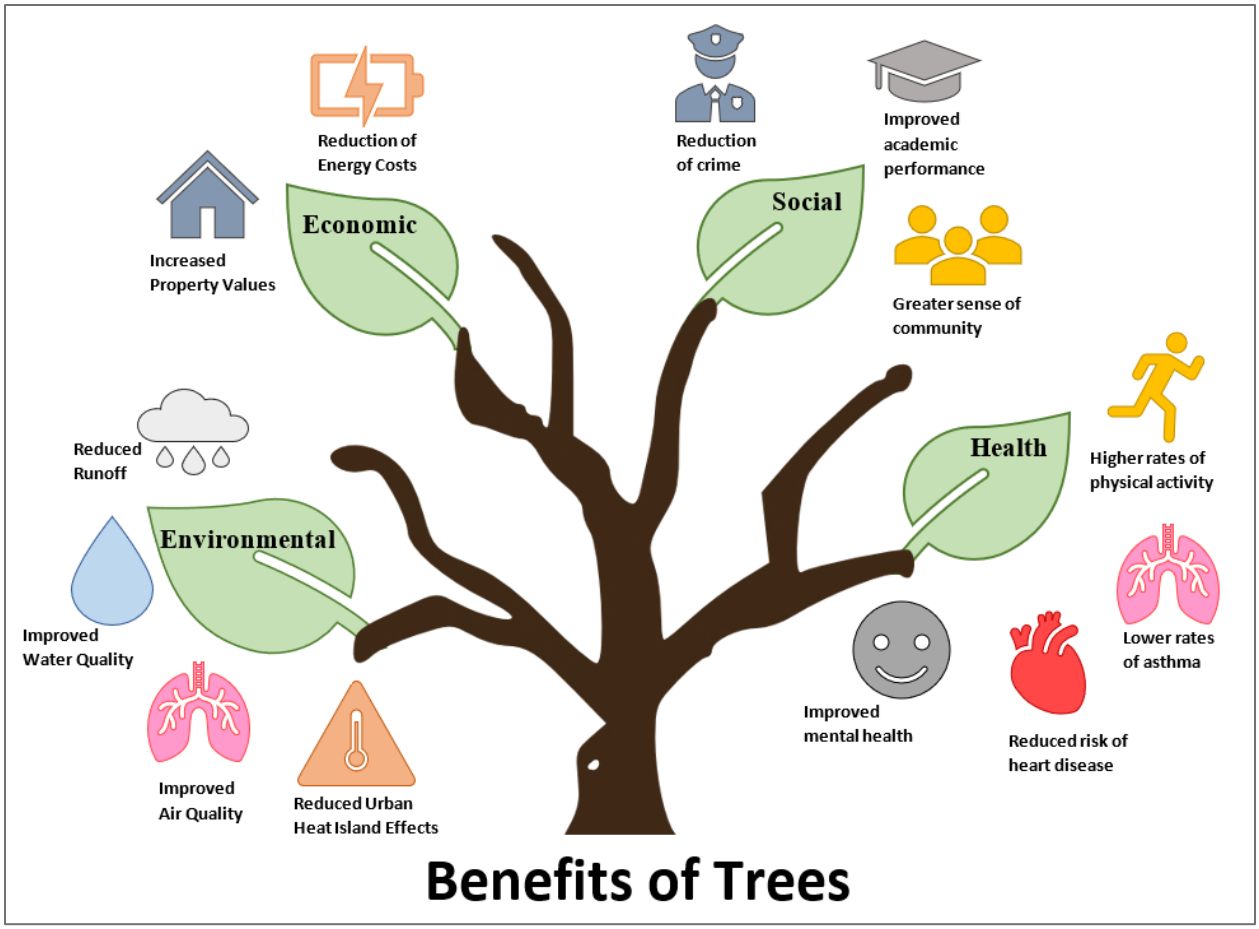

Figure 1 Benefits of trees shown in their associated sectors. Colors that are alike across sectors show the interconnectedness of the two benefits.

4.2 Benefits and Environmental Justice

While the benefits of trees are connected and distributed across multiple sectors, the access to them is not. Many municipalities have an unequal distribution of urban trees, thus creating inequalities in terms of residents being able to reap the benefits of them. Environmental justice neighborhoods are created when a municipality does not have equally accessible benefits throughout their city, often based on socio-demographic and economic status of certain neighborhoods, as is the case in Worcester, Massachusetts.

