PORTLAND PARKS & RECREATION℠

Healthy Parks, Healthy Portland

Growing a more equitable urban forest: Portland's citywide tree planting strategy

December 2018

Growing a more equitable urban forest

December 2018

Prepared by Portland Parks & Recreation

Portland Parks & Recreation Project Staff
Angie DiSalvo, Urban Forestry Supervisor
Chiao Yun Hsiao, Community Engagement & Public Involvement Representative
Leanne Wells, Planting Program Coordinator

Consultant Team
Vivek Shandas, Portland State University
Kara Boden, Portland State University
Jackson Voelkel, Portland State University

Community Engagement Liaisons
Sumitra Chhetri, Bhutanese communities
Hanna Grishkevich, Slavic communities
Isatou Jallow, African communities
Zachary Pham, Vietnamese communities
Gloria Vilchis, Latinx communities

Community Advisory Committee

Anjeanette Brown
Deo Bhandari
Chi Bui
Sumitra Chhetri
Rachelle Dixon
Joe Enlet
Katherine Fischer
Isatou Jallow
Bruce Nelson
Zachary Phan
Kristina Psaris-Weis
Sela Pulotu
Alvey Seeyouma
Hakima Siyad
Thuy Tu
Desale Woldu

Technical Experts

Bureau of Development Services, Bureau of Environmental Services, Bureau of Planning and Sustainability, Friends of Trees, Metro, Multnomah County, Office of Equity and Human Rights, Portland Bureau of Transportation, Portland Housing Bureau, Portland Parks & Recreation, and Portland Water Bureau

Portland Parks & Recreation
1120 SW Fifth Avenue, Suite 1302
Portland, Oregon 97204
(503) 823-8733
www.PortlandParks.org

Commissioner Nick Fish
Interim Director Kia Selley

Contents

Contents	1
Summary	3
Background	5
Methods	9
Findings	11
Recommendations	19
References	25
Appendix A: Citywide Tree Planting Report by Portland State University	27

Recommendations for growing a more equitable urban forest were developed through extensive community outreach, including feedback from Community Advisory Committee members (above) and culturally-specific focus groups (below).

Summary

Portland is committed to improving the city's air quality, public health, and livability by enhancing and maintaining the health of the urban forest, investing millions of dollars each year planting trees.

The current distribution of trees is uneven and is directly linked to income. Affluent and west-side neighborhoods have significantly more tree canopy, while east-side and lower-income neighborhoods have less tree canopy. Communities of color, low-income, refugee, and immigrant communities are in greater need of trees and services supporting tree planting.

Portland Parks & Recreation partnered with Portland State University to conduct a one-year project identifying barriers, opportunities, and recommendations for growing a more equitable urban forest. Findings from this project provide critical guidance for future planting efforts, as well as for updating the city's *Urban Forest Management Plan*.

KEY FINDINGS

- Portland's tree canopy is not distributed evenly throughout the city and is correlated to income. West of the Willamette river tree canopy is 56% while east of the Willamette tree canopy is only 21%. Tree canopy in individual neighborhoods varies from 5-70%. This vastly uneven distribution means that tree services and benefits are not accessible to many of Portland's residents.
- Significant barriers to tree planting for communities of color, low-income, refugee, and immigrant communities include: varying cultural values and relationships with trees, competing priorities and limited resources, fears and concerns, cost, disempowerment of renters, and a need for more authentic engagement from government.
- Tree planting outreach to underserved communities must include culturally-specific elements, such as conducting culturally-specific educational events, tailoring events to the community, providing translation and interpretation, and adapting existing volunteer programs to specific communities.
- Community members favor an active role for the city in maintenance and planting. 67% of survey respondents believe the city should maintain street trees in the right-of-way and 74% believe the city should prioritize street tree maintenance in lower-income areas.
- Additional opportunities for engaging underserved communities in tree planting include eliminating cost barriers, creating jobs, advocating for trees at rental properties, and building trust.

KEY RECOMMENDATIONS

- Fund planting and maintenance in low-income, low-canopy areas to reduce costs for residents. This includes increasing planting programs that focus on rental properties and advocating on behalf of tenants who want trees.
- Conduct culturally-specific outreach and education for communities of color, immigrant, and refugee communities to promote participation in planting; develop long-term partnerships and relationships with these communities to promote planting and trees.

- Update canopy targets in the *Urban Forest Management Plan* and develop corresponding planting goals and timelines.
- Improve collaboration among city bureaus and community partners to clarify and define roles for planting and future development, improve effectiveness of planting efforts, and minimize redundancies.
- Assess and monitor planting efforts in low-income, low-canopy areas to determine the success of planting and outreach efforts.
- Promote use of the planting web tool developed during the project for identifying areas that would benefit the most from tree planting.

Background

PORTLAND IS COMMITTED TO IMPROVING THE CITY'S AIR QUALITY, PUBLIC HEALTH AND LIVABILITY BY EXPANDING THE CITY'S URBAN FOREST

Climate change poses serious environmental threats to our natural resources and the health and jobs of our communities. The effects of climate change disproportionately impact low-income communities and communities of color. The City of Portland and Multnomah County jointly adopted a *Climate Action Plan* in 2015 which identifies increasing green infrastructure, including tree planting and preservation, is identified as a primary tool for mitigating against and preparing for climate change.

Improving Portland's air quality, public health and livability by expanding the city's urban forest is a top priority for Portland Parks & Recreation Urban Forestry. Planting trees mitigates the impacts of climate change by reducing the urban heat island effect, removing air pollution, and sequestering carbon. Improving the environment by increasing canopy cover can also lead to healthier communities, reducing the risk of heat-related illnesses and improving air quality. Improved environmental health leads to better mental and physical health outcomes for all Portlanders.

In recognition of the environmental, public health, and livability benefits of urban trees, Portland has a goal of expanding canopy cover (the area of land covered by trees when viewed from above) from its current 30.7% to a minimum of 33.3% by 2035 (Bureau of Planning and Sustainability 2012; PP&R 2017). Underscoring the importance of the urban forest, canopy cover is cited as an important environmental indicator in Portland's *Urban Forest Management Plan* (2004), the *Urban Forest Action Plan* (2007), the *Climate Action Plan* (2015), the *Portland Plan* (2012), and the *2035 Comprehensive Plan* (2016).

Portland invests millions of dollars each year in tree planting through the work of many city bureaus, nonprofit partners, and community members. Thousands of trees are planted annually along streets, on private property, and in public spaces. Portland Parks & Recreation (PP&R) plants trees in parks, along streets, and conducts tree giveaways for residential yards. The Bureau of Environmental Services (BES) plants street and yard trees by contracting with the nonprofit Friends of Trees (FOT) and private contractors.

In 2015, Portland expanded its tree planting capacity with the creation of a new planting mitigation fund through the implementation of Title 11, the city's tree code. The fund is intended to replace canopy lost to development and tree removal. Before committing funds, PP&R engaged in this study to determine the best way to plant for the most public benefit, with a particular focus on historically underserved communities.

PORTLAND'S MORE AFFLUENT NEIGHBORHOODS HAVE THE MOST TREE CANOPY

Portland's tree canopy is not distributed evenly throughout the city. Significant variation exists, ranging from 5-70% canopy cover among individual neighborhoods. There is a very significant east-west divide in tree cover. West of the Willamette River, canopy cover is 56%. Even excluding the vast contribution of Forest Park (a 5,000 acre heavily treed natural area), tree canopy cover is still high on the westside at 44%. However, east of the Willamette River, where 80% of Portland's residents live, canopy cover is only 21%. This vastly uneven distribution means that the services and benefits of the urban forest are not accessible to many of Portland's residents.

Figure 1: Tree Canopy in Portland (Metro 2016). The citywide goal for tree canopy is 33.3%.

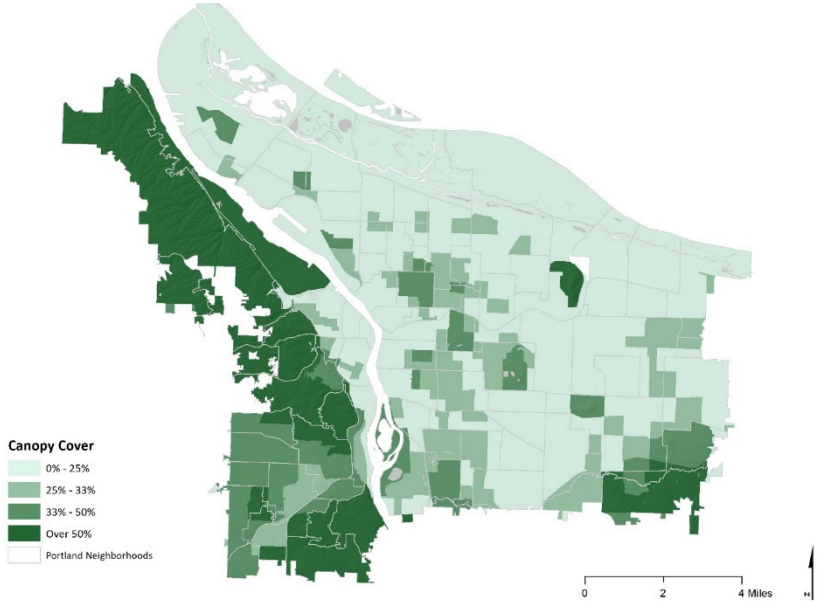


Figure 2: Populations of color in Portland (Office of Community and Civic Life 2010).

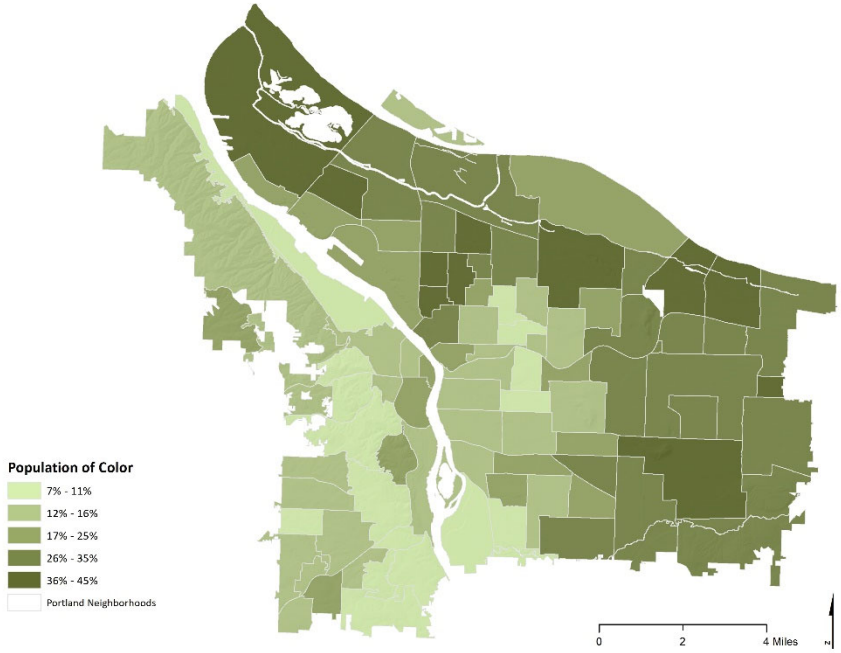


Figure 3: Limited English Proficiency (LEP) population in Portland (BPS 2014). Individuals with limited English proficiency are described as those whose primary language is not English and have a limited ability to read, write, speak, or understand the English language. This serves as a proxy for immigrant and refugee communities.

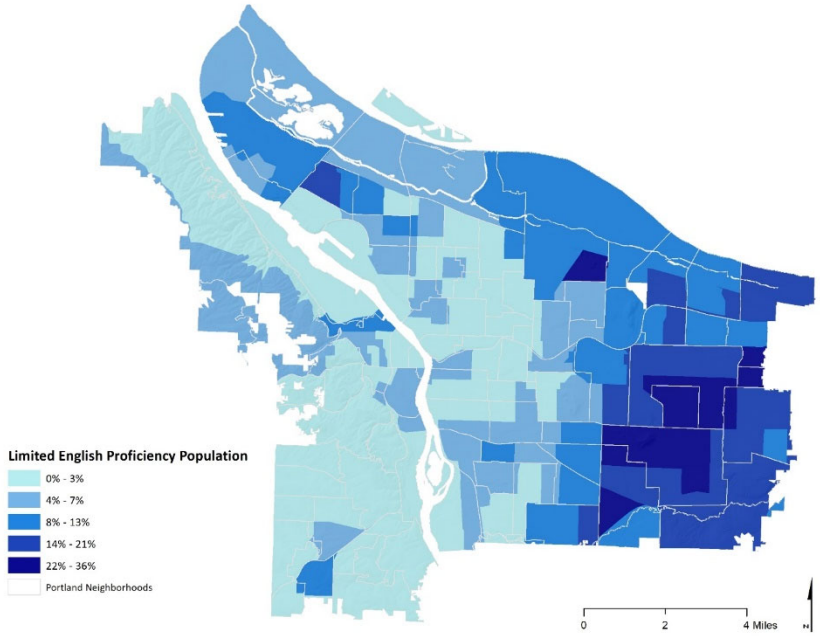
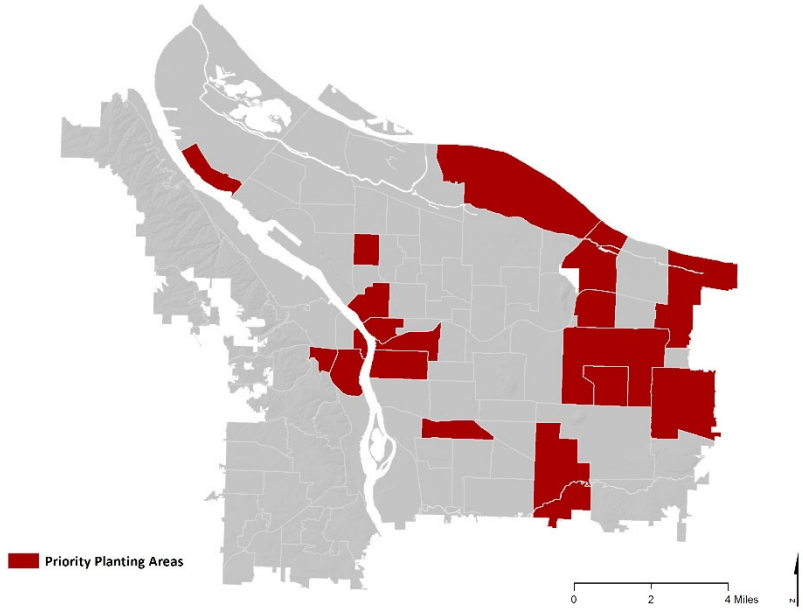


Figure 4. Priority planting areas. Portland Parks & Recreation prioritizes tree planting in neighborhoods where a high percentage of low-income residents live and where canopy is lowest. (PP&R 2018).



There is a high correlation between tree canopy and income in Portland: higher income neighborhoods have more tree canopy. In a recent Portland State University study, households with the top 20% highest incomes have on average 20% more canopy than those in the lowest 20% of incomes (Voelkel 2017). East Portland's low-canopy neighborhoods also represent the City of Portland's highest percentage of communities of color, immigrant, and refugee communities. Reasons for the current inequitable distribution of Portland's trees include the process and timing of annexation, lack of public investment, development, and other historic factors. The inequitable distribution of canopy is not a Portland specific problem. Throughout the United States cities are recognizing disparities in tree canopy as an important environmental justice issue (Schwarz et. al 2015). Reasons for this inequity go beyond the simple answer of having income available to plant and care for trees.

Portland Parks & Recreation is committed addressing historic inequities as we work to expand the city's urban forest. This commitment is supported by the city's *Urban Forest Management Plan* (2004) which sets a goal of providing equitable urban forest benefits for all residents. Additionally, providing equitable city services to all residents and increasing access to trees and urban forest services for communities of color, low-income, refugee, and immigrant communities is an objective of Portland Parks & Recreation's *Five-year Racial Equity Plan* (2017).

THE CHALLENGE: INCREASING CANOPY WITHOUT BURDENING VULNERABLE COMMUNITIES

A conventional approach to growing canopy would be for the city to simply plant more trees in low-canopy areas. However, planting a tree is only the first of many steps in growing tree canopy. A new tree must be watered for several years, pruned when young to develop good structure, and cared for over its long lifespan. Generally, these costs are all absorbed by property owners, although the city has some programs for planting and establishing right-of-way trees and to a lesser extent private property trees. Planting trees without planning for establishment and care can result in unexpected costs for property owners and diminish the likelihood that the tree will stay healthy and grow to maturity, negating the significant investment made in its planting.

For tree planting efforts to be successful, communities must have the resources and support to care for trees, and they must value and desire trees. Without this capacity and willingness, canopy expansion efforts are likely to be unsuccessful. Growing the urban forest -- equitably -- first requires a better understanding of the concerns and needs of communities around trees and planting.

Methods

APPROACH

Due to the high correlation between income and tree canopy, many historically underserved communities are also present in low-income, low-canopy areas of Portland. This creates a significant opportunity to increase tree canopy in critical areas of the city while also improving mental and physical health outcomes for people of color, immigrants, and refugees.

To achieve that outcome, this project needed to focus on understanding the barriers and opportunities that trees pose to low-income community members by directly engaging them in conversations about trees. This report provides recommendations to the City of Portland for increasing the equitable distribution of tree canopy in the city based on those conversations. The primary audience for this report is city staff, tree planting organizations, city contractors, and policy makers.

Extensive outreach and community engagement was conducted to ensure that we heard directly from community members living in low-canopy areas. Community engagement strategies included focus groups, stakeholder meetings, and working with a Community Advisory Committee to ensure significant representation from people of color, immigrant, refugee, and low-income communities.

In addition to community perspectives, the project sought perspectives from municipal and nonprofit professionals in the fields of urban forestry, environmental services, transportation, and others. City plans and reports from Portland and other cities were also reviewed.

Portland Parks & Recreation retained two consultants to assist with this project. Portland State University's (PSU) Sustaining Urban Places Research Lab completed a public survey and stakeholder interviews; developed a planting tool, an interactive database that uses tree canopy measures and socio-economic data to identify priority planting areas; and conducted a review of the City of Portland *Urban Forestry Management Plan* regarding management of tree canopy. A final report from PSU is included as Attachment A and includes details on their findings. PKS International, as part of the city's Community Engagement Liaison program, assisted with focus groups.

Project components are described below.

DEFINING PRIORITY PLANTING AREAS

Priority planting areas were identified in order to focus community engagement efforts. These are neighborhoods with where a high percentage of low-income residents live and where canopy is lowest. Community members in these areas are likely to be most impacted by any outcome of this project, thus their input was vital in developing recommendations.

Low-income was defined as neighborhoods where greater than 50% of households make at or below 80% of the median family income using American Community Survey data (ACS 2015). Low-canopy was defined as an area with less than 25% tree canopy coverage (Metro 2016).

COMMUNITY ENGAGEMENT

Community Advisory Committee: A Community Advisory Committee (CAC) was created to review project outcomes and recommendations. Thirteen community members were selected to participate on the committee. The committee included people of color, immigrants, refugees, and residents from low-income, low-canopy communities. The CAC met five times from May through November 2017. Their

work included: identifying barriers to tree planting for communities of color, low-income, refugee, and immigrant communities; providing recommendations on how to best work with communities to plant trees and gain community support; reviewing city bureau priorities around tree planting; and reviewing the planting tool for selecting tree planting sites.

Culturally-specific focus groups: Five culturally-specific focus groups were conducted in July and August 2017. Focus group demographics were determined based on population density in priority planting areas and included the African, Bhutanese, Latino, Slavic, and Vietnamese communities. Focus groups were identified as a preferred strategy to ensure that perspectives from immigrant and refugees were significantly represented throughout the project. Portland Parks & Recreation contracted with Community Engagement Liaisons (CELs) to arrange the focus groups and recruit participants. Trained civic activists, CELs are fluent in their native language(s) and in English and they assist city government with interpretation, engagement, and understanding the needs of their communities. Community Engagement Liaisons sought participants based on several criteria – they lived in the priority planting areas, included a mix of renters and home owners, and were diverse in age and gender. Groups consisted of eight to sixteen participants. PP&R Community Engagement staff and CELs jointly conducted the focus groups, which ran two and a half hours and were conducted in the participants' native language and English. The primary goal of the focus groups was for participants to communicate barriers and opportunities to tree planting for their communities.

Public survey: Portland State University administered a public survey from May through July 2017 to 3,000 respondents. The survey assessed perceptions and level of interest in trees, understanding of city and resident responsibility for tree maintenance, preferred locations for tree planting, and barriers and opportunities to tree planting. The survey was distributed via social media outlets (NextDoor, Facebook, Twitter), Parks' mailing lists, tabling, and the Community Advisory Committee. The survey was available in English, Spanish, and Vietnamese.

TECHNICAL EXPERTISE

Stakeholder Interviews: PSU conducted 13 interviews with city bureaus, public agencies, and nonprofit organizations engaged in tree planting and/or community engagement. Interviews were conducted with both management, responsible for policy and budget, and field staff, responsible for implementation. Questions solicited input from participants on preferred locations for tree planting, barriers to planting and maintenance, opportunities for engaging underserved residents, and their overall perspective on Portland's urban forest management.