Worcester's neighborhood of Union Hill is one of those environmental justice neighborhoods. Union Hill is made up of mostly renters of multi-family residential homes, which can reduce the plantings of urban trees, as not many renters take responsibility for the property or its street trees. The residents of Union Hill are also predominantly a minority community with lower-than-average incomes. These demographics combined with a lack of urban trees that I found while conducting my street tree inventory with the Worcester Tree initiative at Tower Hill identifies Union Hill as an environmental justice neighborhood. The street tree inventory shows

that Union Hill has only two main roadways with street trees, making up for the majority of the tree cover in the neighborhood, and those trees range from only five different species, leaving them susceptible to higher rates of infestation and disease. Some of the trees have been badly damaged and some have been removed altogether after they passed the point of maintenance being able to help. Compared to other neighborhoods in Worcester, Union Hill's tree cover is lacking and requires government attention to improve it.

4.3 Past Efforts to Address the Uneven Distribution of Benefits

The Worcester municipal government has made attempts to include trees in their planning and create intersectoral policies, with policies such as "Complete Streets" and their "Right Tree, Right Place" collaboration with the Arbor Day Foundation. They also have a city ordinance to protect trees that states there must be approval from a city forester before a tree is removed. However, these policies fail to make trees a priority. In the "Complete Streets" policy, trees take a backseat to other aspects to improve streets in Worcester. According to one city official, trees are the first thing to be removed from the street plan if the city is over budget, or unable to implement those changes (personal reference). The "Right Tree, Right Place" collaboration with the Arbor Day Foundation does focus on trees, but it leaves the action up to the residents, and not the city. The collaboration is to educate residents on how to properly plant and care for trees, but in neighborhoods with many renters and low responsibility for street trees, this can be little to no help. The city ordinance to protect trees is good, because it is specifically related to ensuring that trees are kept safe from unnecessary destruction. However, this ordinance does nothing to provide more trees to Worcester city residents.

The city of Worcester's policies also failed to account for the possible downfalls to the monoculture it created in its urban canopy. This led to an infestation of the Asian Longhorned Beetle in 2009, wiping out more than 30,000 trees in the city. In response to this, the Worcester Tree Initiative at Tower Hill (WTI) was created with the goal of replanting the lost trees. However, the absence of trees continues to plague some Worcester neighborhoods today. The WTI recognizes the benefits that trees provide, and they continue to be one of the main actors fighting for the addition of more trees in Worcester neighborhoods. Other non-governmental groups in Worcester could be allies in promoting and implementing trees in all policies. These organizations can include the Greater Worcester Land Trust, who has promoted the protection of open spaces in all neighborhoods since 1987. They work to protect open spaces and receive grants and donations to do so. They have preserved over 2,300 acres of land in the Worcester area since 1987 and can further their work to incorporate the protection of trees.

Another organization to get involved is more closely associated with the Union Hill neighborhood. The Oak Hill Community Development Center opened in 1972 with the goal of improving the quality of life for residents in the Union and Oak Hill neighborhoods of Worcester, MA. The Oak Hill CDC is run by community members and takes community input to

inform decisions in the plans they are involved with. With an increase in the awareness of the benefits of trees, more community members would begin to advocate for trees in their neighborhood, and the Oak Hill CDC can help them achieve that goal. As for government actors, members of the health, economic, transportation, and education departments can get involved as well to promote trees in all policies and increase the benefits that trees provide to them and their sector. One former city official cites personal relationships between actors in these sectors as the most important factor for intersectoral policies (personal reference).

4.4 A New Way to Address the Uneven Distribution of Benefits: Intersectoral Policy

There is increasing evidence that intersectoral policy can improve the current situation for environmental justice neighborhoods and equally distribute the benefits of trees. Intersectoral policy has had great success in the health sector with the "Health in All Policies" initiative. HIAP has been able to address health inequities by focusing on health connections to other sectors, and through an understanding of how other sectors, like education, finance, transportation, and housing, can cause or exacerbate negative health effects that are unevenly distributed among communities. The incorporation and support of non-health sectors into health policies played a key role in addressing these inequities (Smith et. al, 2019). Health in All Policies can be adapted to create the initiative for "Trees in All Policies," where the benefits of trees are recognized across sectors and this recognition can address the inequities created by an absence of trees.