Plan review and research: PSU reviewed Portland's *Urban Forest Management Plan*, canopy targets, and city plans addressing tree canopy. Portland's plans and policies were compared to five other cities of similar size.

TOOL DEVELOPMENT

Planting Tool Development: To identify areas of the city where tree planting may have the biggest impact in addressing canopy inequities, PSU developed an online planting tool. The tool uses social and environmental factors to prioritize and identify planting opportunities, by both census block group and individual tax lot.

Findings

Findings are summarized according to community perspectives on trees and tree planting; barriers to tree planting for people of color, immigrant, refugee, and low-income communities; opportunities for engaging the communities identified above in tree planting; and technical expertise regarding trees and tree planting. The planting tool is also described. More detailed findings are available in Appendix A.

COMMUNITY PERSPECTIVES ON TREES AND TREE PLANTING

Approximately 3,000 respondents completed the PSU survey. Respondent demographics were generally consistent with overall city demographics - 71% of respondents identified as white and 29% identified as people of color. The survey received more responses from property owners and above-median income respondents. More detailed information is available in Appendix A. Key findings from the survey are summarized below.

Trees are important to Portlanders

- 98% of respondents either strongly agree or agree that Portland's trees are important.
- 86% of respondents have trees at their property either because they desire them, or because trees were already planted at the property.
- Almost one-third of respondents who do not have trees at their residence report not having them because they are not the property owner and lack the decision-making authority to plant them.
- Not all respondents believe their neighborhood has enough trees: 47% believe their neighborhood has enough trees, while 43% of respondents do not believe their neighborhood has enough trees.

Residents favor an active role for the city in maintenance and planting

- 67% of respondents believe the city should maintain street trees in the right-of-way.
- 74% of respondents believe the city should prioritize street tree maintenance in lower-income areas.
- One of the most common responses to the open-ended question, "How should the city increase tree canopy?" was the city should offer free or reduced-cost maintenance.

Residents identify preferences for city planting

- Respondents identified the following as the highest priority factors to consider when planting trees: where the fewest trees are located; where air quality is the worst; and where more concrete and pavement exist.
- Right-of-way ranked as the top location to plant trees, followed by yards and parks.

A statistical analysis of demographics, income, property ownership, and zip code reveal a diversity of opinions around trees

- Overall, respondents who identified as white and respondents of color may have different opinions about trees in the city. Respondents who identified as white were slightly more likely to agree that

trees are important, favor the city planting in all available spaces along the streets, and prioritize planting in lower-income areas.

- There was some correlation between geographic area and attitudes about trees. Respondents who live west of 82nd Avenue indicated greater likelihood to believe their neighborhood has enough trees and that those trees are in good condition and healthy than respondents living east of 82nd Ave.

- Respondents who identified as renters were more likely to agree that the city should plant trees in all available spaces along the street. Respondents who identified as renters indicated a preference for trees. They demonstrated a high level of consistency in their concern that they were not able to plant, maintain, or support canopy expansion due to their inability (perceived or real) to affect change on the property. These responses highlight an opportunity to distinguish tree planting messaging between renters and property owners.

BARRIERS TO TREE PLANTING FOR COMMUNITIES OF COLOR, LOW-INCOME, IMMIGRANT, AND REFUGEE COMMUNITIES

Determining barriers to tree planting for communities of color, low-income, immigrant, and refugee communities was a primary objective of this project. Focus group and Community Advisory Committee members identified a wide variety of barriers, from which six major themes were identified. Each theme is described below.

Varying cultural values and relationship with trees

Educational information on local tree issues does not reach a wide variety of community members. Participants were unfamiliar with programs and organizations that plant trees, such as Portland Parks & Recreation, Bureau of Environmental Services, and Friends of Trees; therefore, these communities were unfamiliar with how to access resources for planting or caring for trees. While many immigrant and refugee community members felt connected to and knowledgeable about the trees from their home countries, they felt disconnected to trees in Portland. Few people knew or understood how Portland's right-of-way trees are managed, or how trees are planted, cared for, and regulated in Portland.

Overall, participants highly valued trees and showed interest in continuing education by PP&R Urban Forestry to learn more about the benefits of local trees.

Competing priorities and limited resources

Many participants expressed that while they value trees, they have a limited amount of time and money to plant or care for them. Limited resources are prioritized for necessities such as rent, food, bills, transportation, and education.

Fears and concerns

Concerns over a tree's potential physical impact, such as sidewalk damage, tree failure, and interference with power lines was identified as a common barrier to planting trees. Additionally, the added burden of costs, such as the expense to purchase a tree, ongoing maintenance, and repairs for damage caused by trees were mentioned. Participants who identified as renters discussed fears of eviction if asking or advocating for more trees. Both participants who identified as renters and property owners cited fear of gentrification from investing in planting trees as a threat to their property ownership or cost and ability to rent.

Cost

Cost of the initial purchase of trees and tree supplies are barriers, as are costs for watering, pest control, and leaf clean up. Property owners were concerned about increased property taxes if trees increase property value.

Disempowerment of renters

Renters discussed not being given the decision-making power to plant or care for trees. This was complicated by the aforementioned fear of eviction by asking or advocating for trees. Also, renting is often temporary, and renters did not see the value in the long-term investment required to plant and care for trees.

Governments need to shift towards authentic engagement

Many communities of color, immigrants, and refugees expressed having personal or historic lack of trust with government agencies and nonprofits, either in their home country or in the United States. Without trust or relationships with city bureaus or nonprofits planting trees, participants said they were not likely to participate. Common outreach methods, such as door-to-door canvassing, were viewed as suspicious and less effective than learning about opportunities through an already known and trusted source. For immigrant and refugee communities, language was an additional barrier to accessing information on trees that was not developed with them in mind.

OPPORTUNITIES FOR ENGAGING UNDERSERVED COMMUNITIES IN TREE PLANTING

Focus group and Community Advisory Committee members identified many opportunities to engage and encourage tree planting with communities of color, low-income, immigrant, and refugee communities. Opportunities are arranged into eight major themes described below.

Conduct culturally- and linguistically-specific educational workshops and events

Participants recommended offering regular educational workshops to discuss, share information on trees, and gain community support with specific cultural communities. Topics suggested included: demystifying fears, understanding local trees and plants, tree care and tree planting, the importance and benefits of trees, and education about tree code and policy. These workshops should introduce participants to city and nonprofit resources and encourage their participation. Many suggested a format similar to that used in focus groups, which included both information sharing and discussion.

Use culturally-specific outreach strategies

Participants stressed that outreach and community engagement strategies must be tailored to their communities in order to be successful. Many recommended hiring leaders from their communities to conduct direct outreach or going through an established organization that is trusted in their community. Each focus group recommended culturally-specific outreach methods, such as Russian radio, Spanish language newspapers, and word of mouth. Language was an important factor, and it was recommended to conduct outreach and events in the language best for the community. Location of events was also important, and many participants recommended working where the community lives and gathers as well as participating in their community events.

Provide translation

Translating materials into multiple languages was highly recommended. Participants noted that translated materials must be shared strategically through appropriate outlets, such as via community leaders, by word of mouth, through culturally-specific organizations, and through language specific media outlets.

Volunteer programs

Many participants were not aware of existing volunteer and tree planting programs, but thought that the concept was positive and could be used to connect and build relationships with their communities, especially if they involved youth. Participants recommended adapting existing programs to work with schools, churches, temples, nonprofits, or businesses that serve their specific communities.

Funding solutions to alleviate cost barriers

Participants suggested many opportunities to reduce the financial burden of planting and caring for trees. City-funded maintenance for low-income families, incentives such as utility subsidies, free trees, and free tools were top suggestions.

Job creation

Participants were generally unaware of employment opportunities in tree planting or related fields. They were interested in ideas around apprenticeships and contracting. Participants expressed that hiring their community members would not only improve their economic situation, but would build relationships, increase trust, and create tree champions in their communities.

Advocate for trees at rental properties

Many renters discussed fearing consequences for advocating or asking for trees at their rental properties, and suggested that city program staff take on this role. Participants suggested offering incentives for property owners to plant trees.

Build Trust

Participants recommended building trust through investment in long-term relationships with communities. Other ideas included creating a permanent community group such as the Community Advisory Committee for problem solving and shifting costs of tree maintenance away from low-income community members.

TECHNICAL PERSPECTIVES ON TREES AND TREE PLANTING

Interviews with public agencies and nonprofits provided additional perspectives on barriers and opportunities to equitable expansion of tree canopy. Findings presented below are generally focused on community outreach. More detailed information on interviews is presented in Appendix A. When interviewees addressed equity in tree planting, four themes emerged about equitable approaches including cultural value and messaging, language barriers, tree maintenance responsibility and city-governance structure.

Value and Messaging

An understanding of the value and messaging of trees is key to equitable canopy expansion. Educating residents on the benefits of trees, such as how trees manage stormwater and reduce heating and cooling costs, is needed but the interviewees indicated their perception that standard environmental benefits messaging does not resonate with some communities. A one-size-fits-all tree approach will not work to

meet the needs of all communities. Interview results suggest using multiple approaches to build community-specific value for trees. Many interviewees also believed that celebrating trees was a way to build value. Relevant takeaways include:

- Tree education should begin with building cultural value, not on regulatory requirements.
- There may be a disconnect between technical framing of the importance of trees and community interests. For example, technical experts may focus on ecosystem benefits and stormwater management while residents may focus on benefits such as beauty and shade.
- For some residents, the desire to have a tree and care for it begins with the celebration of trees.
- For some residents, trees are at the center of building relationships and community through the shared use of public spaces, such as parks.

Additionally, some interviewees expressed barriers in messaging to culturally-specific communities, and how one-size-fits-all outreach and engagement may hinder expansion of trees into low-canopy and low-income neighborhoods. Engaging immigrant communities, for example, suggests a need for integrating multiple languages, cultures, and approaches to understanding the role of trees in the city. Relevant takeaways include:

- Because tree species are regional, immigrants and refugees may not be familiar with the local trees and plants that grow in Portland, their uses, or their benefits.
- Involvement in tree programs by historically underserved groups should be made accessible by tailoring the importance of trees to the specific community's way of valuing trees.
- Messaging should include culturally-specific ways for how trees specifically benefit the individual and the community.

Language Barriers

Language barriers present challenges to effective community outreach, further emphasizing the need for specific community-focused strategies for tree planting efforts. Relevant takeaways include:

- Some communities are distrustful of government, and therefore, hesitate to participate during outreach efforts for tree planting programs.
- Understanding verbal and written English is a barrier for communities to actively participate, whether in person, at public meetings, or when receiving printed materials.
- Special care should be taken with interpretation to ensure that values and cultural cues are reflected in the messages presented to communities.

Tree Maintenance Responsibility

Tree maintenance responsibility in low-income areas can hinder an individual's desire to plant a tree, and this was recognized by technical stakeholders. The interviews provide insight into the challenges they perceive that culturally specific community members may have in caring for trees, and offer solutions to solve the maintenance barrier. Relevant takeaways include:

- The cost to purchase a tree, as well as the time it takes to care and maintain a tree, are harder on lower-income residents, creating barriers to participating in tree planting.
- Finding solutions to lower costs will be beneficial to reaching those most in need, and to meeting long-term tree planting goals.

City Governance Structure

Ensuring that equitable tree planting remains a priority entails changing the organizational framework of governance, by inviting historically underserved groups to have a continuous voice in tree planting decisions. Inviting people to the table may not be sufficient. Engaging historically underserved communities by providing opportunities for involvement and building trust with groups who have not held good relationships with government in the past is essential. Relevant takeaways include:

- Long-term success in equitable tree planting includes representation of historically underserved communities in positions of influence and power, and utilizing their skills and ideas during decision-making.
- Building relationships with historically underserved communities takes time, requires actively listening to the desires and needs of those who have been left out of conversations in the past, and should be a continuous effort (not project-based).

The role the city plays in engaging the public on the value of trees, particularly those who have not historically been a part of tree planting campaigns, is an opportunity to work together to meet planting goals. By addressing key issues--maintenance responsibility, language barriers, and the structure of government--the results from community outreach have the ability to address equity concerns around tree planting, and therefore, allows for learning from past mistakes, and creation of equity goals for future planting.

PLANTING TOOL DEVELOPMENT: WWW.BRANCHOUTPDX.ORG

Portland State University developed a web-based planting tool to identify areas that would benefit the most from tree planting. The tool is intended for use by the public and organizations planting trees. The website includes an instructional video on how to use the tool.

The planting tool uses both social and environmental data sets. The base map is the amount of canopy. Users prioritize factors of importance via a series of filters. Two scales are used: census block group and parcel.

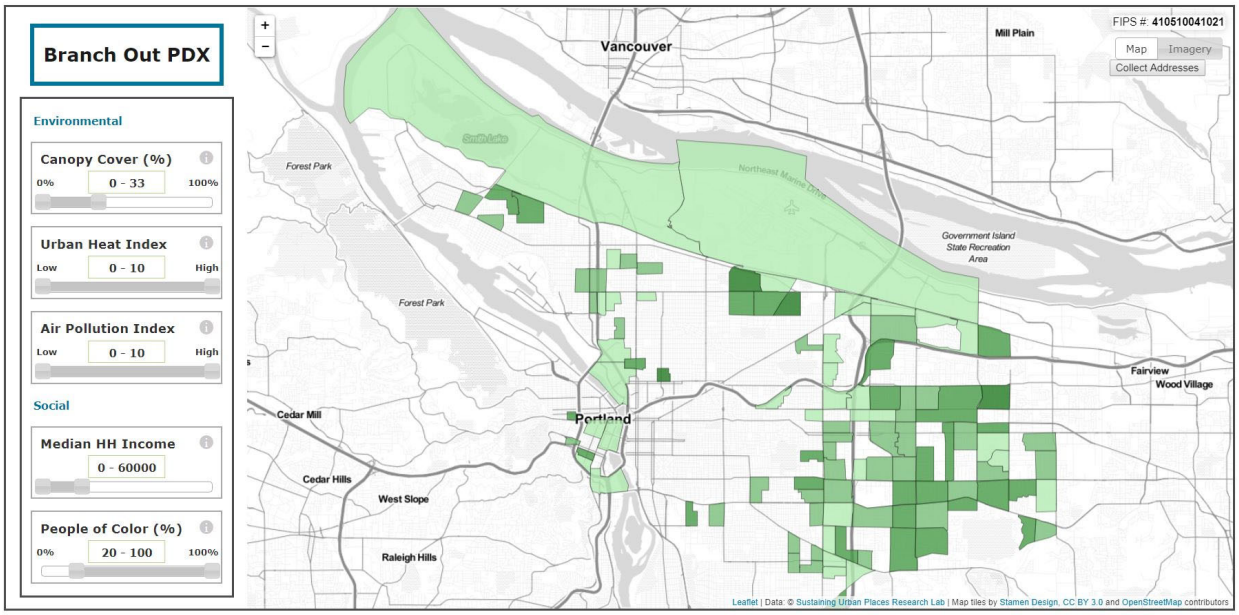
The home screen of the planting tool is at the census block group level, which contain approximately 1500 residents. Block groups are shaded green to represent tree cover, with darker areas having more canopy and lighter areas having less. Filters on the left are divided into the following environmental and social categories:

Environmental

- Canopy cover: Percent of the census block under tree canopy (Metro 2016).
- Urban Heat Index: Urban heat island effect as determined by PSU (Voelkel and Shandas 2017).
- Air Pollution Index: Nitrogen dioxide concentrations (Rao et al. 2014).

Social

- Median household income: as reported by the American Community Survey (2015).
- People of color (%): People who do not identify as 'white' as a percent of total block group population, as reported by the American Community Survey (2015).



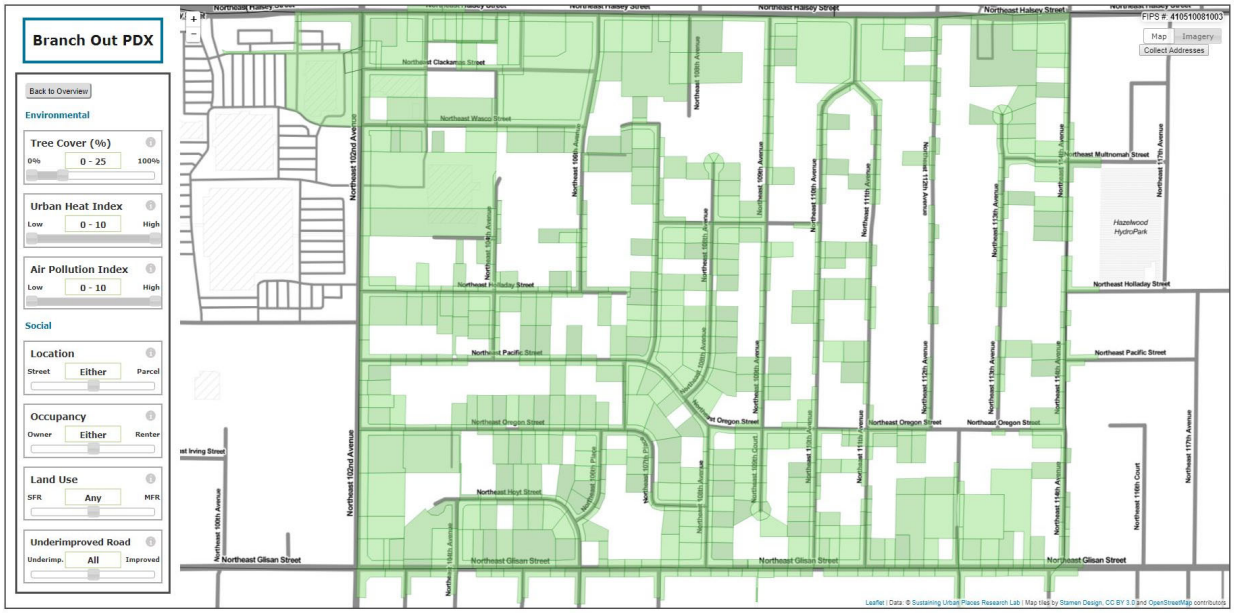
The first map view of the planting tool allows users to filter for environmental and social factors using census block group level data. In this example, the map is filtered for lower canopy cover, lower income, and higher percentage people of color.

From the first block group screen, the user can click on one or more block groups to zoom into a parcel level map. On the parcel level map, both parcels and adjacent right-of-way are shaded different colors of green to represent canopy. Filters on the left are still divided into environmental and social categories. The environmental categories are the same as the previous screen, but the social categories change to represent parcel level data:

Social

- Location: Street (right-of-way), parcel, or either.
- Occupancy: Owner, renter, or either (PortlandMaps 2018).
- Land use: Single family residential, multifamily residential, or all (PortlandMaps 2018).
- Underimproved road: Underimproved, improved, or all.

Clicking on an individual parcel or right-of-way reveals details, including percent canopy cover, site address, and owner information. A link to Google Maps opens a different view of the site. Upon final selection, data on all highlighted parcels can be downloaded via the “Collect Addresses” button.



The second map view provides more details on individual sites. Clicking on an individual parcel or right-of-way reveals details, including percent canopy cover, site address, and owner information that can be exported using the"Collect Addresses" button.

Recommendations

Below is list of recommended actions to improve the equitable distribution of tree canopy based on project findings. Each recommendation section includes a summary of implementation efforts to date. Because equitable distribution of trees has been a goal for Portland for many years, there is already much positive, ongoing work towards implementation to highlight.

Implementing all of the recommendations in this report will require continued funding, commitment, and collaboration from the multiple bureaus and organizations that plant trees in the city. Portland's current tree code and current resource levels are constraints for implementation. For example, right-of-way tree maintenance is currently unfunded and is assigned the adjacent property owner by Title 11.

An implementation update will be published in 2019.

Draft recommendations and the report were made available to the Community Advisory Committee, the Urban Forestry Commission, Portland Parks & Recreation (PP&R), Bureau of Environmental Services (BES), other city bureaus, and Friends of Trees (FOT) for review.

Recommendations for improving the equitable distribution of canopy in Portland:

1. FUND PLANTING AND MAINTENANCE IN PRIORITY PLANTING AREAS

- Fund and plant trees in the right-of-way, yards, parks, and schools to reduce financial barriers.
- Increase planting efforts focusing on rental properties and advocate for tenants who want trees.
- Provide varied, multiple opportunities for tree planting that minimize barriers to participation.
- Pursue funding right-of-way tree maintenance to reduce financial burdens, encourage tree planting, and build trust with historically underserved communities.