4.5 Considerations of Intersectoral Policy

The implementation of intersectoral policy is not easy. There are many factors and challenges that affect the success rate of an intersectoral policy, including conflicts of interest between sectors, issues of relativity between sectors, conflicts within resource allocation, the interest levels and cooperation with the public, and problems that require long-term solutions and collaboration. There is a need for governments to address these challenges by creating a culture surrounding the importance of trees to improve awareness of their benefits and increase actors' willingness to act. The first step would be educating each sector on the benefits of trees and their connections across government. In this way, government sectors outside of the forestry department will have a greater understanding on the importance of trees and will be more likely to consider them in their policy making.

The next step would be governments incentivizing collaboration between government sectors through formal or informal means. Formally, governments can create policies that call for interdisciplinary task forces, information system-links, inter-agency meetings, and cross-departmental collaboration (Oickle, 2014). Informally, governments can create an environment where actors feel comfortable to collaborate with one another through unwritten agreements or

through the beginnings of coordinated action (Oickle, 2014). Whether formal or informal, incentives show the commitment the government is making to including trees in all policies.

One thing the government cannot do is build personal relationships between individual government actors. While they are able to incentivize these relationships, it is up to each individual to foster them. These personal relationships play a major role in overcoming the challenges to intersectoral action, according to a former Worcester city government actor. When individuals know each other on a personal level, they are able to better understand them, their job position, and their points of view on different topics (personal reference). This helps them to create a common vision that everyone can understand and support.

4.6 Moving Forward: An Intersectoral Policy Framework

Taking all of this information into consideration, I have developed a framework for intersectoral policy, specifically analyzing how the situation in Worcester, Massachusetts can be improved through the use of this framework.

Chapter 5: Intersectoral Policy Framework

A framework for intersectoral tree action is needed for municipal governments to be able to take the necessary action to address inequalities within their urban canopy. Using my literature review, interviews, and assessment of policies currently in place, I have developed both a general framework and a Worcester-specific framework using my analysis of the Union Hill neighborhood for the implementation of Trees in All Policies. This framework incorporates four main steps: develop logistics of the site, develop connections between sectors through the articulation of benefits and the identification of key actors, develop relationships, and develop incentives. An overview of the framework can be found in Figure 2 below.