Implementation efforts:

- City-sponsored programs currently plant or fund thousands of trees annually through multiple programs. In 2017, this included approximately: 8,200 park and natural area trees; 2,800 street trees; 1,100 yard trees; and 75 school trees. Most city-sponsored programs have goals to reach priority planting areas and trees are available at low or no cost to participants. Some programs include watering, mulching, and structural pruning. *Status: ongoing.*
- Currently, all city-sponsored right-of-way tree planting programs are "opt-in," which requires the property owner to request and give permission to plant. This is especially challenging for multi-family and rental properties, which have low rates of participation. Portland Parks & Recreation is exploring an alternative "opt-out" program that would allow the city to give notice of planting and require no action by the property owner, except to choose to opt out of the planting. *Status: under development.*
- Portland City Council has directed the formation of an interbureau Street Tree Task Force to examine Portland's options for city-funded street tree maintenance, rather than the current policy

of assigning this responsibility to the adjacent property owner. The task force will present options to Council for the city to take on street tree maintenance. *Status: planned for 2018-2019.*

- UF, BES, and FOT stewardship programs, including the Community Tree Care program, provided free structural pruning for property owners of approximately 1600 young street trees. *Status: ongoing.*
- City sponsored planting programs are shifting program delivery locations towards priority planting areas. PP&R's yard, park, and school plantings are focused in priority planting areas that are both low-canopy and low-income. FOT, through a contract with BES, conducts 75% of their planting, outreach, and pruning in areas that meet one of the following criteria: low-canopy, low-income, or racially diverse communities. *Status: ongoing.*

2. CONDUCT CULTURALLY-SPECIFIC OUTREACH AND EDUCATION FOR COMMUNITIES OF COLOR, IMMIGRANT, AND REFUGEE COMMUNITIES

- Conduct culturally-specific outreach and education on trees addressing benefits, myths, planting, tree care, involvement opportunities, permitting, and local issues.
- Train and hire leaders in culturally-specific communities to engage with those communities and conduct outreach and education on trees and tree planting.
- Locate and deliver outreach and education programs where key communities live and work; engage communities at their events and institutions.
- Conduct events in the language most appropriate for a community, translate materials, and distribute materials strategically through appropriate outlets.
- Review and retool existing volunteer, outreach, and education programs to ensure accessibility and appeal to communities of color, immigrant, and refugee communities.
- Provide incentives to participation in outreach and education events, such as childcare, meals, and transportation vouchers.
- Partner with schools in priority planting areas to plant trees with youth.

Implementation efforts:

- Portland Parks & Recreation conducts ongoing outreach, education, and volunteer programs. Current programming is under review to incorporate the recommendations above. This includes an evaluation of volunteer recruitment and training, programming content, the annual Arbor Day celebration, and methods used for outreach. *Status: review ongoing in 2018.*
- Portland Parks & Recreation publishes multiple outreach and education materials, with some critical documents translated into multiple languages. Portland Parks & Recreation maintains a published phone line for requesting translation. Portland Parks & Recreation is exploring opportunities for delivering programming in languages other than English. *Status: under evaluation.*

- Portland Parks & Recreation partners with schools to plant approximately 100 trees a year with students through its Learning Landscapes program. Two-thirds of participating schools are in priority planting areas. *Status: ongoing.*
- Through the Jade Greening Coalition, PP&R, BES, and FOT collaborated with other partners to produce a multi-lingual, informational tree tag to educate Jade residents and passersby about the air purifying and community building services that trees provide. *Status: completed.*
- The BES contract with FOT contains funding for community benefit organizations to help FOT better serve communities that have been traditionally under-served. *Status: ongoing.*
- Through a contract with BES, FOT canvassers visit over 90,000 properties each year to offer trees. FOT endeavors to match the ethnicity and language skills of the canvasser to the area canvassed where possible. *Status: ongoing.*
- PP&R, BES, and FOT staff and volunteers table at culturally-specific community events each year. *Status: ongoing.*
- BES partners with Confluence Environmental Center to host an AmeriCorps service member whose role is to build and deepen relationships and proactively engage with underrepresented communities, including a partnership with People.Places.Things to teach English language learners about stormwater, trees, and other green infrastructure. *Status: ongoing.*

3. DEVELOP PARTNERSHIPS AND BUILD RELATIONSHIPS

- Partner and contract with culturally-specific organizations for planting, tree care, education, outreach, and job training.
- Invest in long-term relationships and trust building with leaders of culturally-specific organizations, such as nonprofits, businesses, and faith communities.
- Collaborate with city bureaus and residents to identify planting opportunities in priority planting areas, such as excess right-of-way, affordable housing, parks, and others.

Implementation efforts:

- Portland Parks & Recreation is piloting an Arborist Trainee program. The trainee program includes collaborating with community-based organizations who serve communities of color and refugee and immigrant communities, labor partners, and Urban Forestry to create an apprenticeship program. *Status: pending budget approval.*
- Through a contract with BES, FOT held focus groups and distributed surveys to improve service delivery to the Hispanic community. This work serves as a pilot for future efforts with other communities. *Status: completed.*
- Through a contract with BES, FOT is developing relationships with community benefit organizations that serve specific communities in Portland (e.g., APANO, Wisdom of the Elders, Teatro Milagro) to increase the reach and cultural relevancy of FOT's services and serve more residents more meaningfully. *Status: ongoing*

- BES, FOT, and PP&R, are working alongside APANO and other community partners on tree planting, outreach, and education in the Jade District of East Portland as part of the Jade Greening Coalition. *Status: ongoing*
- Over the past ten years, PP&R and BES have built relationships with neighborhood groups such as business districts, tree teams, tree advocates, school districts, ODOT, Home Forward, Depave, and various City of Portland bureaus and teams with tree planting needs and interests. *Status: ongoing*

4. PLANNING AND MANAGEMENT

- Promote use of the planting tool to focus planting efforts on priority planting areas.
- Establish a protocol for defining and updating priority planting areas using the best available data.
- Review and update existing canopy targets in updates to the *Urban Forest Management Plan*.
- Based on canopy targets, develop specific planting targets and timelines in updates to the *Urban Forest Management Plan*.
- Collaborate with city bureaus to avoid conflicts between tree planting and future development in underimproved rights-of-way.
- Improve communication and collaboration among city bureaus and partners involved in tree planting to improve effectiveness and minimize redundancies.

Implementation efforts:

- The planting tool is currently being used by PP&R for outreach to priority areas for free yard trees. Promotion of the planting tool via announcements to key users are planned for 2018. *Status: planned for 2018.*
- Portland Parks & Recreation recently updated priority services areas and defined the protocol for updating on a three-year cycle. *Status: completed*
- The *Urban Forest Management Plan* is updated approximately every ten years. The next update is planned to begin in 2019, pending budget approval. A review of canopy goals and tree planting targets will be recommended for inclusion in the update. *Status: planned to begin in 2019*

5. MONITOR AND ASSESS PLANTING EFFORTS IN PRIORITY SERVICE AREAS

- Track and evaluate tree planting and participant demographics to determine if trees are being planted in low-income, low-canopy areas.
- Monitor health and survival of trees planted to determine if tree plantings are successful and to inform future management approaches.

Implementation efforts:

- Portland Parks & Recreation tracks planting locations and participant demographics for its planting programs. A current project is underway to determine how much planting over the past five years has occurred in priority planting areas. *Status: in process.*
- Portland Parks & Recreation implemented a monitoring protocol in 2018 for its tree planting in yards, parks, and schools. *Status: ongoing.*
- BES supports Friends of Trees' Summer Inspector program, which monitors young tree survival and health. *Status: ongoing.*

References

American Community Survey. 2015. 2015 Data Release. https://www.census.gov/programs-surveys/acs/news/data-releases.html

American Community Survey. 2016. 2016 Data Release. https://www.census.gov/programs-surveys/acs/news/data-releases.html

Bureau of Planning and Sustainability. 2015. Climate Action Plan. http://www.portlandoregon.gov/bps/article/531984

Bureau of Planning and Sustainability. 2012. The Portland Plan. http://www.portlandonline.com/portlandplan/index.cfm?c=58776

Bureau of Planning and Sustainability. 2016. 2035 Comprehensive Plan. https://www.portlandoregon.gov/bps/2035-comp-plan.pdf

Bureau of Planning and Sustainability. 2016. Attendance of limited English Proficiency (LEP) Students. https://www.portlandmaps.com/arcgis/rest/services/Public/COP_OpenData/MapServer/119

Metro. 2016. Canopy 2014. http://rlisdiscovery.oregonmetro.gov/?action=viewDetail&layerID=3552#

Office of Community and Civic Life. 2010. 2010 Census Data for Portland Neighborhoods. https://www.portlandoregon.gov/civic/56506.

Portland Maps. 2018. https://www.portlandmaps.com/

Portland Parks & Recreation. 2004. Urban Forest Management Plan. http://www.portlandoregon.gov/parks/38306?a=184641

Portland Parks & Recreation. 2007. Urban Forest Action Plan. http://www.portlandoregon.gov/parks/article/226238

Portland Parks & Recreation. 2017. Five-year Racial Equity Plan. https://www.portlandoregon.gov/parks/article/623289

Portland Parks & Recreation. 2017. Tree Canopy Monitoring: Protocol and Monitoring from 2000-2015. https://www.portlandoregon.gov/parks/article/684077

Portland Parks & Recreation. 2018. Tree Canopy and Potential in Portland, Oregon. https://www.portlandoregon.gov/parks/article/674593

Portland Parks & Recreation. 2018. Methods for classifying low income and low canopy neighborhoods.

Rao, Meenakshi, Linda A. George, Todd N. Rosenstiel, Vivek Shandas, and Alexis Dinnoc. 2014. Assessing the relationship among urban trees, nitrogen dioxide, and respiratory health. Environmental Pollution Volume 194, November 2014, Pages 96-104. https://www.sciencedirect.com/science/article/pii/S0269749114003030

Schwarz, Kirsten, Michail Fragkias, Christopher G. Boone, Weiqi Zhou, Melissa McHale, J. Morgan Grove, Jarlath O'Neil-Dunne, Joseph P. McFadden, Geoffrey L. Buckley, Dan Childers, Laura Ogden,

Stephanie Pincetl, Diane Pataki, Ali Whitmer, and Mary L. Cadenasso. 2015. Trees Grow on Money: Urban Tree Canopy Cover and Environmental Justice. https://doi.org/10.1371/journal.pone.0122051

Voelkel, Jackson. 2017. Canopy Analysis: CBG. https://climatecope.research.pdx.edu/income/

Voelkel, Jackson, and Vivek Shandas. 2017. Towards Systematic Prediction of Urban Heat Islands: Grounding Measurements, Assessing Modeling Techniques. Climate 2017, 5(2). http://www.mdpi.com/2225-1154/5/2/41

Appendix A:
Citywide Tree Planting Report by Portland State University

CITYWIDE TREE PLANTING REPORT

A collaboration between
Portland Parks & Recreation Urban Forestry and
Portland State University's
Sustaining Urban Places Research Lab

STUDY AND REPORT BY:

Vivek Shandas, Professor, Toulan School of Urban Studies and Planning, Portland State University

Kara Boden, Research Assistant, Toulan School of Urban Studies and Planning, Portland State University

Jackson Voelkel, Research Assistant, Toulan School of Urban Studies and Planning, Portland State University

Winter 2017

Portland State UNIVERSITY

PORTLAND PARKS & RECREATION℠
Healthy Parks, Healthy Portland

TABLE OF CONTENTS

EXECUTIVE SUMMARY **3**

INTRODUCTION **5**

STATE OF PORTLAND'S URBAN FOREST **6**

OUTREACH **9**

COMMUNITY PERSPECTIVE OF PORTLAND'S URBAN FOREST *9*

PROFESSIONAL PERSPECTIVE OF PORTLAND'S URBAN FOREST *12*

ONLINE TREE PLANTING TOOL **16**

CONTEXTUALIZING PORTLAND'S URBAN FOREST **17**

RECOMMENDATIONS **21**

FINAL THOUGHTS **23**

APPENDIX **24**

APPENDIX A: COMMUNITY SURVEY *24*

APPENDIX B: INTERVIEWS *48*

APPENDIX C: TREE PLANTING TOOL *52*

APPENDIX D: POLICY REVIEW *57*

APPENDIX E: WEBSITE *57*

EXECUTIVE SUMMARY

The purpose of this report is to describe stakeholder perspectives of trees in the City of Portland, and offer an online mapping tool for identifying potential locations that address the current inequities in tree canopy. Over the course of one year, the research team in the Sustaining Urban Places Research (SUPR) Lab at Portland State University conducted a series of interviews with multiple city bureaus, engaged the general public through a survey of community members, and developed an online mapping tool. Together these elements provide timely and comprehensive perspective of those physical and social conditions that enable the expansion of the tree canopy within the City.

The findings suggest several opportunities and challenges that will support or potentially hinder the ability for the City and/or community groups to expand tree canopy. Notable among the findings from public agencies is a consistent recognition that expanding tree canopy will require support in the form of maintaining newly established trees. In fact, these stakeholders suggest that without sufficient support, in the form of financial incentives, and/or technical and labor support, expanding the tree canopy into areas currently deficient will only exacerbate existing inequities. Additionally, public agencies indicated that a lack of clarity about the implementation of the recently adopted Tree Code (Title 11) creates several challenges among agencies when considering land use proposals. One such challenge is how best to manage the right-of-way, which is a highly contentious public area of the city, in which adjacent property owners and multiple city agencies negotiate for management and space. Finally, public agency staff were generally clear that developing culturally-specific outreach strategies will be important when engaging communities, especially those in the eastside of the City.

Outreach through surveys also provided insights into the needs and opportunities for the general public. Unlike the interviews with agency staff, survey results identified specific locations and qualities of outreach that would help to expand tree canopy. Among these, the survey results indicated that respondents were generally favorable to expanding tree canopy among low-income and low-canopy areas of the City, though areas with degraded air quality and extensive pavement were further identified as the most important physical considerations. The survey results did diverge in terms of the socio-demographics, specifically with renters highly supporting trees in the public right-of-way and maintenance support by the City – these patterns were not as consistent among owners. Those respondents identifying as white were also more likely to indicate that city trees are important, while non-white respondents indicated that their neighborhoods had enough trees. These findings corroborate public agency staff concerns that many communities, especially

those with limited English language ability and those identifying as non-White may be less receptive of accepting trees in their neighborhood.

These results suggest a need for broad engagement among communities that are not currently engaged with city tree planting efforts. Indeed, one of the major findings of this report is that expanding tree canopy will require culturally specific engagement, distinguishing between right-of-way versus private trees, and the creation of a maintenance program to support low income households and neighborhoods. Education and outreach in the form of trainings, discussions, and neighborhood planning will be equally important when considering trees in historically underserved parts of the City. A related outreach strategy is to identify financial, technical, and labor support for communities to take care of newly established trees. Engaging with 'non-traditional' community partners, for example, will require a clear and diverse set of options for addressing questions of support. If effective, engagement efforts will provide opportunities to visualize specific locations for planting trees in neighborhood, which is possible through the online planting tool created by the present project. Another strategy, though mostly administrative, is to link tree planting efforts with ongoing plans and planning efforts. After the promulgation of Title 11, almost all city plans interact, in one way or another, with the urban forest. Most notable are the *2035 Comprehensive Plan*, which includes urban infill and multi-family rezoning, and the *Climate Action Plan* – both of these plans have elements that can modify the urban forest, and finding those intersections on a case-by-case basis can help to reduce unwanted removal of trees or the capacity for landscapes to contain spaces for trees.

In planning for the longer term, however, organization engaging with tree plantings will also need to ensure that existing trees are preserved. Public agency staff and community members echoed the importance of preservation of existing canopy – indeed, one stated that preservation can serve as a new form of planting strategy, although, as observed, the largest form trees, including the majority of heritage trees, are located in high income neighborhoods. Longer-term strategies for ensuring a healthy urban forest in newly established tree-planting areas will require partnerships with community members, including property owners who can serve as neighborhood tree champions. Such partnerships, perhaps akin to the neighborhood emergency teams, who serve as citywide network members that serve as technical and informational liaisons for reducing societal impacts from natural disasters, can be a model for creating place-based tree teams. Such tree teams are well established in some city neighborhoods, and supporting the creation of such programs can be an important element of ensuring long-term sustainability of the city's tree canopy. In an era of reduced public funding for supporting tree planting and maintenance, these community-based partnerships become essential for the development of a tree planting strategy.

INTRODUCTION

CREDIT: FRIENDS OF TREES

Urban forests in the Portland metropolitan region are vast and ever-changing. With millions of trees, large and small, the region's urban forest provides innumerable services to the community members and businesses, including improving air quality, reductions of temperatures during heat events, stormwater mitigation, and energy conservation. These benefits are well-documented. For example, a report from the U.S. Forest Service and University of California, Davis states, "for every $1 spent in Californian cities on tree planting and maintenance, there were $5.82 in benefits." Another study (Rao et al., 2014) found that Portland's current urban forest reduces healthcare costs to its communities by almost $5 million per year through improvements in air quality – almost $750 per month per person. Other local research in Portland suggest that communities living next to urban trees experience less isolation, fewer crimes, and more engagement with neighbors and involvement with civic life. These benefits are essential to ensuring a high quality of life, and enabling all communities to live and thrive in places throughout the region. At the same time, all communities in the city do not share these benefits equally. While historic development patterns, planning policies, structural bias in decision making systems, and other factors have created these inequities, we now have the opportunity to improve access to these 'ecosystem benefits' through understanding where and how to expand the tree canopy.

This report supports the creation of a neighborhood-based tree planting strategy by engaging Portland communities and presenting analyses of their perspectives on expanding canopy cover in lower canopy and lower-income neighborhoods. The present study offers three dimensions to describe the urban forest; (1) community perspective on the condition and future of the urban forest; (2) professional perspectives from city and nonprofit staff regarding equitable tree planting; and (3) a practical web-based spatial engagement tool for identifying areas of, and communities in, the city to implement equitable planting. This study comes on the heels of a City of Portland audit report, *Tree Code: Implementation Phase Shows Progress and Pitfalls*, released on September 6, 2017, that states a need for greater resources to manage the urban forest, and

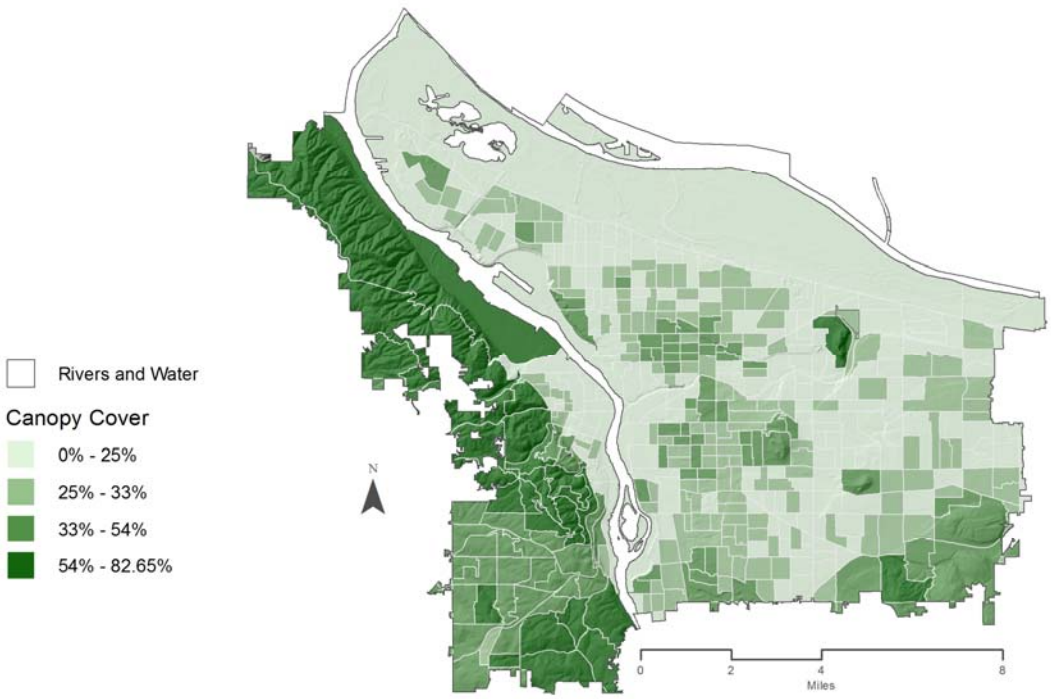
identifies several opportunities for improving current practices. In addition, the promulgation of Title 11 (the City of Portland's Tree Code) in January 2015, directs the City Forester and staff to implement a series of regulatory measures aimed to conserving the existing forest and expanding into areas currently lacking canopy cover. Title 11 aims to provide oversight, management, and direct mandates to the City Forester and staff for ensuring that the city's forest serves all community members. As of 2014, the city participated in a consortium to collect high-resolution remotely-sensed data on the physical conditions of the urban forest. This Light Detection and Ranging (LiDAR) dataset offers an immediate and direct observation of the urban forest, allows for understanding its distribution of the urban forest, and sets the foundation for evaluating future change.

We begin this report by discussing the current state of Portland's canopy cover, and subsequently describe the findings from the above three components (community perspective, professional perspective, and spatial tool engagement). We then move to contextualizing the goals of Portland's *Urban Forest Management Plan* (2004) within the broader context of national efforts to address canopy coverage targets. Although we address the social, political, and biophysical aspects of the urban forest, we note that no single report will be able to exhaustively address all the questions that may be pertinent to the management of the urban forest. We provide these findings as a first step to developing a planting strategy, and ultimately, updating the *Urban Forest Management Plan*.

STATE OF PORTLAND'S URBAN FOREST

An examination of the distribution of Portland's urban forest indicates some neighborhoods have upwards of 82% canopy cover, while others have as little as 4% (Figure 1). While the physical infrastructure and other urban features may preclude all areas of the city from having large tracts of forests, the current distribution suggest that some communities are disproportionately receiving benefits while others not. In fact, the City of Portland has recognized these inequities and is in the process of developing strategies to expand into historically underserved neighborhoods, and this report serves as additional support for these strategic tree-planting efforts. The city defines low-canopy as less than 25% canopy coverage, and low income as 50% or more of an area (e.g. neighborhood) making less than 80% of the median household income. These definitions provide a means for identifying those areas that meet both criteria, and developing outreach strategies to expand tree plantings.