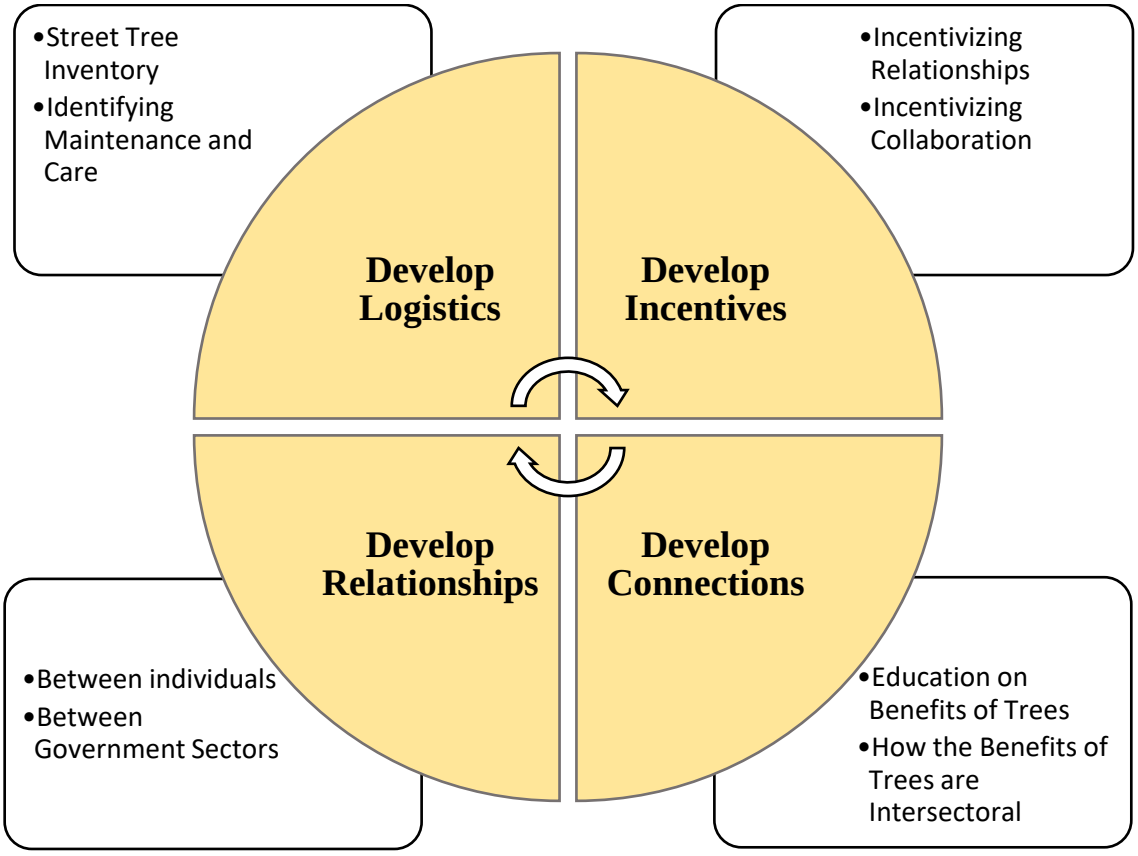

Figure 2 Framework for Intersectoral Policy

5.1 Develop Logistics

The first step in this framework is to develop the knowledge of the area or city in question. The first component of this step is a street tree inventory that helps to determine the number of trees, their species, and their condition. The data gathered by the street tree inventory helps to identify the density and biodiversity of the urban tree canopy for that area, both of which are indicators for the benefits provided by the trees. This information is necessary in determining

inequalities between neighborhoods in terms of urban tree cover, which is crucial when attempting to address environmental justice issues within a municipality.

The next component of this step is to identify the maintenance and care needed for trees in the specified area. The data gathered on the condition of trees from the street tree inventory can determine how much maintenance is needed on each tree, such as crown cleaning, crown removal, pruning, or complete removal of the tree from the planting area. This ensures that the tree is not putting others or their property in danger, and that the tree is providing the maximum amount of benefits possible. The maintenance and care for additional trees will also need to be determined to best prepare the city for an increase in the urban tree canopy. When the urban tree canopy is increased, this planning ahead will ensure that the trees chosen will be the best fit for the environment and that the trees will be diverse within the community.

5.2 Develop Connections Between Sectors

The second step in this framework is to develop connections between sectors. This is the step that showcases the importance of trees to all sectors of government and draws connections from the benefits of trees to more than just a city's forestry department. It also demonstrates the importance for a proper education on the benefits of trees and their connections to all sectors of government to increase government actor's awareness and consideration of trees in all policies. Once the education and awareness levels are increased, government actors can then begin work on adapting existing policies to better reflect these benefits and connections.

5.3 Develop Relationships

The third step in this framework is to develop relationships. Through my interviews and my literature review into the success of Health in All Policies, I have identified the development of relationships as an important factor in facilitating intersectoral policy and collaboration. This includes relationships between sectors similar to step two, relationships between individuals in different sectors, or relationships between the government and outside actors, such as citizens or non-governmental organizations.

The role of personal relationships is important in bridging the gap between different sectors of government. Not everyone is trained in every sector of the government, therefore a knowledge of the other person, their job, and their points of view are needed to promote effective collaboration. This understanding begins with the development of a personal relationship that becomes formalized when collaboration begins. This is true for both relationships between government workers, and between the government and citizen advocates.

5.4 Develop Incentives

The fourth step in this framework is to develop incentives. This step specifically involves the city government to create incentives for collaboration, whether it is through incentivizing relationships, or incentivizing intersectoral policies. This can be done in a few ways. The main way it is being done now is through collaborative plans for sustainability. These plans often incorporate all sectors of the government that come together and find ways to improve their sustainability throughout the city. However, city governments can also incentivize relationships by assigning multiple sectors of government to one project, such as creating a task force, instead of leaving it up to one sector. The task force could be similar to the one described by Rudolph et.al for Health in All Policies in California, where government actors from many different sectors of government came together and collaborated with each other, with their departments, and with Californian citizens (Rudolph et. al, 2013)

Chapter 6: Conclusion and Future Work

The goal of this project was to articulate the benefits of trees, the broad range of their contributions to environmental justice, and to examine the possibility of intersectoral means of increasing tree cover and benefits through policies. Through this project, the benefits of trees and their interconnectedness to all sectors was made evident. Yet, access to and distribution of these benefits is not always equal. I argue that Trees in All Policies (TIAP) is a promising new intersectoral approach to urban forests that could provide pathways to improve access to these benefits for environmental justice neighborhoods. I created a framework for TIAP; the first step towards a comprehensive approach to urban forestry for Worcester, Massachusetts, and local environmental justice communities such as Union Hill. However, the implementation of this framework is far from complete. Listed below are some necessary steps of action to make Trees in All Policies a reality.