Figure 1: City of Portland Tree Canopy Cover by Census Block Group (2014)



Source: Portland State University - Sustaining Urban Places Research Lab (Summer 2014)

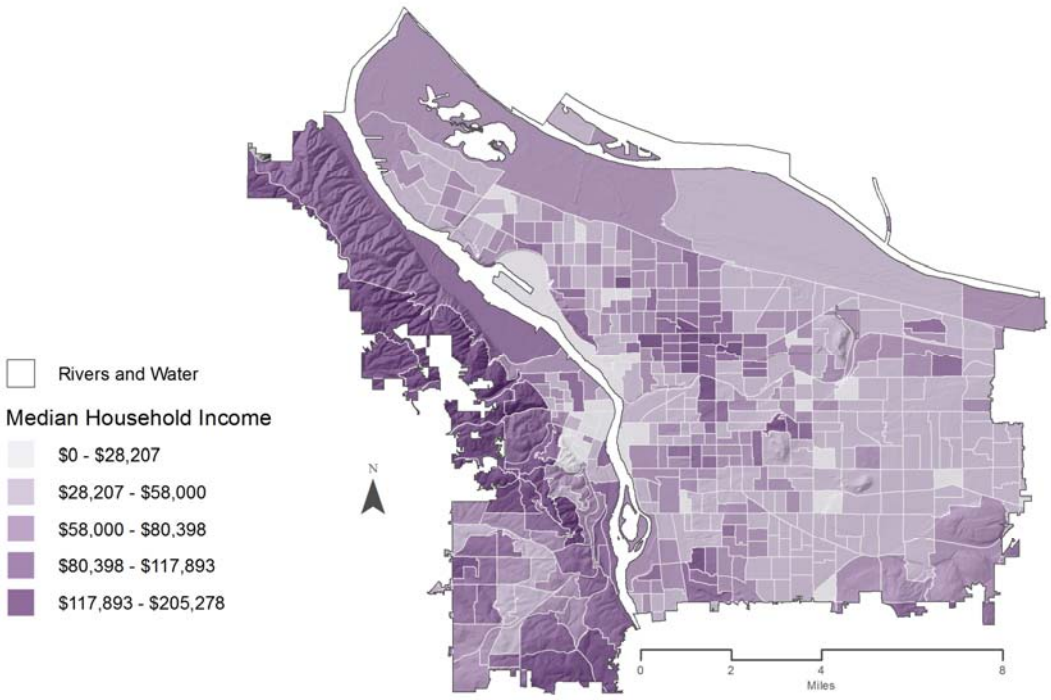
The differences in the amount of forest across Portland's neighborhoods are due to myriad reasons, some of which include the process and timing for annexation, geographic disparities in the distribution of city resources, and social processes that encourage or discourage planting. Nevertheless, the current state of Portland's urban forest consists of an east-west divide, where neighborhoods west of the Willamette River contain a large amount of forest, and those on the east contain less, although with tremendous disparities even within the east areas of the city. For a visual example of this disparity, visit the following website:

"The current state of Portland's urban forest consists of an east-west divide, where neighborhoods west of the Willamette River contain a large amount of forest and those on the east contain less."

https://climatecope.research.pdx.edu/soc. The darker green circle indicates total amount of canopy by neighborhood, while the lighter green and orange further divide the canopy into coniferous and deciduous.

These trends suggest more than an acute disparity of trees; they also suggest a potential opportunity for directing future tree campaign to lower canopy neighborhoods. Generally, neighborhoods in Portland with lower canopy cover are also coincident with areas of the city that are below the median household income (Figure 2). A recent analysis by the Sustaining Urban Places Research (SUPR) Lab at Portland State University, suggests that households in the top quintile of income have, on average, 20% more canopy cover than those at the bottom quintile of income. For more information see: *climatecope.research.pdx.edu/income*. These patterns are statistically significant for the City of Portland, and consistent for trees located on the right-of-way (ROW), in private yards, or both. The strong and significant relationship between higher incomes and more canopy cover are also consistent in cities around the U.S.

Figure 2: Median Household Income in Portland, OR by Census Block Group (2011-2015)



Source: U.S. Census Bureau - American Community Survey 2011-2015

At first, the geographic disparities of canopy cover suggest a need for planting trees in areas where they currently don't exist, thereby creating a 'canopy equity' campaign. At the same time,

communities vary in their capacity to engage in tree stewardship, and lack necessary resources to maintain newly planted trees. In cities like Portland, in which property owners are responsible for stewarding adjacent trees, the resources and knowledge may be formidable and cost-prohibitive. Without understanding whether communities require additional support, placing a tree in their front yard or right-of-way may exacerbate inequities, and ultimately lead to damage or death of trees planted.

As such, developing approaches to engage community groups around tree stewardship is a first step to creating a plan for expanding canopy cover and addressing inequities. Such a plan would recognize these disparities, and identify mechanisms for supporting communities that may not have the knowledge and/or financial resources to care for trees. A first step is outreach, which, for the purposes of this project contained several communities, and approaches. We describe these below.

OUTREACH

Gaining insight into the needs, concerns and perspectives of multiple stakeholders, including city staff, nonprofit agencies, and the community-at-large, increases the likelihood of long-term success. To that end, a primary focus of this project is to engage and understand the perspectives of the general public and professional staff, both of whom directly affect the conservation, removal, and/or management of the urban forest. Although the specific survey and interview instruments along with details about the findings are available in the Appendix, in this section we highlight our approach and major findings, beginning with the survey of community members, and then leading into a description of our interviews with professional staff.

COMMUNITY PERSPECTIVE OF PORTLAND'S URBAN FOREST

A survey of the public provides insight into their perspectives about urban forests. The tree-specific questions of the survey address: (1) residents' perceptions and level of interest in trees; (2) level of agreement to city and resident responsibility for maintenance of trees; (3) ideal factors and locations for planting and how to get more trees planted. These sections offer a means for associating perceptions to potential limitations and opportunities for managing the urban forest, including the capacity for some communities to accept trees. We begin the analysis with residents' perceptions and level of interest in trees.

A total of approximately 3,000 residents of Portland responded to the survey. Respondents were distributed broadly across the metro region, and contained demographics consistent with the general public. The key findings from the survey indicate:

Importance of Trees:

- 98% of respondents either strongly agree, or agree, Portland's trees are important;
- 86% of respondents have trees at their property either because they desire them, or trees were already planted at the property;
- Respondents were split on whether or not their neighborhood has enough trees: 47% believe their neighborhood has enough trees, while 43% of respondents do not believe their neighborhood has enough trees; and
- Almost one-third of respondents report not having trees at their property because they are not the property owner.

Maintenance Responsibility:

- 67% of respondents believe the city should maintain street trees in the right-of-way;
- 74% of respondents believe the city should prioritize maintenance in lower-income areas; and

---

When asking respondents, open-endedly, how the city should get more trees planted, one of the most common written responses was to offer free or reduced cost maintenance.

Ideal Factors and Locations for Planting:

- Respondents indicate places where the fewest trees are located, where air quality is the worst, and where more concrete and pavement exist are the top factors to take into consideration when planting trees; and
- Focusing efforts along the street (right-of-way) ranked as the top location to plant trees.

Further statistical analysis of the survey results revealed relationships between particular demographic variables and responses to survey questions. The statistical analysis provides a means for understanding how responses to specific questions vary by the self-identified demographics of the respondents. Of note are the following:

- Whites were more likely to agree that Portland's trees are important;
- Older, higher income, non-white, females, who are relatively recent arrivals to Portland (less than five years), and live west of 82nd Avenue are more likely to state their neighborhood has enough trees – note, not all of these characteristics need

to be present at the same time since each of these attributes were also individually significant;

- Males, who are recent arrivals to Portland (less than five years), and live west of 82nd Avenue were more likely to agree that their neighborhood trees are in good condition;
- Older adults who are recent arrivals to Portland (less than five years) are more likely to want the city to maintain street trees;
- White females were more likely to agree that the city should prioritize maintenance of trees in lower-income areas; and
- White renters were more likely to agree that the city should plant trees in all available spaces along the street.

Overall, the statistical analyses indicate that whites and non-whites may have different opinions about trees in the city. Whites were more likely to agree that trees are important, to plant in all available spaces along the streets, as well as prioritize lower-income areas. These findings were not consistent with non-white respondents, who described greater challenges with the management, knowledge, and maintenance costs for tree plantings. Differences were also apparent within geographies across the city, including those who live west of 82nd Avenue, indicating greater likelihood to believe their neighborhood has enough trees and that those trees are in good condition and healthy. Given Portland's history of annexation, and lack of investment in neighborhoods east of 82nd Avenue, these findings suggest neighborhoods have varying degrees of perceived tree health and canopy cover.

"Non-white respondents described greater challenges with the management, knowledge, and maintenance costs for tree plantings."

In terms of specific demographics, older residents who haven't lived in Portland longer (greater than 5 years) are more likely to state their neighborhood has enough trees and that those trees are in good condition and healthy, but also want the city to maintain the street trees. This may suggest older retirees moving to Portland whom are able to reside in close-in, wealthier neighborhoods, which have healthier trees, but also larger trees with more costly maintenance. Additionally, older adults may be less able to physically care for the trees in their property or the right-of-way.

Finally, renters are more likely to agree the city should plant trees in all available spaces along the street, highlighting the differences in renter and landlord views about trees. Renters have a desire for trees, though were unequivocally consistent in their concern that they were not able to plant, maintain, or support canopy expansion due to their inability (perceived or real) to affect change

on the property. The responses from renters specifically highlights an opportunity to distinguish tree planting messaging between renters and property owners.

PROFESSIONAL PERSPECTIVE OF PORTLAND'S URBAN FOREST

Interviews with public agencies and nonprofits engaging with trees provide another perspective on opportunities and challenges with expanding canopy cover in Portland. Overall, our interview results indicate professional staff believe canopy cover is important, which is also consistent with the aforementioned survey results. After interviewing staff at ten public agencies, Multnomah County, and one nonprofit, three broad themes emerge and define the public bureau perspectives for an urban tree planting strategy in the City of Portland:

> Professional Collaboration: Opportunities and barriers for coordinating multiple public agencies and nonprofits in the management of city trees;
>
> Community Outreach: Concepts of engaging the general public in expanding tree canopy in the city; and
>
> Urban Forestry Management: Internal operations for managing the overall health of the city's canopy cover.

It's no surprise collaboration or coordination, and how to best manage the urban forest, would emerge as two themes when interviewing public agencies. With multiple city bureaus directly or indirectly working with trees through Title 11, or infrastructure improvements, the Urban Forest Management theme will require public agencies to develop ways that best address the internal operations. Multiple public agencies expressed interest in focusing tree planting efforts in East Portland; however, tree planting in lower-income areas of the city requires more than public agency collaboration, discussing best urban forest management practices, or updating city codes. Indeed, the mention of equitable distribution of tree planting was present throughout the interview process and ties together all three themes, which suggest a need to examine more closely the theme of Community Outreach. Often, community outreach requires dedicated personnel and, to that end, we focus on findings from our Community Outreach efforts here.

"Tree planting in lower-income areas of the city requires more than public agency collaboration, discussing best urban forest management practices, or updating city codes."

During the interview process, we heard that equitable tree planting was about more than broad community outreach and the standard equitable view on tree planting, which often focuses on the distribution of trees – one neighborhood having more trees than another. In fact, this view of tree planting

acts as a reminder to some Portland residents of the imbalance in power; the classic "haves" and "have-nots". But when our interviewees addressed equity in tree planting, non-standard themes emerged about equitable approaches including, (1) cultural value and messaging; (2) language barriers; (3); tree maintenance responsibility and (4) city-governance structure.

"A one-size-fits-all tree planting mentality will not work to meet the needs of various communities; education on trees should begin with building culturally specific value, not on regulatory requirements."

An understanding of the value and messaging of trees are key components when increasing canopy cover in the city. Educating residents on the benefits of trees, whether to reduce heating and cooling costs, cleaning the air, or increasing the beauty of the landscape is needed, but the interviewees highlight how standard environmental service messages do not resonate with some in the city. A one-size-fits-all tree planting mentality will not work to meet the needs of various communities. The interviews suggest using multiple approaches to build community-specific value for trees. Many interviewees also suggested celebrating trees as a way to build value. Relevant takeaways include:

- Education on trees should begin with building culturally specific value, not on regulatory requirements;
- A mismatch exists between professional framing of the importance of trees and community interests;
- For some communities, the desire to have a tree and care for it begins with the celebration of trees; and
- For others trees are at the center of building relationships and community, through the shared use of public spaces, such as parks.

Additionally, other interviewees expressed barriers in messaging to culturally-specific communities, and how 'one-size-fits-all' outreach and engagement may hinder expansion of trees into lower canopy and lower-income neighborhoods. Engaging immigrant communities, for example, suggests a need for integrating multiple languages, cultures, and approaches to understanding the role of trees in the city. Relevant takeaways include:

- Tree species are regional, which means the importance and benefits of specific tree species, their role in the broader environment, and tree programs are often lost on, or misunderstood by, new residents and immigrant refugee communities;
- Involvement in tree programs by marginalized groups should be accessible by tailoring the importance of trees to the specific community's way of valuing trees; and

- Messaging should include culturally-specific ways for how trees can specifically benefit the individual and the community.

Not only is messaging of trees a barrier to expansion, but language barriers also present challenges to effective community outreach, further emphasizing the need for specific community-focused strategies for tree planting efforts. Relevant takeaways include:

- Some immigrant communities are distrustful of government, and therefore, hesitate to participate during outreach efforts for tree planting programs;
- Understanding verbal and written English is a barrier for communities to actively participate, whether in person, at public meetings, or when receiving printed materials; and
- Due to language differences, the messages may not translate, or as stated earlier, values and cultural differences may create barriers, as the following quote highlights:

"Language barriers are huge. It's largely language and cultural barriers that you can't understand me because I'm speaking English and you can't understand English, or […] my message is not resonating with you, I'm not being culturally relevant, I'm being culturally insensitive […] I'm here at the wrong time, I'm using the wrong words, I'm looking you in the eye when that's not okay, or whatever it might be."

Tree maintenance responsibility in lower-income areas can hinder an individual's desire to plant a tree. Survey results were consistent with these findings, and indicate maintenance is one of the major challenges facing the expansion of trees in lower-income and lower-canopy neighborhoods. In fact, regardless of the benefits trees may provide to residents, if the cost or time for maintaining is too much, the benefits hold little to no value. Whether or not the City of Portland will be able to provide tree maintenance is unknown at this time, but the interviews provide insight into the challenges many have in caring for trees, and offer solutions to solve the maintenance barrier. Relevant takeaways include:

- The cost to purchase a tree, as well as the time it takes to care and maintain a tree, are harder on lower-income residents, creating barriers to participating in tree planting;

- Finding solutions to lower the cost will be beneficial to reaching those most in need, and to meeting long-term tree planting goals. Possible solutions include increasing the cost of purchasing a tree or accepting individual donations with each tree purchase, and ensuring a portion of the additional funding is earmarked to help lower-income residents in the future purchase and care for a tree.

"I can afford to maintain my trees, I'm lucky. But if I was juggling two jobs, two kids, a car that's broken down, rent that I can barely afford on my house or a distant landlord that lives god only knows where […] never comes and takes the trees. That is the last thing on my list, to take care of. If somebody runs it over, all the better. Because then I don't have to look at how bad it looks."

Finally, ensuring that equitable tree planting remains a priority entails changing the organizational framework of governance, by inviting marginalized groups to have a continuous voice in tree planting decisions. Inviting people to the table may not be sufficient, rather, engaging historically marginalized communities by providing opportunities for involvement and building trust with groups who have not held good relationships with government in the past is essential. Relevant takeaways include:

- Long-term success in equitable tree planting includes representation of marginalized communities in positions of influence and power, and utilizing their skills and ideas during decision-making;

- Building relationships with marginalized communities takes time, requires actively listening to the desires of those who have been left out of conversations in the past, and should be a continuous effort (not project based) .

"You can't just walk up to people and say, "I want to be your friend." It's about networking and building trust."

"There's one thing to reach out, which we all like to think we do, and do to a greater or lesser extent. There's another thing to be heard."

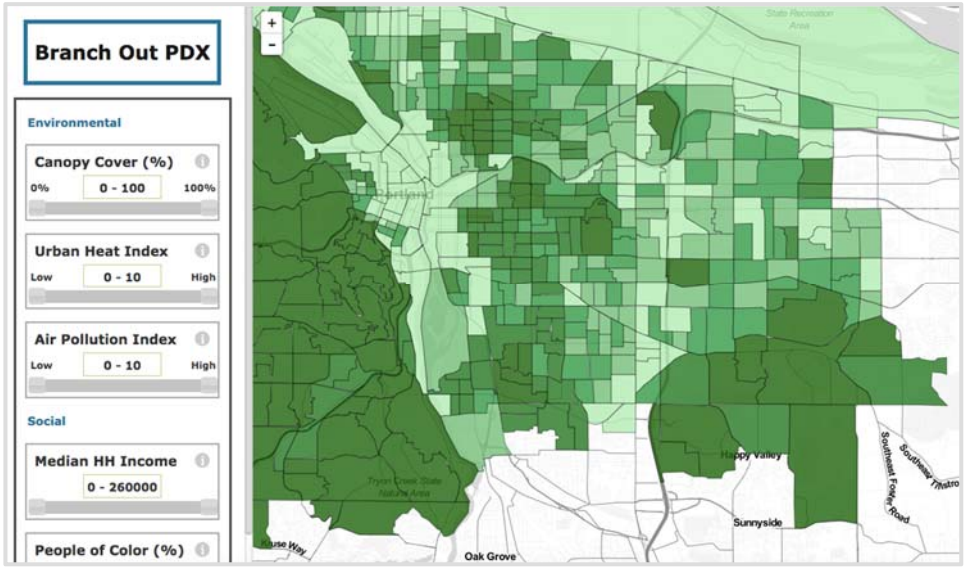
The role the city

plays in engaging the public on the value of trees, particularly those who have not traditionally been a part of canopy cover campaigns, is an opportunity to work together to meet planting goals. By addressing the other issues – maintenance responsibility, language barriers, and the structure of government – the results from our community outreach has the ability to address the lack of equitable concerns around tree planting, and therefore, allows us to learn from our past mistakes, and create equitable goals for future planting.

ONLINE TREE PLANTING TOOL

As a means for identifying areas of the city where expanding canopy cover may address historically inequitable planting strategies, we developed a location-based, online planting tool to offer the general public opportunities to identify locations relevant for tree plantings. The online planting tool, available at branchoutpdx.org, brings together the social and environmental considerations for expanding tree canopy. With this tool, community members are able to assess available neighborhood and street-level tree planting locations using a series of 'filters' that allow for specification of criteria. Users can customize the map by filtering results based on social factors, planting site type, and environmental stressors. The base map of the tool consists of the amount of canopy in each of the areas of the city (Figure 3).

Figure 3: Branch Out PDX Online Tree Planting Tool



The social and environmental filters were selected based on decades of research, which suggests the need for specific attributes when identifying location for tree plantings. Studies by Troy et al (2007) suggest a need to ensure multiple scales of analysis, since some data are available at

neighborhood scales, while others are available at the tax lot. At the neighborhood scale, primary social factors include income and communities of color as criteria for addressing historically underserved communities. Social factors at the tax lot scale include distinguishing between the private and public areas (e.g. street versus parcel), occupancy (e.g. renters versus owners), land use (e.g. single family, multi-family, etc.), and quality of roads (e.g. under-improved, unimproved). The environmental factors for which we have the most accurate data include, air quality in the form of mobile sources (e.g. nitrogen dioxide), and temperatures (e.g. urban heat islands). These two environmental factors are directly affected by trees, and as a result will change with expanding canopy.

With these data, we envision this tool being used by community members for initial assessment of tree planting space availability, which can be further analyzed on the ground for confirmation of suitability of potential sites. This tool aims to help communities and relevant organizations save time and resources by initially identifying locations for potential tree plantings, and subsequently conducting specific site assessments. As such the tool is not intended to finalize planting locations, rather it primarily aims to help communities understand tree distribution in their neighborhoods, and assess available space on the street.

CONTEXTUALIZING PORTLAND'S URBAN FOREST

In order to contextualize the urban forest, and provide insight for Portland's *Urban Forest Management Plan* update, we reviewed the relationship between the City of Portland's urban forest goals in relation to other cities. Plan evaluation is a common practice to evaluate differences among a set of jurisdictions aiming to address one goal, in our case, urban canopy coverage targets. We also use urban forestry management plans from other cities to understand major drivers and contextual issues (e.g. poverty rates, major challenges, current canopy cover, etc.). The cities to consider were Charlotte (NC), Pittsburgh (PA), Austin (TX), Seattle (WA), and Baltimore (MD).

CREDIT: FRIENDS OF TREES

URBAN FORESTRY MANAGEMENT PLAN REVIEW

Portland's 2004 *Urban Forest Management Plan* sets a citywide canopy cover goal at 33% of the city, and currently canopy is at 30%. In order to develop a planting strategy and inform the *Urban Forest Management Plan* update, we used the following approach: (1) assess how Portland's tree coverage and goals compared on a national scale; and (2) review citywide plans identifying specific tree policies and trends. Overall, Portland's tree planting goals rank in the middle when compared to other comparable cities. Within the six cities on the list, Charlotte, NC and Pittsburgh, PA both rank higher in current canopy cover and goals than Portland (Table 1). Austin, however, did not present a specific canopy cover goal, rather they aspire to plant a total of 7,600 tree per year.

Table 1: Comparison of Current and Future Canopy Goals

City	Current Canopy	Canopy Goal
Charlotte	46%	50%
Pittsburgh	42%	60%
Austin	38%	7,600 trees/year
Portland	30%	33%
Seattle	28%	30%
Baltimore	27%	40%

Source: Urban Forest Management Plan

Our research suggests Portland's average ranking may be a result of an outdated urban forestry management plan. For reference, the oldest urban forestry management plans in the six cities we researched were Baltimore and Seattle (both updated in 2007) with goals at 40% and 30%, respectively. These findings lead us to believe that newer plans contain higher canopy cover goals, and suggests Portland may consider increasing their 33% goal once the urban forestry management plan is revised in upcoming years. We further recognize that targets were set because several reports emerged in the late 1990s suggesting a benchmark of 40% urban canopy targets based on analysis by American Forests, after "analyzing the tree canopy in dozens of cities over the prior five years and working closely with the research community." While arguably convincing many urban forestry managers to identify targets around 40%, the technology, research, and our understanding has changed over the past 20 years, leading to a consensus that more nuanced approaches are necessary.

One common planting strategy among all the plans, regardless of maintenance responsibility, was the offer of free trees to residents. In reviewing urban forestry plans from these other five cities, all indicate that they use a mix of private and public funding for tree plantings, relying primarily on a combination of grants, sponsorships, individual donors, and partnerships with utility companies. Within the scope of this current tree planting project, Portland's Urban Forestry Division aims to use primarily the 'Tree Fund' – financial resources from fees paid as a part of tree removals – to fund the increase in citywide canopy cover. The research on funding was included to provide

Urban Forestry with additional options for addressing long-term tree planting goals beyond this current project, and to help address tree maintenance responsibility concerns.

The review of the urban forestry plans also highlights that Pittsburgh's plan covered equity in greater detail – some plans had no mention of equitable planting – and deserves further mention. Pittsburgh's overall urban forestry management goal is to increase accessibility to trees for all to benefit. The plan explains how environmental injustice led to inequitable tree distribution, due to past projects focusing on brownfield cleanup rather than ecosystem services. These environmental injustices have disproportionately impacted lower-income communities and currently the city prioritizes tree planting in communities below median household income, and in neighborhoods at or below average canopy cover (Pittsburgh Urban Forest Management Plan August 2012). The city quantifies equitable distribution of tree planting by comparing poverty level statistics and percent canopy coverage by neighborhood (Table 2):

"The city [of Pittsburgh] quantifies equitable distribution of tree planting by comparing poverty level statistics and percent canopy coverage by neighborhood."

Table 2: Average Percent Below Poverty, Race, and Percent Tree Canopy Cover

Neighborhood	Average % Below Poverty Level	Average Race Demographics			% Tree Canopy
		African American	White	Other	
Allegheny Center	34%	49%	41%	10%	29%
Allentown	29%	35%	59%	6%	41%
Bluff	80%	31%	66%	3%	12%
California-Kirkbride	63%	76%	19%	5%	30%
Central Northside	25%	46%	49%	5%	21%
Chateau	100%	27%	73%	0%	5%
Crawford-Roberts	48%	82%	14%	4%	30%
East Liberty	33%	30%	66%	4%	19%
Esplen	61%	30%	65%	5%	28%
Homewood South	32%	95%	2%	3%	18%
Homewood West	37%	96%	2%	2%	30%
Knoxville	29%	52%	43%	5%	27%
Marshall-Shadeland	28%	43%	51%	6%	30%
Middle Hill	26%	94%	4%	2%	27%
Terrace Village	46%	68%	28%	4%	30%
Upper Lawrenceville	26%	28%	66%	6%	19%
West Oakland	47%	39%	53%	8%	39%
Citywide	**22%**	**26%**	**66%**	**8%**	**42%**

Recent research on establishing canopy coverage targets is becoming increasingly nuanced, and does not encourage single numeric targets for the entire city. Rather, the aim for establishing canopy coverage targets is to examine a set of existing conditions of the built environment, and create targets for neighborhoods, similar to the approach taken by Pittsburg. Greg McPherson, a

noted urban forest researcher, states that targets are best developed for specific neighborhoods and will need to consider constraints to creating canopy cover such as:

- Development densities (e.g. dense development patterns with more impervious surfaces have less opportunity for cover);
- Land use patterns (e.g. residential areas may have more opportunity for canopy cover than commercial areas, but canopy cover tends to be less in residential areas of disadvantaged communities versus wealthy ones);
- Ordinances (e.g. parking lot shade ordinances promote cover over some impervious areas); and
- Climate (e.g. canopy cover in desert cities is often less than tropical cities).

Within those parameters, quantifiable data about existing canopy cover can be linked to goals that achieve specific objectives, such as reaching the canopy coverage percentage necessary to reduce urban heat island temperatures to a specific range, or to reduce stormwater runoff by a projected amount. Such a 'functional approach' to addressing canopy coverage targets, albeit data-intensive, offers a tractable and contextual approach to linking canopy coverage targets to improvements in neighborhood-scale environmental conditions. Based on this and other research, we recommend conducting neighborhood-level analysis of major environmental and social stressors that trees can help to ameliorate, and developing tree canopy coverage targets that conform with the development patterns that are amenable to expanding the canopy cover.

POLICY REVIEW – CITY OF PORTLAND

CREDIT: FRIENDS OF TREES

Portland has several bureau-specific plans that guide citywide policies and goals. The implementation of tree policies into citywide plans, including the passage of Title 11, indicates the level of importance Portland places on preserving, maintaining and increasing canopy cover in the city. Portland's *Urban Forest Management Plan* has a comprehensive overview and detailed directives on tree management in the city. However, because trees provide multiple benefits they have an impact on other citywide goals (i.e. *Climate Action Plan, 2035 Comprehensive Plan, Watershed Management Plan*, etc.). Policies and codes referencing trees allow city staff to collaborate with Urban Forestry on shared interests and goals.

After a basic search of city plans with a keyword search for the terms 'tree(s)', 'environment,' and 'ecosystem,' we compiled a summary of Portland's policies that directly relate to the trees. Overall, the following focus areas emerge for how policies in other plans may support the city's goal to increase canopy cover and strengthen collaboration:

- Development and redevelopment policies have the greatest potential to incorporate trees, especially in East Portland neighborhoods, whether through new housing and/or infrastructure (transit, roads and sidewalks);
- Environmental service goals, including policies on the management of stormwater, reduction in air pollution, and overall resilience can be met through the increase of Portland's canopy cover. Additionally, focusing on East Portland neighborhoods, where heat islands and pollution tend to be highest, will have the most impact on environmental service goals and help those most vulnerable to climate change;
- Increasing education on food production, by focusing on planting fruit trees, allows communities to be self-sufficient, builds value, and ensures cultural needs are met; and
- Meeting the economic (increase in land values) and social (aesthetics) can be improved through the consideration of trees.

The tree policies in Portland's city plans provide a way for city bureaus to collaborate on shared goals. Title 11 guarantees trees remain a focus in future planning, and by doing so, allows many other citywide goals to be strengthened or met. The direct consideration or indirect effects of trees is apparent across all plans in the city. At the same time, the potential for effective collaboration remains a challenge. With the goal of developing an equitable tree planting strategy, the division of Urban Forestry within Portland Parks & Recreation may need to consider the avenues by which specific actions for other city plans affect the management of trees. Such coordination will have the additional benefit or a communication strategy by the City to community groups who may become partners in implementing Title 11 goals.

RECOMMENDATIONS

Based on the outreach efforts and the responses to our interviews and survey questions, we can offer a series of recommendations that help to frame the creation of a long-term tree planting strategy. These strategies are not meant to provide operational procedures or direct mechanisms

to plant trees in specific locations, rather we offer these 'high level' recommendations to support broad approaches to engaging communities and creating an equity-based planting strategy. Support for these recommendations are contained in the findings, many of which are in the main body of this document, though others evidence is available in the Appendix.

1. Trees represent a long-term change to the physical landscape of the city, and hence require a systematic planting strategy that looks 25, 50, and even 100 years into the future. If the goal of a tree planting strategy is to establish an urban forest in historically underserved areas, then opportunistic planting efforts need to be replaced with systematic, long-term strategy that anticipates, when and wherever possible, future changes to the physical landscape.
2. Any equity-based strategy would ensure that communities and neighborhoods receiving new trees have the necessary financial, technical, and physical supports necessary for maintenance. Maintenance for the first three to five years of a newly plated tree is essential for its survival; without carefully observation of growth patterns and adequate watering, for example, trees will fail, which can further exacerbate existing inequities.
3. Public bureaus responsible for the public right-of-way need to develop coordination plans for ensuring that trees are maintained, and that spaces have both green and gray infrastructure. While pipes and service boxes (i.e. gray infrastructure) are often seen as an essential component of the right-of-way, trees (i.e. green infrastructure) are often disregarded; yet, in highly developed and rapidly developing areas, the ecosystem services provided by trees also makes them essential part of the infrastructure system in cities.
4. Portland city staff and community members are still reeling from regulatory from the promulgation of Title 11. Creating a communication strategy that includes easy to understand concepts and rules for diverse communities will reduce confusion. These can be as simple as providing 'frequently asked questions' relevant to developers, public agencies, home/land owners, and others, and similarly easy to follow information brochures.
5. Recognition of the different perspectives of trees suggests a need to develop culturally-specific outreach strategies. Strategies that offer one-size fit all, such as English-only flyers containing information about tree care will not reach those communities whose neighborhoods are devoid of trees. Rather, finding multiple mechanisms, including engagement of culturally-specific groups (e.g. linguistic, racial, religious, etc.) will involve communities to advance an equity-based approach for expanding the urban forest.
6. Incorporating emerging and novel technologies with outreach efforts can yield access to communities who may not be traditional engaging with urban forestry efforts. With major developments in web-based technology, data collection and analysis techniques, and mapping platforms since the creation of the last urban forestry management plan, the future of urban forestry will need identify the role that emerging technologies will play in

community engagement, internal operations, and collaborative efforts. The online mapping platform that was created as a part of this project offers a first step to engaging communities in identifying opportune locations for expanding tree canopy.

FINAL THOUGHTS

A primary aim of this study is to address current inequities in the distribution of Portland's canopy cover. While a conventional approach to assessing inequities may directly expand canopy cover into areas currently lacking trees, our study presumes that communities that are not engaged early and often may not support canopy coverage targets (or plantings), which suggests a need for broadening community engagement. Creating an equitable citywide tree planting strategy in Portland requires learning from past mistakes, listening, and engaging the community in creative approaches. The city has an opportunity to re-assess their overall canopy coverage goal, especially during the update of the *Urban Forest Management Plan* in coming years. The use of tree policies within other Portland plans allows collaboration and coordination among public agencies and nonprofit organizations, ultimately lending itself to meet multiple citywide goals. Our community survey and interviews allowed us a glimpse into the public and professional perception of trees in the city, helping us gather information on past mistakes and set future goals. The City of Pittsburgh acts as an example to a creative solution for addressing the distribution of tree planting, and shows us that an equity lens can be implemented into an urban forestry management plan. Ultimately, we hope this research is useful to Portland Parks & Recreation Urban Forestry when designing their equitable tree planting strategy. This Portland State University report is one part of a series of reports on the Portland Parks and Recreation citywide tree planting strategy.

APPENDIX

APPENDIX A: COMMUNITY SURVEY

This section of the appendix describes the community survey portion of the outreach phase.

METHODS

The online survey tool was designed to query City of Portland residents. The project outreach was equity focused, to ensure a representative sample, and to capture respondents from lower-income neighborhoods and areas that have historically been underserved with tree planting.

The survey was open from mid-May to mid-July 2017. The survey link was distributed on multiple platforms, including the City of Portland's bureau-wide email listserv, Nextdoor, and social media channels. The survey was also mentioned at the community advisory committee and focus group meetings. The survey contained four sections: (1) residents' perceptions and level of interest in trees; (2) level of city and resident responsibility for maintenance of trees; (3) ideal factors and locations for planting; as well as how to get more trees planted (4) demographic characteristics of each respondent.

The survey included 10 total questions, and nine (optional) demographic questions:

Portland Parks & Recreation and Portland State University Tree Planting Strategy Survey

Thank you for taking the time to complete our survey! In this survey you'll be asked a series of questions about tree planting. This survey should take no more than 10 minutes. If you're ready to start the survey, please click the arrow button.

Below is the informed consent agreement for this research. Please review the text, and when you are finished click to the next page to continue.

Project

Portland State University and Portland Parks & Recreation have partnered to evaluate ways to equitably increase Portland's urban tree canopy. Portland has a goal of increasing tree canopy and its distribution to improve not only the environment, but also public health and livability. The project seeks to identify the best ways to increase canopy, with a special focus on equity. Currently tree canopy in Portland is below the city's goal. Additionally, existing canopy is not equitably distributed throughout the city: lower income neighborhoods have significantly lower tree canopy coverage and fewer street trees than other neighborhoods. Portland Parks & Recreation Urban Forestry (PP&R UF) is committed to improving the equitable distribution of trees in the city. As the responsible bureau for the management and regulation of trees, PP&R UF is mandated to maximize the benefits of the urban forest for all residents (Urban Forest

Management Plan 2004). PP&R UF has engaged Portland State University (PSU) to research this important issue and create a Citywide Tree Planting Strategy.

Purpose

The purpose of this research is to evaluate how Portland Parks and Recreation (PP&R) can best utilize its resources to increase urban tree canopy. PSU's research will help PP&R implement a citywide tree planting strategy.

Survey Process

The responses from the online survey will be coded and transcribed for analysis. The survey will take no more than 10 minutes to complete. There is no obligation to participate in this research. If, at any time, you feel uncomfortable or wish to stop for any reason, you may do so without penalty.

Anonymity

Your name and contact information will remain confidential, and your survey answers will be coded and un-identifiable. Any information you provide during the survey will remain confidential and within the research team. If a quote is used in writing, identifying attributes will not be included, unless consent is given.

Benefits

Although there will be no monetary benefit from this survey, you will be contributing to the overall health and well-being of tree canopy coverage. The information you provide can help make recommendations to benefit communities in the City of Portland.

Questions

If you have any questions about the survey please contact Kara Boden at kaboden@pdx.edu. You may also contact Professor and Project Lead, Vivek Shandas at vshandas@pdx.edu.

I've read the consent agreement and agree to participate in this survey.

- ❍ Yes
- ❍ No

1) Portland's trees are important to me.

- ❍ Strongly Agree
- ❍ Agree
- ❍ Don't Know
- ❍ Disagree
- ❍ Strongly disagree

2) My neighborhood has enough trees.

- ❍ Strongly Agree
- ❍ Agree
- ❍ Don't Know
- ❍ Disagree
- ❍ Strongly disagree

3) The trees in my neighborhood are in good condition and healthy.

- ❍ Strongly agree
- ❍ Agree
- ❍ Don't Know
- ❍ Disagree
- ❍ Strongly disagree

4) Do you have trees at the property where you live?

- ❍ Yes
- ❍ No

5) If you have trees at the property where you live, why do you have trees? Check all that apply.

- ❑ I want trees
- ❑ I have good places to plant trees
- ❑ Trees are affordable to buy and plant
- ❑ Trees are affordable to maintain
- ❑ I don't mind the work
- ❑ I know about planting or caring for trees
- ❑ Trees are a priority
- ❑ I was educated on the importance of trees
- ❑ An organization offered to plant trees
- ❑ Trees were planted on my property before I arrived
- ❑ I'm the property owner
- ❑ Other _____

6) If you don't have trees at the property where you live, why not? Check all that apply.

- ❑ I don't want trees
- ❑ There are no good places to plant trees
- ❑ Trees are too expensive to buy and plant
- ❑ Trees are too expensive to maintain
- ❑ Trees are too much work
- ❑ I don't know anything about planting or caring for trees
- ❑ I have bigger priorities than trees
- ❑ I have never thought about it
- ❑ I'm not the property owner
- ❑ Other _____

7) Portland has a goal of increasing tree canopy, because trees improve public health, improve our environment, and make the city more livable. How do you feel about the following statements?

a. The city should maintain all trees along the street (in the public right-of-way, next to the sidewalk area)

Strongly Agree Agree Don't Know Disagree Strongly Disagree

b. The city should prioritize maintenance of trees along the street (in the public right-of-way, next to the sidewalk area) in low income communities

Strongly Agree Agree Don't Know Disagree Strongly Disagree

c. The city should plant trees in all available spaces along the street (in the public right-of-way, next to the sidewalk area)

Strongly Agree Agree Don't Know Disagree Strongly Disagree

8) In your opinion, which of the following factors need consideration when planting trees? Please rank them by importance, with 1 being most important

_____ Where there are the fewest trees
_____ Where there is heavy traffic
_____ Where there is a lot of pavement and concrete
_____ Where the worst air quality is
_____ Where more youth and elderly live
_____ Where the most people live (density)
_____ Where there are fewer parks
_____ Where more low income residents live
_____ Other

9) In your opinion, which of the following locations are ideal for planting trees? Please rank them by importance, with 1 being most important

_____ Along the street (public right-of-way, the 'sidewalk' area)
_____ Yards
_____ Parks
_____ Schools
_____ Industrial areas
_____ Commercial and business areas
_____ Next to highways
_____ Other

10) How do you think the city should get more trees planted?

The next section will ask you a series of demographic questions.

1) What is your home zip code?

2) PDX How long have you lived in Portland?

- ❍ Less than a year
- ❍ 1-5 years
- ❍ 5-10 years
- ❍ 10-15 years
- ❍ 15+ years

3) Do you rent or own the place where you live?

- ❍ Rent
- ❍ Own

4) What is your age group?

- ❍ Under 18
- ❍ 18 - 24
- ❍ 25 - 34
- ❍ 35 - 44
- ❍ 45 - 54
- ❍ 55 - 64
- ❍ 65 - 74
- ❍ 75 - 84
- ❍ 85 or older

5) What is your household income?

- ❍ Less than $10,000
- ❍ $10,000 - $19,999
- ❍ $20,000 - $29,999
- ❍ $30,000 - $39,999
- ❍ $40,000 - $49,999
- ❍ $50,000 - $59,999
- ❍ $60,000 - $69,999
- ❍ $70,000 - $79,999
- ❍ $80,000 - $89,999
- ❍ $90,000 - $99,999
- ❍ $100,000 - $149,999
- ❍ $150,000 - $199,999
- ❍ $200,000 or more
- ❍ I don't know

6) What is your gender?

- ❍ Male
- ❍ Female

- Trans male
- Trans female
- Genderqueer/Androgynous
- Other _____

7) Which best describes your race or ethnicity? Choose as many as apply.

- ☐ Alaska Native
- ☐ American Indian/Native American
- ☐ East Asian
- ☐ South Asian
- ☐ Southeast Asian
- ☐ West Asian
- ☐ Middle Eastern
- ☐ Black or African American
- ☐ African
- ☐ Hispanic or Latino
- ☐ Native Hawaiian or Pacific Islander
- ☐ Slavic or Eastern European
- ☐ White
- ☐ Other (please specify) _____

8) What is your home address? (For research purposes only. We won't share your home address).