Trees in All Policies needs to be implemented in the city of Worcester, MA. This is a large, but necessary, step to be taken by the Worcester government. Trees in All Policies can begin with intersectoral policy's first step of developing logistics. In this step, a street tree inventory is conducted. The information provided by the street tree inventory is a major factor in identifying environmental justice neighborhoods and the communities with the greatest need for trees. Therefore, a further look into the status of tree cover in every Worcester neighborhood is essential in identifying environmental justice neighborhoods. The classification of these neighborhoods will showcase the need for intersectoral policy, and an increased level of importance put on trees in policymaking.

After the identification of environmental justice neighborhoods, the implementation needs to move into the second step, and an awareness campaign surrounding the benefits of trees must be created. According to one city advocate group member, too many members of the public, and the government alike, are unaware of the benefits trees provide to them. Their unfamiliarity with the topic fosters an environment where they are less likely to take action for trees. An awareness campaign in the form of flyers, ads, or a speaker at community meetings can increase the level at which community members advocate for trees in their neighborhoods.

Trees in All Policies is not something that will be easy or happen overnight. It will take hard work from the community, non-governmental organizations, and the government in order to properly implement this new approach to policymaking. However, the benefits this new approach would be long-lasting and work to create equity in neighborhoods that is long overdue. Trees in All Policies has the ability to amplify the benefits of trees and improve the situation in environmental justice neighborhoods.

List of Expert Interviews

Karin Goins, March 5,2020, Former Worcester City Official in the Public Health Sector

Ruth Seward, April 7,2020, Director, Worcester Tree Initiative at Tower Hill

Bibliography

Barton, J., & Rogerson, M. (2017). The importance of greenspace for mental health. BJPsych international, 14(4), 79–81.

Chou, C.K.S. 1981. Monocultures, species diversification, and disease hazards in forestry. N.Z. J. For. 26(1): 20–36.

Constante, A. (2018, March 20). In a fight for much-needed green spaces, these Latino advocates bring a winning formula.

Department of Environmental Conservation, UMass/Amherst , & U.S. Forest Service, Northern Research Station, Amherst, MA . (2014). Urban Tree Canopy Assessment for Massachusetts 10 Largest Communities. ITree Canopy Cover Report.

Dubois, A., St-Pierre, L., & Veras, M. (2015). A scoping review of definitions and frameworks of intersectoral action. *Ciência & Saúde Coletiva*, *20*(10), 2933–2942. doi: 10.1590/1413-812320152010.01222014

Flocks, Joan & Wade, Jeffry & Varela, Sebastian & Wald, Claudia. (2011). Environmental Justice Implications of Urban Tree Cover in Miami-Dade County, Florida. Environmental Justice. 4. 10.1089/env.2010.0018.

Fuller, R. A., Irvine, K. N., Devine-Wright, P., Warren, P. H., & Gaston, K. J. (2007). Psychological benefits of greenspace increase with biodiversity. *Biology Letters*, *3*(4), 390–394. doi: 10.1098/rsbl.2007.0149

G.H. Donovan, D.T. Butry, Y.L. Michael, J.P. Prestemon, A.M. Liebhold, D. Gatziolis, M.Y. MaoThe relationship between trees and human health. Am. J. Prev. Med., 44 (2013), pp. 139-145

Goddard, M. A., Dougill, A. J., & Benton, T. G. (2009, September 14). Scaling up from gardens: biodiversity conservation in urban environments.

Governing Content Studio. (2017). How Cities Can Harness the Public Health Benefits of Trees. _Urban_Trees_FINAL.pdf.

Hanson, P., & Frank, M. (2016). The Human Health and Social Benefits of Urban Forests. Dovetail Partners.