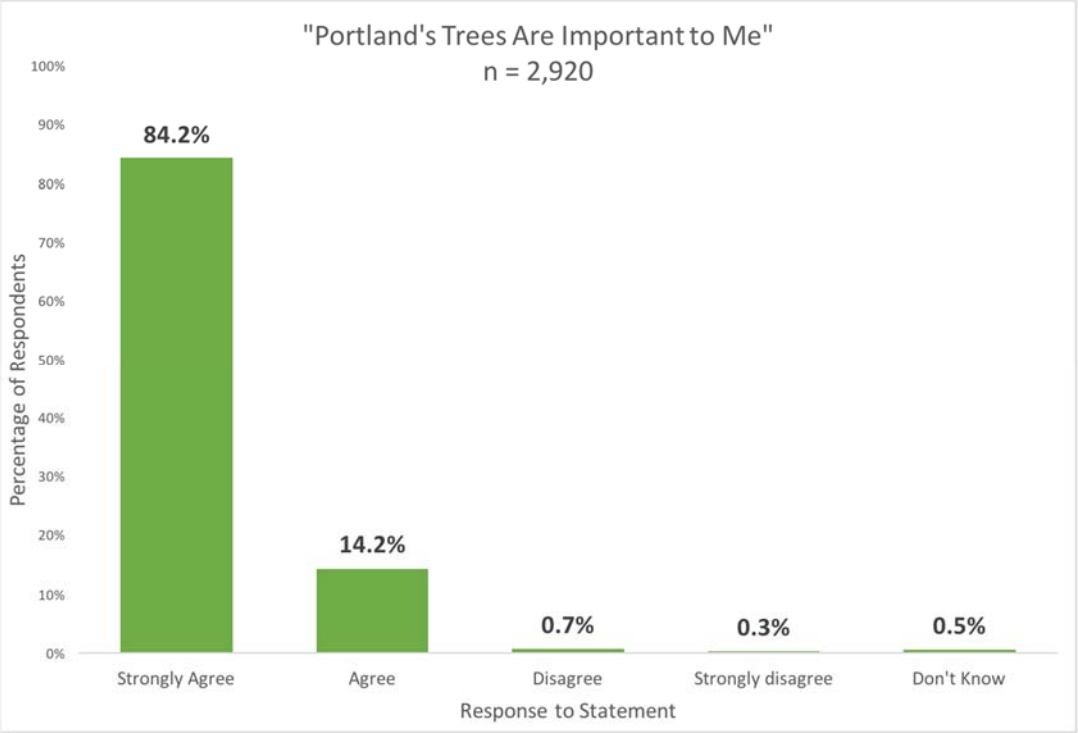
House Number
Street Name (include Ave, St, Pl)
City
State
Zipcode

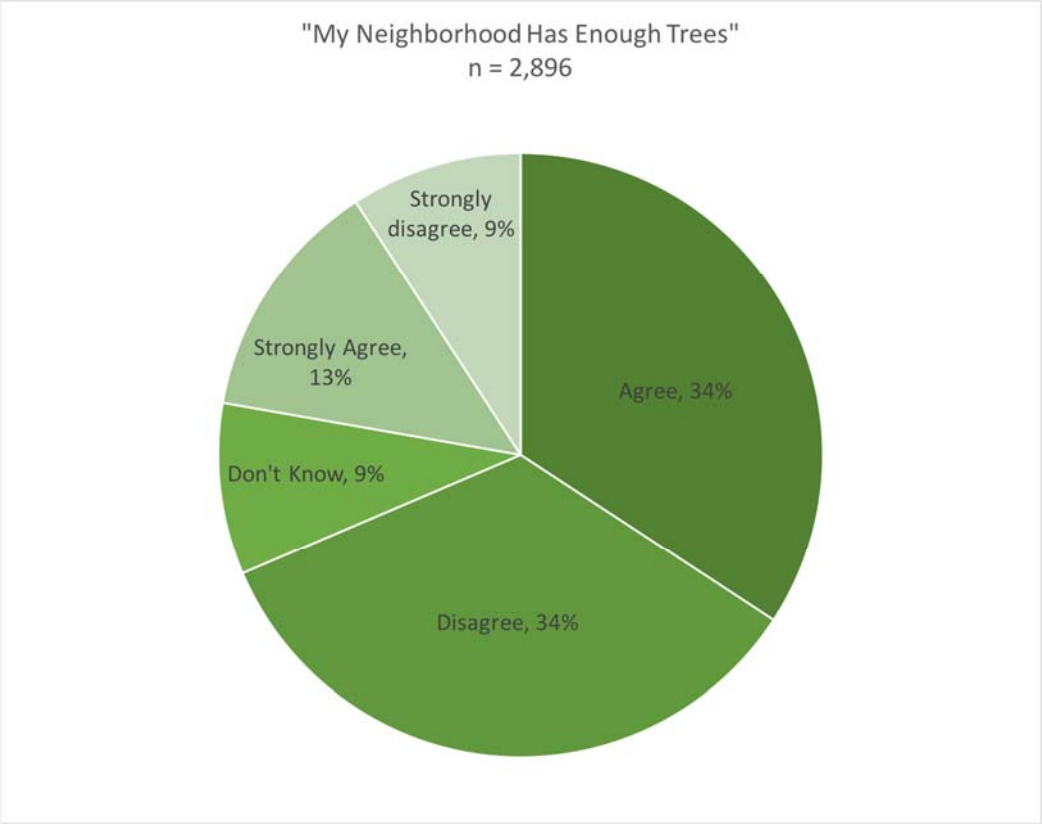
9) What is your email address? (Please provide to receive an update on tree planting. We won't share your email address).

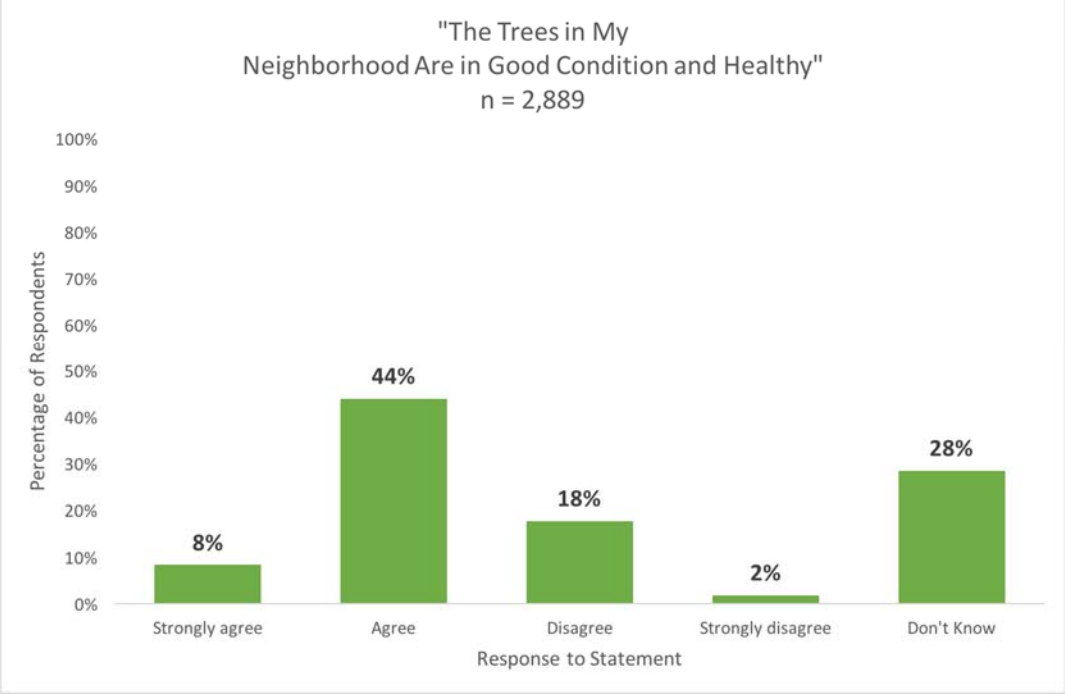
SURVEY RESULTS:

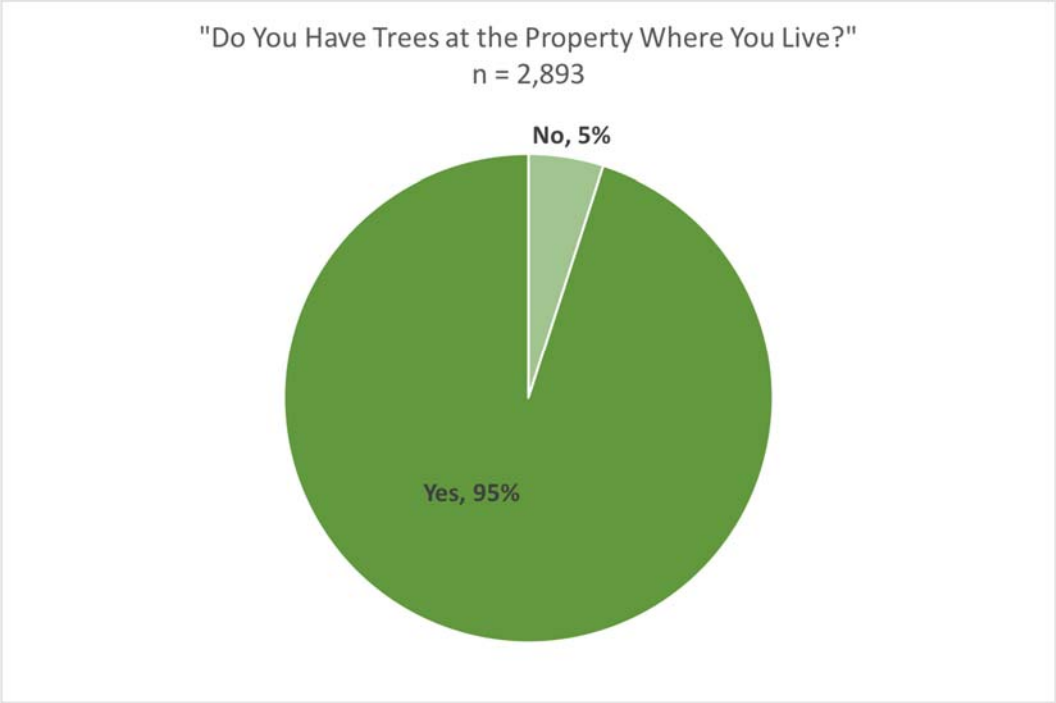
This section lists the survey results. The total respondent number (defined as "n") will vary from question to question because not every respondent answered each question. Overall, the survey produced 3,271 responses.

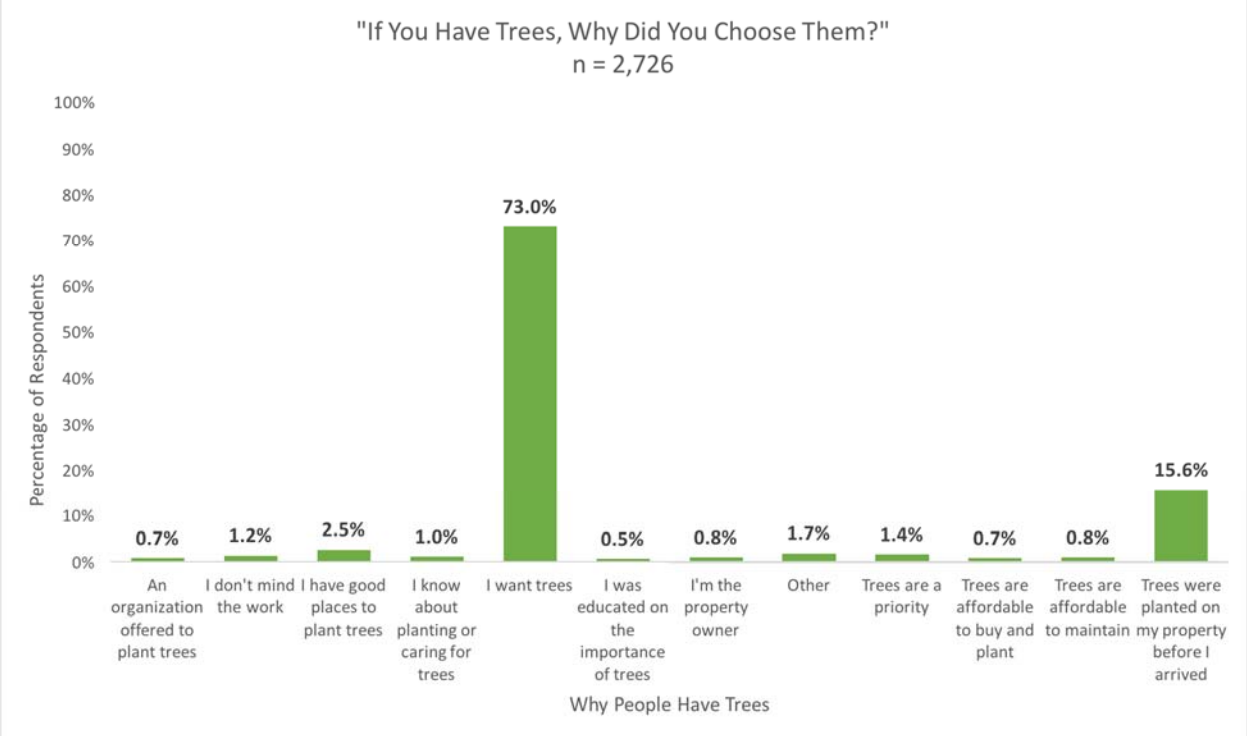
TREE-RELATED QUESTION RESULTS

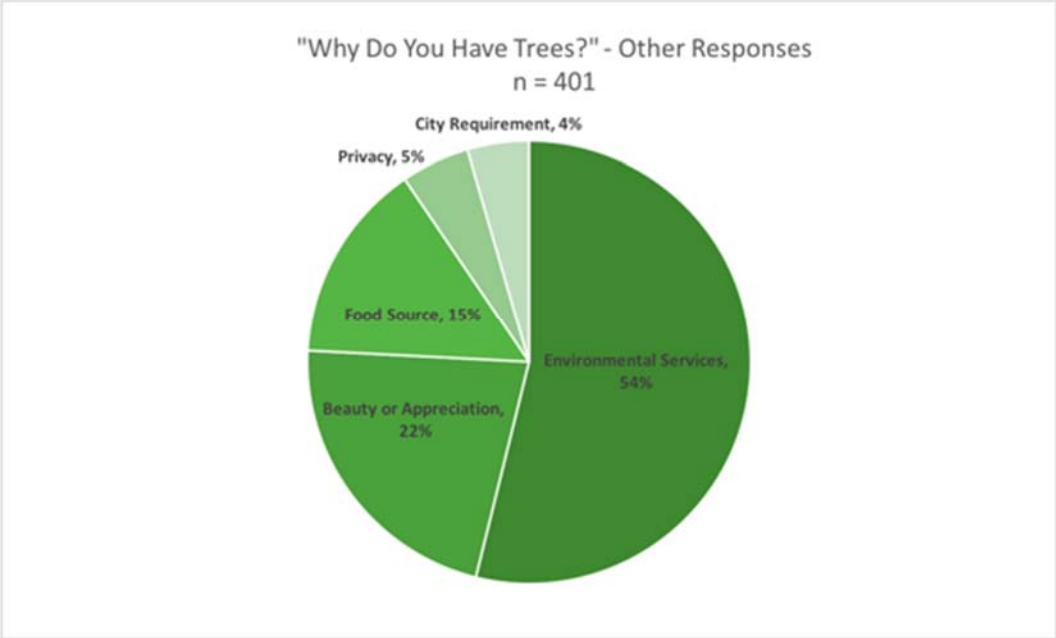



"My Neighborhood Has Enough Trees"
n = 2,896
Strongly disagree, 9%
Strongly Agree, 13%
Agree, 34%
Don't Know, 9%
Disagree, 34%

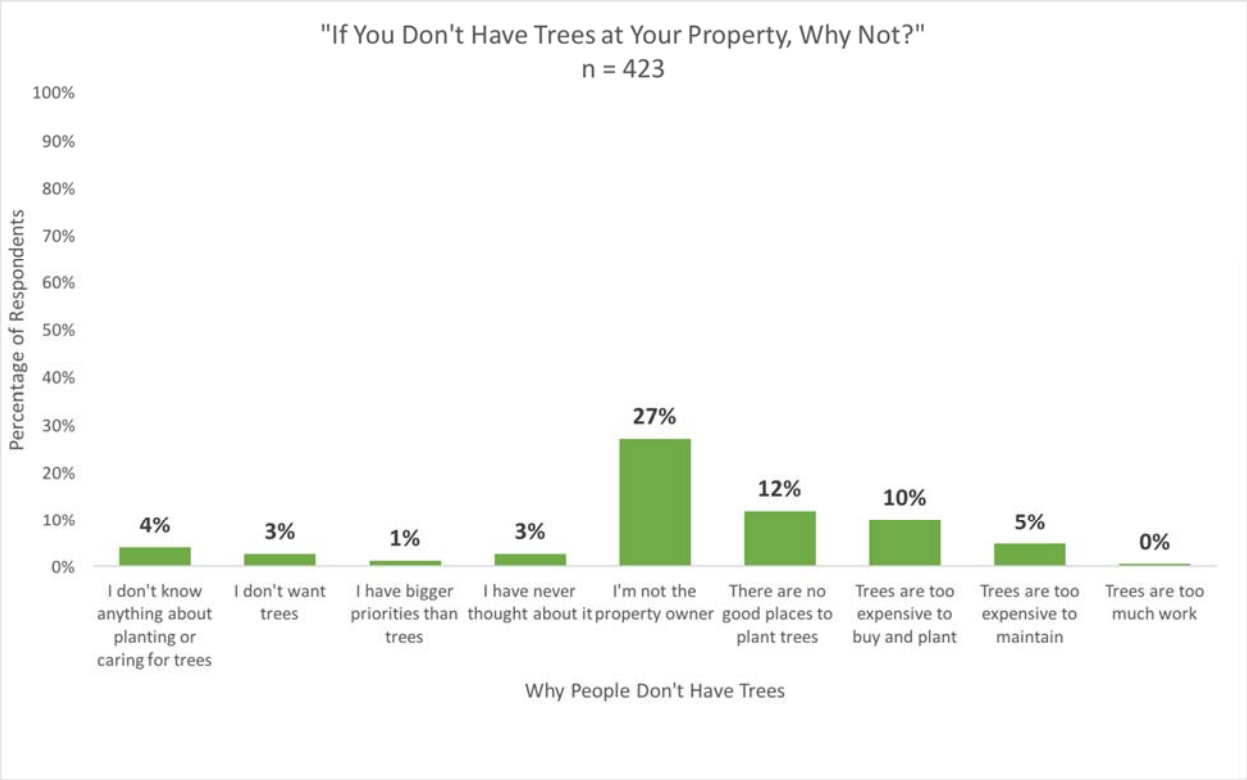

"The Trees in My Neighborhood Are in Good Condition and Healthy"
n = 2,889
Percentage of Respondents
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
8%
44%
18%
2%
28%
Strongly agree
Agree
Disagree
Strongly disagree
Don't Know
Response to Statement

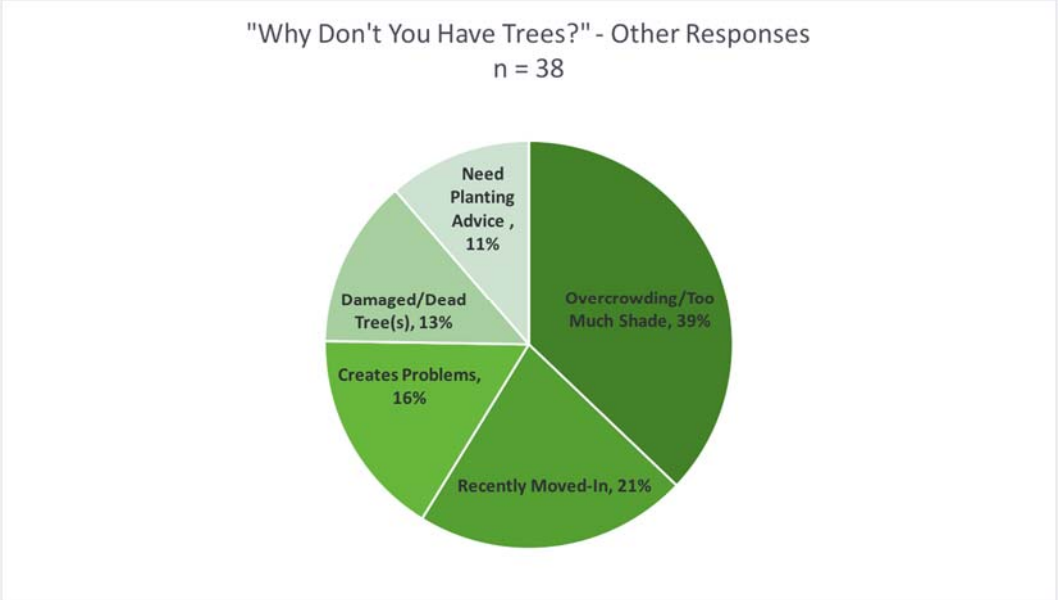

"Do You Have Trees at the Property Where You Live?"
n = 2,893
No, 5%
Yes, 95%


"If You Have Trees, Why Did You Choose Them?"
n = 2,726
Percentage of Respondents
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.7%
1.2%
2.5%
1.0%
73.0%
0.5%
0.8%
1.7%
1.4%
0.7%
0.8%
15.6%
An organization offered to plant trees
I don't mind the work
I have good places to plant trees
I know about planting or caring for trees
I want trees
I was educated on the importance of trees
I'm the property owner
Other
Trees are a priority
Trees are affordable to buy and plant
Trees are affordable to maintain
Trees were planted on my property before I arrived
Why People Have Trees