Harrison, J. L. (2016). Bureaucrats' Tacit Understandings and Social Movement Policy Implementation: Unpacking the Deviation of Agency Environmental Justice Programs from EJ Movement Priorities. Social Problems, 63(4), 534–553. doi: 10.1093/socpro/spw024

Harrison, J. L. (2016). Bureaucrats' Tacit Understandings and Social Movement Policy Implementation: Unpacking the Deviation of Agency Environmental Justice Programs from EJ Movement Priorities. Social Problems, 63(4), 534–553. doi: 10.1093/socpro/spw024

Jennings, V.; Baptiste, A.K.; Osborne Jelks, N.; Skeete, R. Urban Green Space and the Pursuit of Health Equity in Parts of the United States. Int. J. Environ. Res. Public Health 2017, 14, 1432.

Kabisch, N., & Haase, D. (2013, December 20). Green justice or just green? Provision of urban green spaces in Berlin, Germany.

Leppo, K., Ollila, E., Peña Sebastian, Wismar, M., & Cook, S. (2013). *Health in all policies: seizing opportunities, implementing policies*. S. l.: Ministry of social affairs and health, Finland.

Loughner, C. P. (2012, May 4). Roles of Urban Tree Canopy and Buildings in Urban Heat Island Effects: Parameterization and Preliminary Results.

MillionTrees NYC. (2015).

Mullaney, J., Lucke, T., & Trueman, S. J. (2014, November 13). A review of benefits and challenges in growing street trees in paved urban environments.

Norman, J., Ellingson, L., Boman, M., & Mattsson, L. (2010). The value of forests for outdoor recreation in southern Sweden: Are broadleaved trees important. *Ecological Bulletins*, (53), 21-32.

Nowak, D. J. (2002). THE EFFECTS OF URBAN TREES ON AIR QUALITY.

Oickle, D. (2014, November 6). The Five W's of Intersectoral Collaboration.

Parker, B. L. (2012). Asian longhorned beetle and its host trees. In *Asian longhorned beetle and its host trees*. Washington, D.C.: United States Department of Agriculture, Forest Service, Northeastern Area, State and Private Forestry.

Pauleit, S., Jones, N., Garcia-Martin, G., Garcia-Valdecantos, J. L., Rivière, L. M., Vidal-Beaudet, L., … Randrup, T. B. (2002). Tree establishment practice in towns and cities – Results from a European survey. *Urban Forestry & Urban Greening, 1*(2), 83–96. doi: 10.1078/1618-8667-00009

Perez, A. C., Grafton, B., Mohai, P., Hardin, R., Hintzen, K., & Orvis, S. (2015). Evolution of the environmental justice movement: Activism, formalization and differentiation. Environmental Research Letters,10(10), 105002. doi:10.1088/1748-9326/10/10/105002

Reduce Urban Heat Island Effect. (2019, May 22).

Rigolon, A., & Flohr, T. (2014). Access to Parks for Youth as an Environmental Justice Issue: Access Inequalities and Possible Solutions. Buildings,4(2), 69-94. doi:10.3390/buildings4020069

Rudolph, L., Caplan, J., Mitchell, C., Ben-Moshe, K., & Dillon, L. (2013). Health in All Policies: Improving Health Through Intersectoral Collaboration. *NAM Perspectives*, *3*(9). doi: 10.31478/201309a

Santamour, F. S. (2004). Trees for Urban Planting: Diversity, Uniformity, and Common Sense. In *The Overstory Book: Cultivating Connections with Trees* (2nd ed., pp. 396–399). Holualoa, HI: Permanent Agriculture Resources.

Shoen, E. (2018). Access to Parks and Green Space.

Sjoman, H., Ostberg, J., & Buhler, O. (2011, October 24). Diversity and distribution of the urban tree population in ten major Nordic cities.

Smith, M. J., & Weinstock, D. (2019, January 1). Reducing Health Inequities Through Intersectoral Action: Balancing Equity in Health With Equity for Other Social Goods.

Ståhl Timo, Wismar, M., Ollila, E., Lahtinen, E., & Leppo, K. (2006). *Health in all policies: prospects and potentials*. Helsinki.

Trees Improve Our Air Quality. (n.d.).

Van Dillen, S. de Vries, P.P. Groenewegen, P. SpreeuwenbergGreenspace in urban neighbourhoods and residents' health: adding quality to quantity. J. Epidemiol. Community Health, 66 (2012), p. e8

Vibrant Cities Lab. (n.d.). Promote Trees in all Policies.