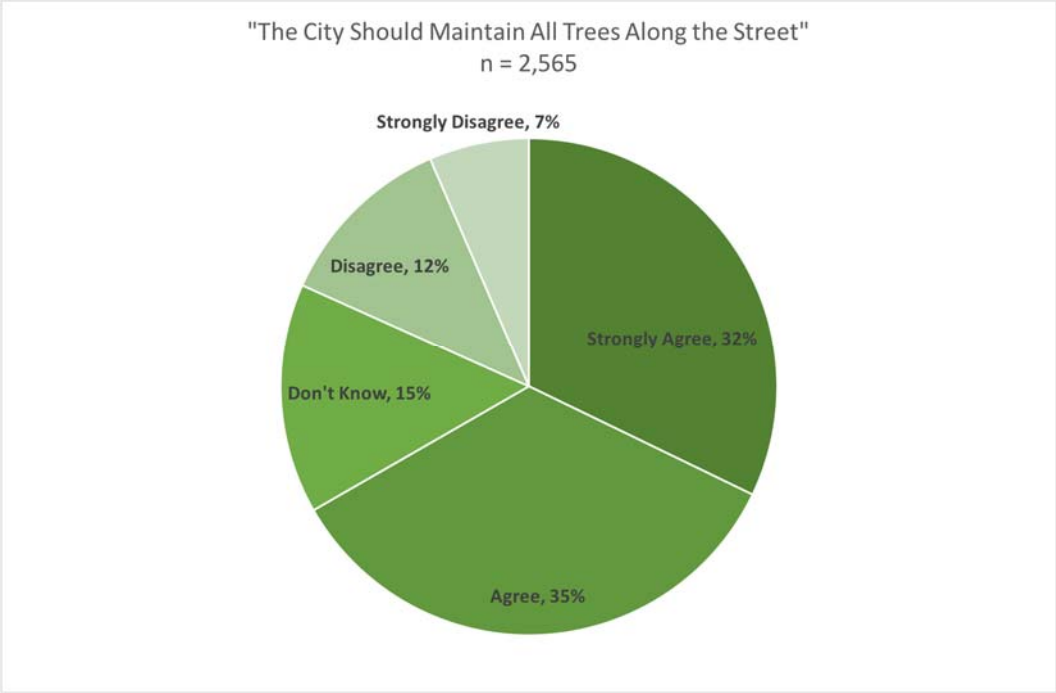


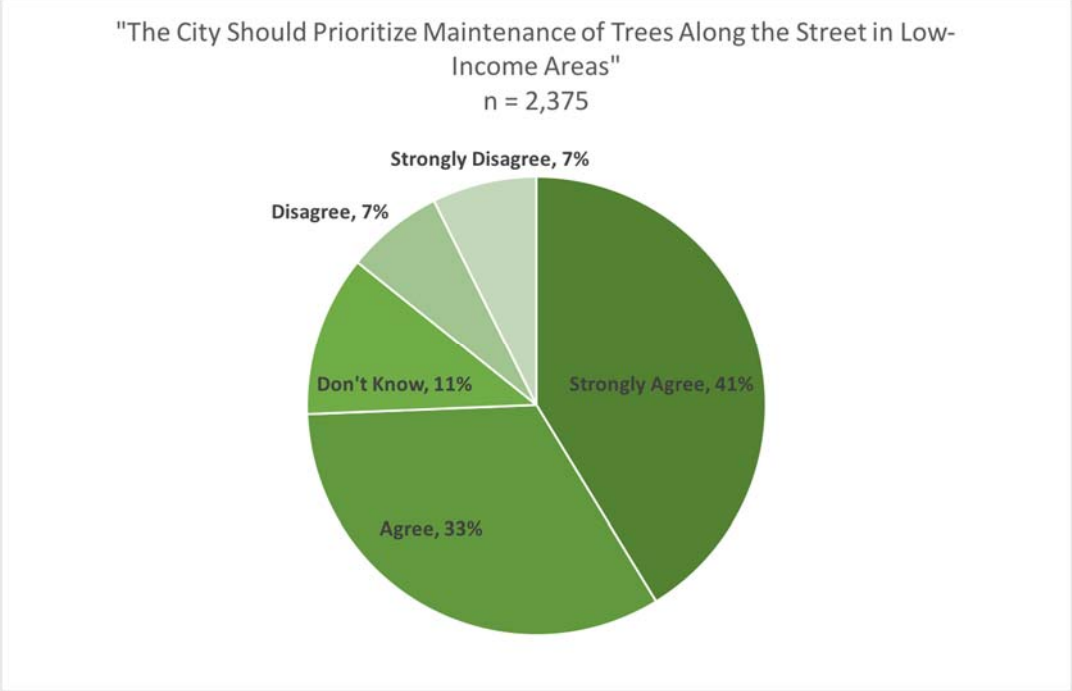
Reason	Description
Environmental Services	Cooling, shade, soil stability, wildlife habitat, reduce noise
Beauty or Appreciation	Relaxation, Mental or Emotional Wellness
Food Source	Utilizing fruit/nuts trees offer
Privacy	From neighbors, unsightly buildings
City Requirement	Title 11 codes

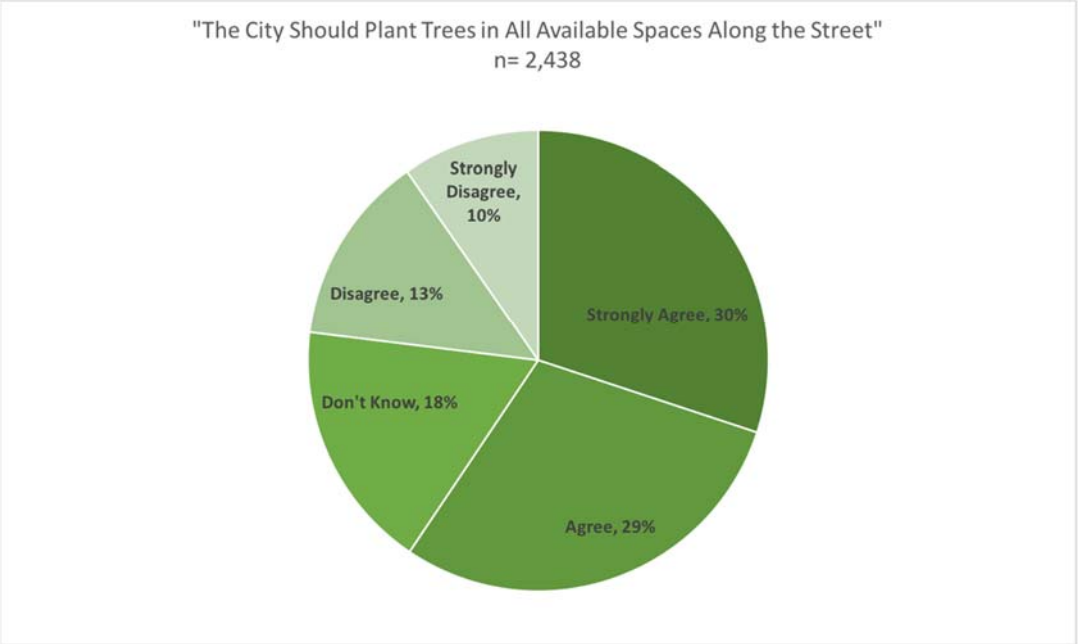




Reason	Description
Overcrowding/Too Much Shade	Wants sun to grow flowers/garden; preserve views
Recently Moved-In	Deciding on landscape
Creates Problems	Sidewalk buckles, Drops leaves, Less visibility in drive-way
Damaged/Dead Tree(s)	Trees became unhealthy, doesn't want to replace
Needs Planting Advice	Not sure who to contact or what to plant


"The City Should Maintain All Trees Along the Street"
n = 2,565
Strongly Disagree, 7%
Disagree, 12%
Strongly Agree, 32%
Don't Know, 15%
Agree, 35%


"The City Should Prioritize Maintenance of Trees Along the Street in Low-Income Areas"
n = 2,375
Strongly Disagree, 7%
Disagree, 7%
Don't Know, 11%
Strongly Agree, 41%
Agree, 33%

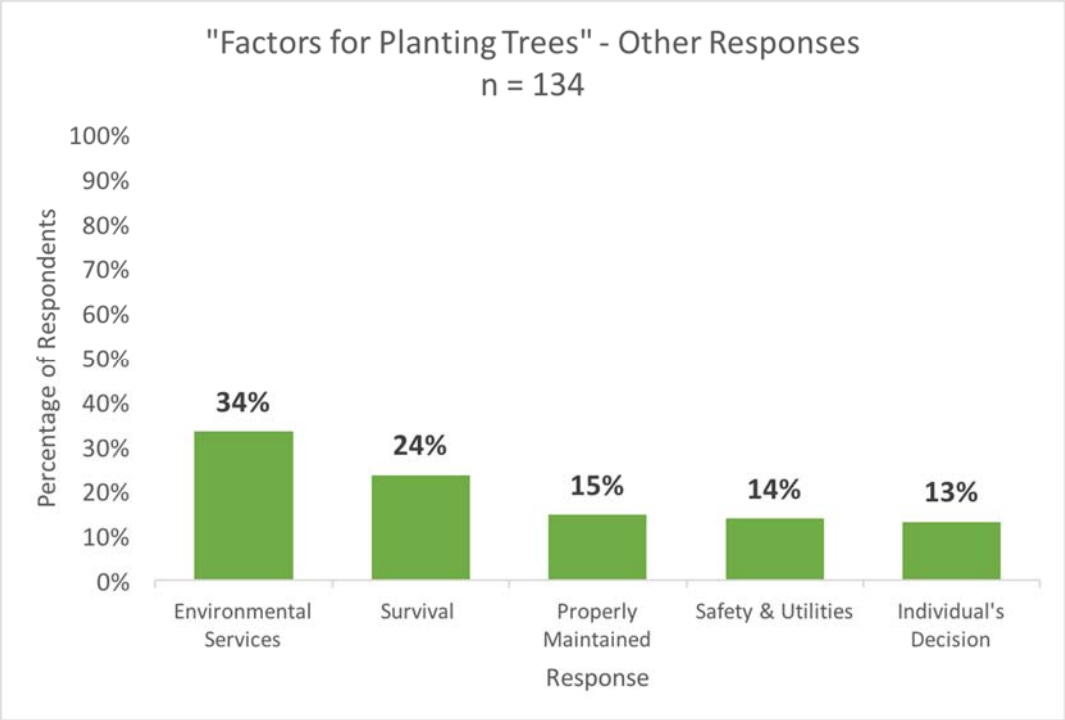


For two of the survey questions, we asked respondents to rank locations and factors for tree planting (Table 1 and 2). The number of times (e.g. count) respondents ranked a particular factor or location was tallied. Next, the factors or locations were listed in order from highest to lowest count, with respective ranks. In the case of a factor or location having the same rank, the count was used to break the tie.

Table 1: Ranked Factors for Tree Planting

Factor Rank	Factor (Count)
1	Fewest Trees (1135)
1	Worst Air (474)
3	Pavement (529)
3	Fewer Parks (388)
6	Youth/Elderly (647)
8	Heavy Traffic (446)
8	Density (722)
8	Low Income (560)
9	Other (2481)

	Rank	Factor
Top 3	1	Fewest Trees
	2	Worst Air
	3	Pavement
Middle 3	4	Fewer Parks
	5	Youth/Elder
	6	Density
Bottom 3	7	Low Income
	8	Heavy Traffic
	9	Other

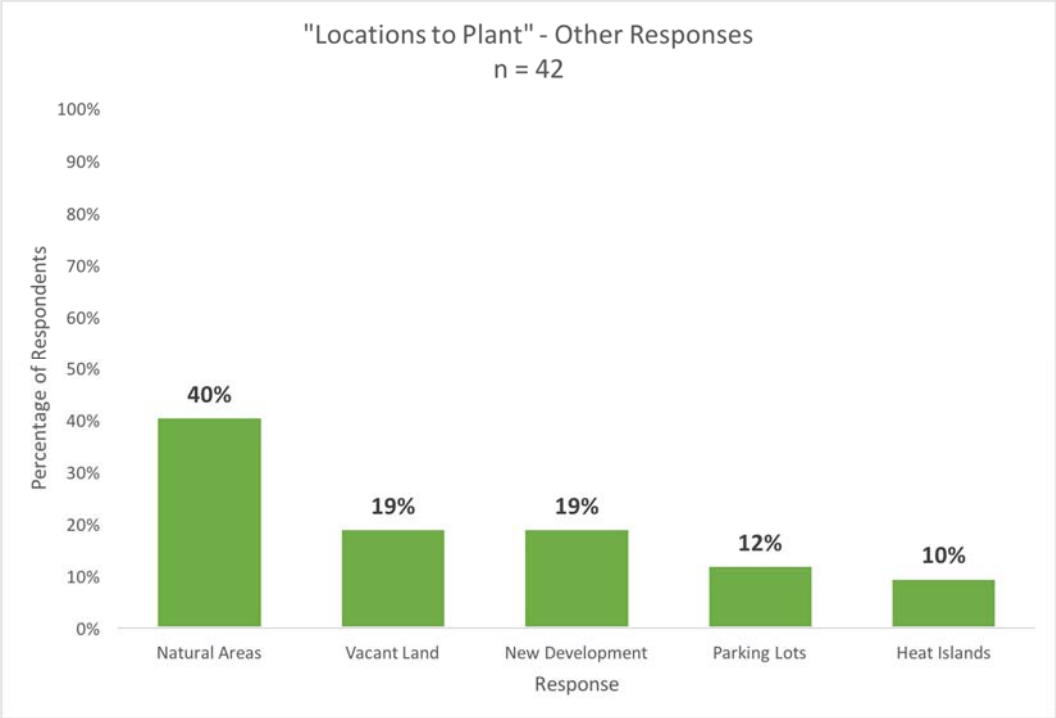


Reason	Description
Environmental Services	High temperatures; flood prone; wildlife
Survival	Where tree will be healthy and thrive
Properly Maintained	Where people can afford to maintain
Safety & Utilities	Public safety (liability); away from public works (sewer, power)
Indivdual's Decision	Want, desire and value trees

Table 2: Ranked Locations for Tree Planting

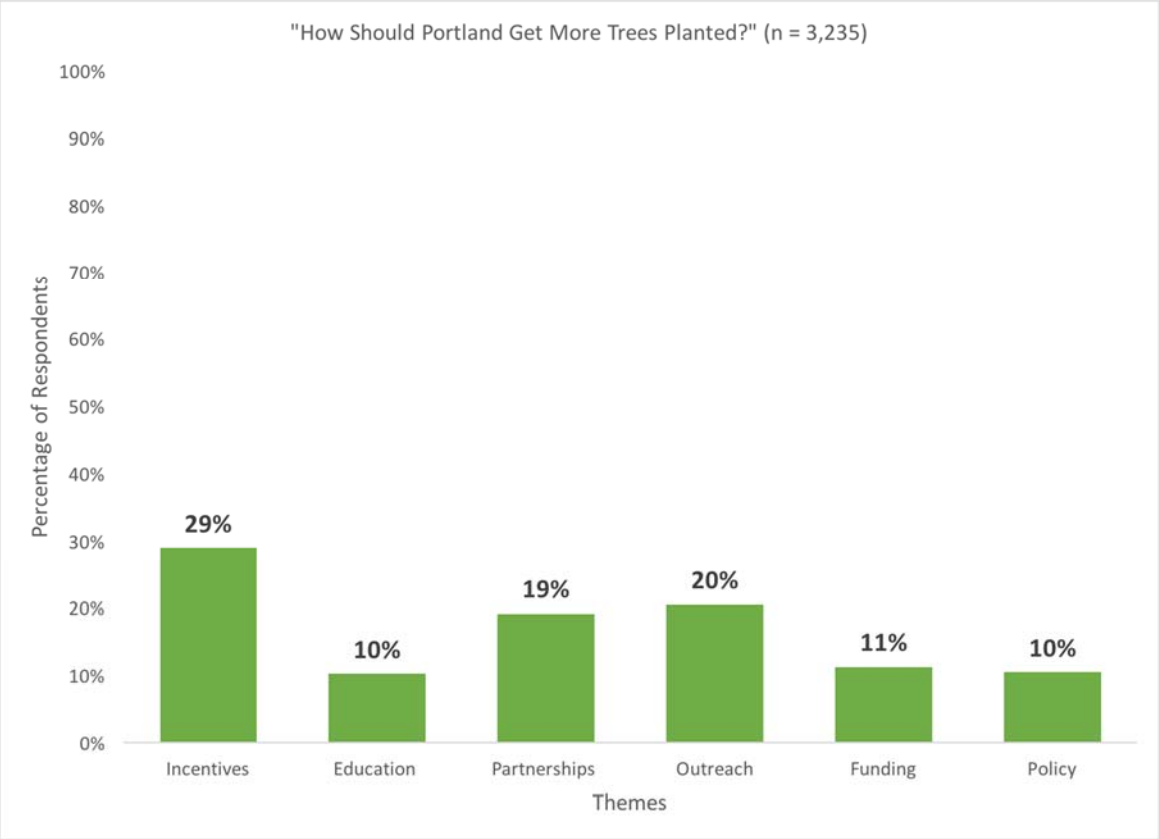
Rank	Locations (count)
1	Street (1338)
2	Yards (485)
3	Parks (602)
4	Schools (628)
6	Industrial (717)
6	Commercial (690)
7	Highways (873)
8	Other (2412)

	Rank	Locations
Top	1	Along Street
	2	Yards
	3	Parks
Middle	4	Schools
	5	Industrial
	6	Commercial
Bottom	7	Highways
	8	Other



Reason	Description
Natural Areas	Waterways, forests, wetlands, ponds, migratory routes
Vacant Land	Open space, abandoned lots
New Development	Places where trees are removed but not always replaced
Parking Lots	Underutilized spaces in and around
Heat Islands	Areas of high temperatures or less shaded

The final survey question was an open-ended question asking respondents how the city should get more trees planted. The question generated over 2,100 written responses, which were manually categorized into broader categories. The "n" is greater than 2,100 because some respondents shared multiple ideas:

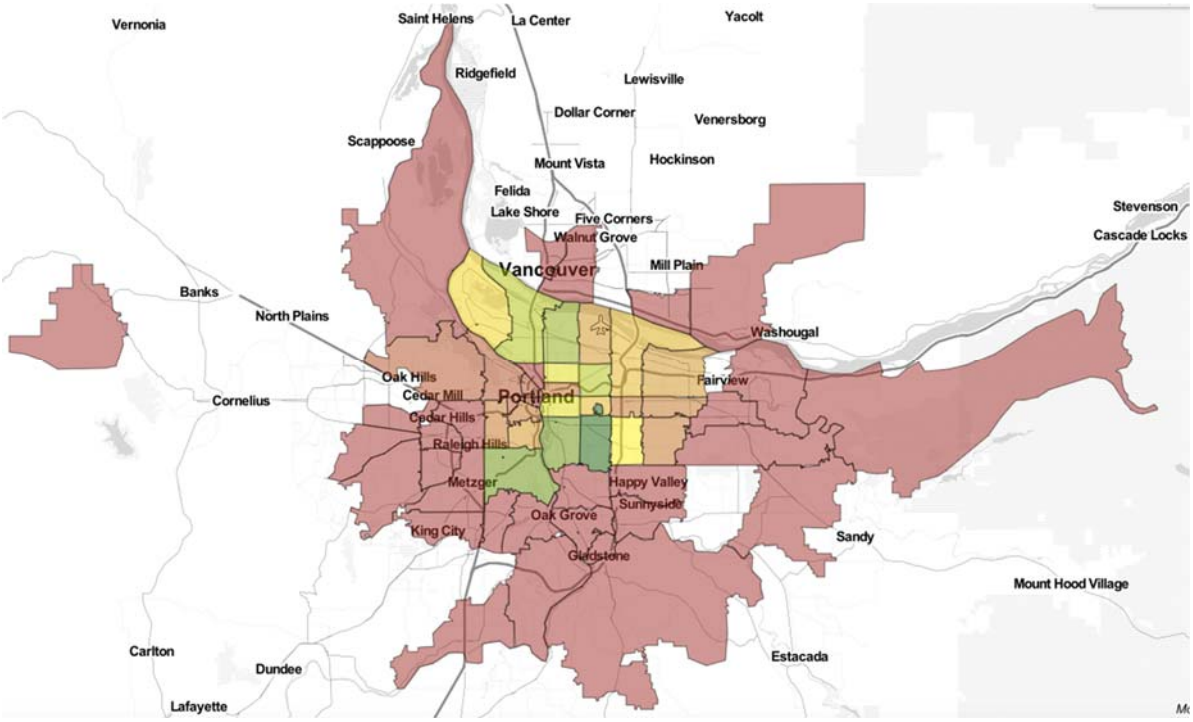


Themes: "How Should The City Get More Trees Planted"

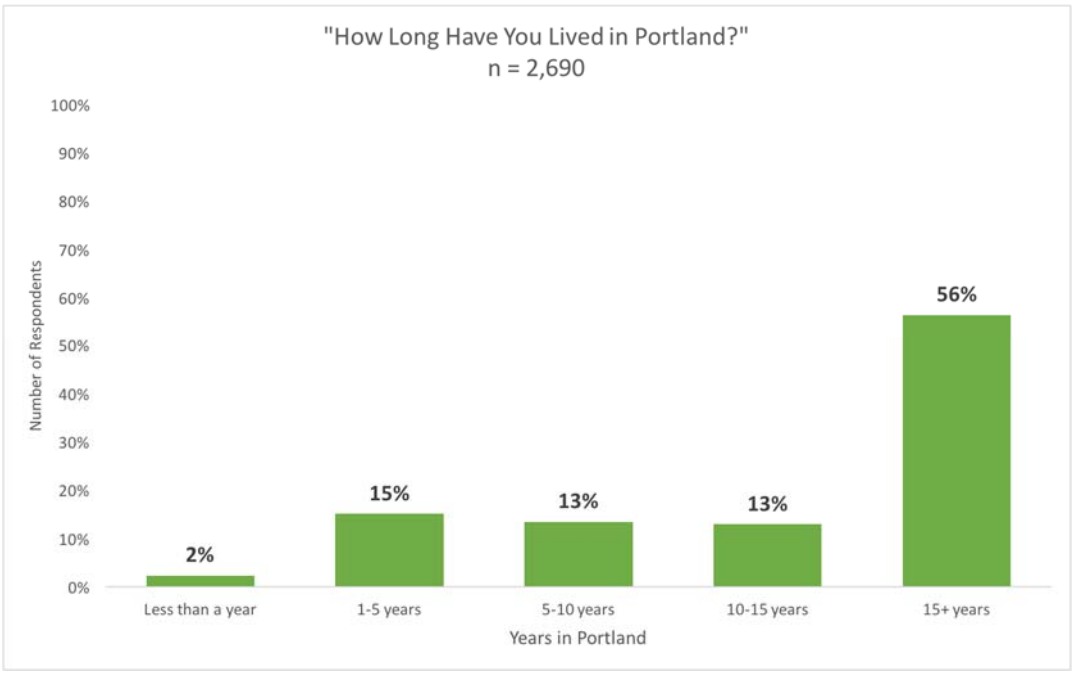
Category	Description of Themes
Incentives	Incentives to encourage planting. Offering free or reduced cost trees and/or maintenance; offering tax breaks or other incentives to volunteers or landlords for planting.
Outreach	Encourage community-wide tree planting; create and promote tree planting programs and events; encourage neighborhood-level involvement; solicit underutilized volunteers (i.e. kids, teens, retirees).
Partnerships	Continue and create partnerships with nonprofits, schools, universities and businesses.
Funding	Secure funding through public and private methods, including grants, taxes, and business sponserships, invidual donations, and fundraising events.
Policy	Examine city tree codes and regulations on permitting, species type, and to ensure preservation during construction.
Education	Increase education on tree care and benefits through marketing (i.e. brochures, website, mailers)

DEMOGRAPHIC SURVEY RESULTS

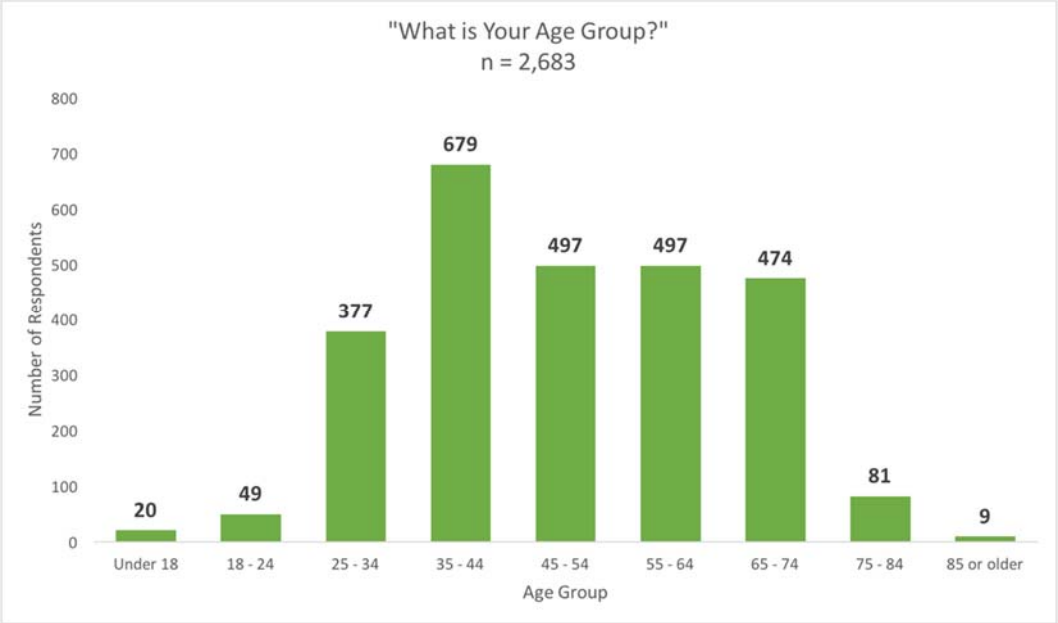
The following map shows the overall distribution of survey respondents (n = 2,670). Darker (red) shades are lower number of respondents; lighter shades (orange, yellow, and green) are higher number of respondents.

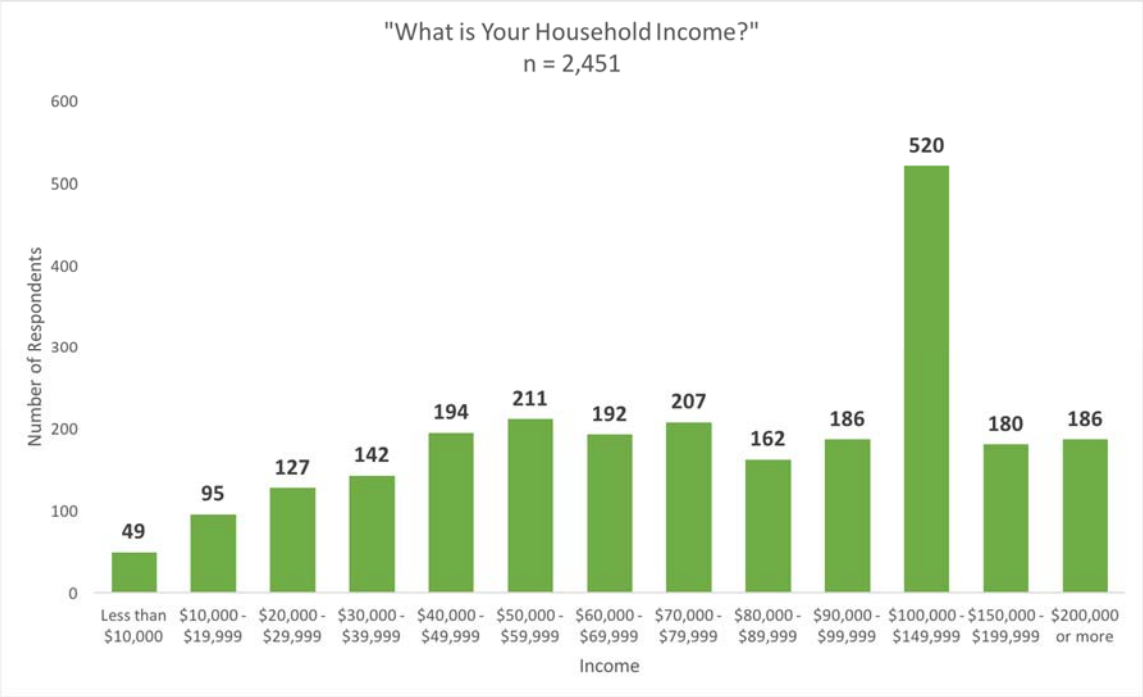


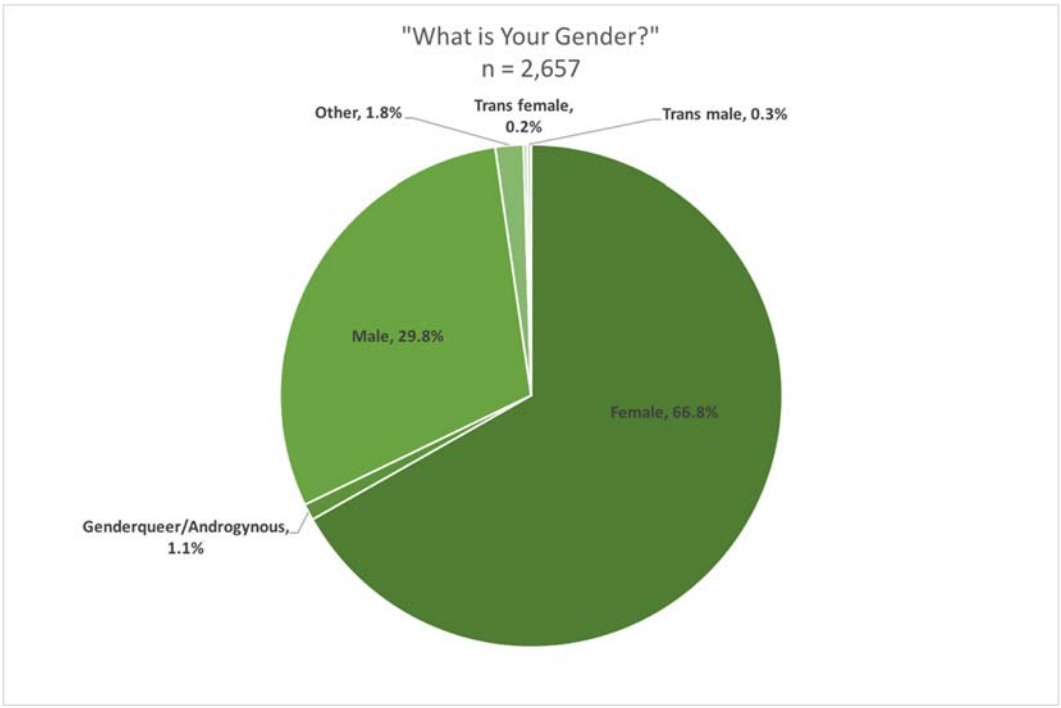
Source: City of Portland zipcode boundary data

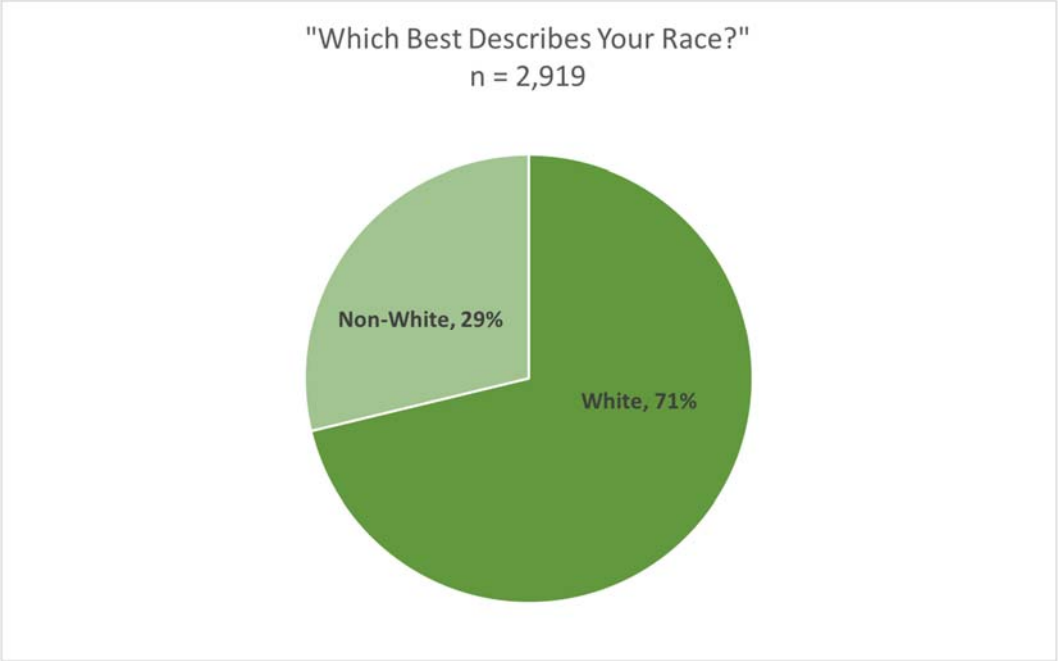


"Do You Rent or Own the Place Where You Live?"
n = 2,692
Rent, 16%
Own, 84%


"What is Your Age Group?"
n = 2,683
Number of Respondents
800
700
600
500
400
300
200
100
0
20
49
377
679
497
497
474
81
9
Under 18
18 - 24
25 - 34
35 - 44
45 - 54
55 - 64
65 - 74
75 - 84
85 or older
Age Group


"What is Your Household Income?"
n = 2,451
Number of Respondents
600
500
400
300
200
100
0
49
95
127
142
194
211
192
207
162
186
520
180
186
Less than $10,000
$10,000 - $19,999
$20,000 - $29,999
$30,000 - $39,999
$40,000 - $49,999
$50,000 - $59,999
$60,000 - $69,999
$70,000 - $79,999
$80,000 - $89,999
$90,000 - $99,999
$100,000 - $149,999
$150,000 - $199,999
$200,000 or more
Income


"What is Your Gender?"
n = 2,657
Other, 1.8%
Trans female, 0.2%
Trans male, 0.3%
Male, 29.8%
Female, 66.8%
Genderqueer/Androgynous, 1.1%



Additionally, when asking about their race and ethnicity, survey respondents could check all that applied. The following two tables show the breakdown of racial makeup of survey responders:

Race/Ethnicity	Count	Percent
White	2,079	0.795
Other (please specify)	127	0.049
Hispanic or Latino	44	0.017
Slavic or Eastern European,White	41	0.016
Black or African American	38	0.015
Hispanic or Latino,White	37	0.014
Slavic or Eastern European	25	0.010
White,Other (please specify)	25	0.010
East Asian	23	0.009
American Indian/Native American,White	22	0.008
East Asian,White	17	0.006
Southeast Asian	17	0.006
American Indian/Native American	9	0.003
South Asian	8	0.003
Middle Eastern	7	0.003
American Indian/Native American,Black or African American,White	6	0.002
Middle Eastern,White	6	0.002
African	5	0.002
Black or African American,White	5	0.002
Native Hawaiian or Pacific Islander,White	5	0.002
American Indian/Native American,Hispanic or Latino,White	4	0.002
American Indian/Native American,Other (please specify)	4	0.002
South Asian,White	4	0.002
Southeast Asian,White	4	0.002
American Indian/Native American,Hispanic or Latino	3	0.001
American Indian/Native American,Slavic or Eastern European,White	3	0.001
Native Hawaiian or Pacific Islander	3	0.001
Alaska Native,American Indian/Native American,East Asian,South Asian,Southeast Asian,West Asian,Middle Eastern,Black or African American,African,Hispanic or Latino,Native Hawaiian or Pacific Islander,Slavic or Eastern European,White	2	0.001
American Indian/Native American,Black or African American	2	0.001
American Indian/Native American,White,Other (please specify)	2	0.001
Black or African American,Other (please specify)	2	0.001
Hispanic or Latino,Slavic or Eastern European,White	2	0.001
Slavic or Eastern European,White,Other (please specify)	2	0.001
South Asian,Southeast Asian	2	0.001
Southeast Asian,Native Hawaiian or Pacific Islander	2	0.001

Alaska Native,Hispanic or Latino	1	0.000
Alaska Native,Southeast Asian,White,Other (please specify)	1	0.000
American Indian/Native American,African,White	1	0.000
American Indian/Native American,Black or African American,Hispanic or Latino,White	1	0.000
American Indian/Native American,Black or African American,Other (please specify)	1	0.000
American Indian/Native American,Hispanic or Latino,Native Hawaiian or Pacific Islander	1	0.000
American Indian/Native American,Slavic or Eastern European	1	0.000
American Indian/Native American,Southeast Asian,White	1	0.000
Black or African American,African	1	0.000
Black or African American,Hispanic or Latino	1	0.000
East Asian,Hispanic or Latino,White	1	0.000
East Asian,Native Hawaiian or Pacific Islander,White	1	0.000
East Asian,Other (please specify)	1	0.000
East Asian,South Asian	1	0.000
East Asian,South Asian,Native Hawaiian or Pacific Islander,White	1	0.000
East Asian,South Asian,White	1	0.000
East Asian,Southeast Asian	1	0.000
Middle Eastern,Black or African American,African,Hispanic or Latino,Native Hawaiian or Pacific Islander,Slavic or Eastern European,White	1	0.000
Middle Eastern,Black or African American,Hispanic or Latino,Slavic or Eastern European,White	1	0.000
Middle Eastern,Hispanic or Latino	1	0.000
Middle Eastern,Native Hawaiian or Pacific Islander,Slavic or Eastern European,White	1	0.000
Middle Eastern,Other (please specify)	1	0.000
Middle Eastern,Slavic or Eastern European	1	0.000
Middle Eastern,Slavic or Eastern European,White	1	0.000
Slavic or Eastern European,Other (please specify)	1	0.000
South Asian,Black or African American	1	0.000
Southeast Asian,Native Hawaiian or Pacific Islander,White	1	0.000
Southeast Asian,White,Other (please specify)	1	0.000
West Asian,White	1	0.000
Total	**2,616**	**1.000**

Regression Analysis

In order to analyze the survey data further, SPSS was used to run a statistical regression analysis to help us evaluate the relationship between particular demographic variables and responses to six Likert-style survey questions. For the questions a response of "1" equaled strongly agree and "5" equaled strongly disagree. We analyzed the beta coefficients to determine if the relationship between the two variables was positive or negative, and also analyzed the p-value to determine how significant the relationship was between the two variables:

	Variable	Beta	Significance	Relationship	Codes
Portland's Trees Are Important to Me	Lived in PDX	0.029	0.214		0-4; "0" Less Year; "1" 1-5 years etc
	Age	0.031	0.189		0-8; "0" Under 18; "1" 18-24 etc
	Income	-0.036	0.061		0-12; "0" = Less $10K; "1" $10K-19K etc
	Gender	0.033	0.078		"0" = Female; "1" = Male
	Race	0.119	0.000	Postive and Significant	"0" = White; "1" = Non-White
	Zipcode	0.016	0.404		"0" = West of 82nd; "1" = East
	Rent or Own	-0.025	0.176		"0" = Own; "1" = Rent

	Variable	Beta	Significance	Relationship	Codes
My Neighborhood Has Enough Trees	Lived in PDX	0.049	0.035	Postive and Significant	0-4; "0" Less Year; "1" 1-5 years etc
	Age	-0.101	0.000	Negative and Significant	0-8; "0" Under 18; "1" 18-24 etc
	Income	-0.046	0.017	Negative and Significant	0-12; "0" = Less $10K; "1" $10K-19K etc
	Gender	0.035	0.055	Postive and Significant	"0" = Female; "1" = Male
	Race	-0.059	0.003	Negative and Significant	"0" = White; "1" = Non-White
	Zipcode	0.124	0.000	Postive and Significant	"0" = West of 82nd; "1" = East
	Rent or Own	-0.009	0.635		"0" = Own; "1" = Rent

	Variable	Beta	Significance	Relationship	Codes
The Trees in My Neighborhood Are in Good Condition and Healthy	Lived in PDX	0.066	0.005	Positive and Significant	0-4; "0" Less Year; "1" 1-5 years etc
	Age	0.011	0.625		0-8; "0" Under 18; "1" 18-24 etc
	Income	-0.005	0.802		0-12; "0" = Less $10K; "1" $10K-19K etc
	Gender	-0.043	0.021	Negative and Significant	"0" = Female; "1" = Male
	Race	-0.027	0.181		"0" = White; "1" = Non-White
	Zipcode	0.079	0.000	Positive and Significant	"0" = West of 82nd; "1" = East
	Rent or Own	-0.029	0.121		"0" = Own; "1" = Rent

	Variable	Beta	Significance	Relationship	Codes
The City Should Maintain All Trees Along the Street	Lived in PDX	0.068	0.004	Positive and Significant	0-4; "0" Less Year; "1" 1-5 years etc
	Age	-0.065	0.007	Negative and Significant	0-8; "0" Under 18; "1" 18-24 etc
	Income	0.029	0.151		0-12; "0" = Less $10K; "1" $10K-19K etc
	Gender	0.023	0.244		"0" = Female; "1" = Male
	Race	0.005	0.820		"0" = White; "1" = Non-White
	Zipcode	-0.02	0.317		"0" = West of 82nd; "1" = East
	Rent or Own	-0.02	0.312		"0" = Own; "1" = Rent

	Variable	Beta	Significance	Relationship	Codes
The City Should Prioritize Maintenance of Trees Along the Street in Low-Income Communities	Lived in PDX	0.032	0.183		0-4; "0" Less Year; "1" 1-5 years etc
	Age	-0.029	0.228		0-8; "0" Under 18; "1" 18-24 etc
	Income	-0.022	0.301		0-12; "0" = Less $10K; "1" $10K-19K etc
	Gender	0.085	0.000	Positive and Significant	"0" = Female; "1" = Male
	Race	0.103	0.000	Positive and Significant	"0" = White; "1" = Non-White
	Zipcode	-0.038	0.062		"0" = West of 82nd; "1" = East
	Rent or Own	-0.036	0.082		"0" = Own; "1" = Rent

	Variable	Beta	Significance	Relationship	Codes
The City Should Plant Trees in All Available Spaces Along the Street	Lived in PDX	0.037	0.121		0-4; "0" Less Year; "1" 1-5 years etc
	Age	0.004	0.858		0-8; "0" Under 18; "1" 18-24 etc
	Income	-0.02	0.341		0-12; "0" = Less $10K; "1" $10K-19K etc
	Gender	0.017	0.410		"0" = Female; "1" = Male
	Race	0.084	0.000	Positive and Significant	"0" = White; "1" = Non-White
	Zipcode	0.014	0.500		"0" = West of 82nd; "1" = East
	Rent or Own	-0.077	0.000	Negative and Significant	"0" = Own; "1" = Rent

APPENDIX B: INTERVIEWS

This section of the appendix describes the interview portion of the outreach phase.

METHODS:

Approval from the Institutional Review Board (IRB) at Portland State University was required before interviews could be conducted. The process included submitting a research proposal, a list of interviewees, set of interview questions, and a written consent form template.

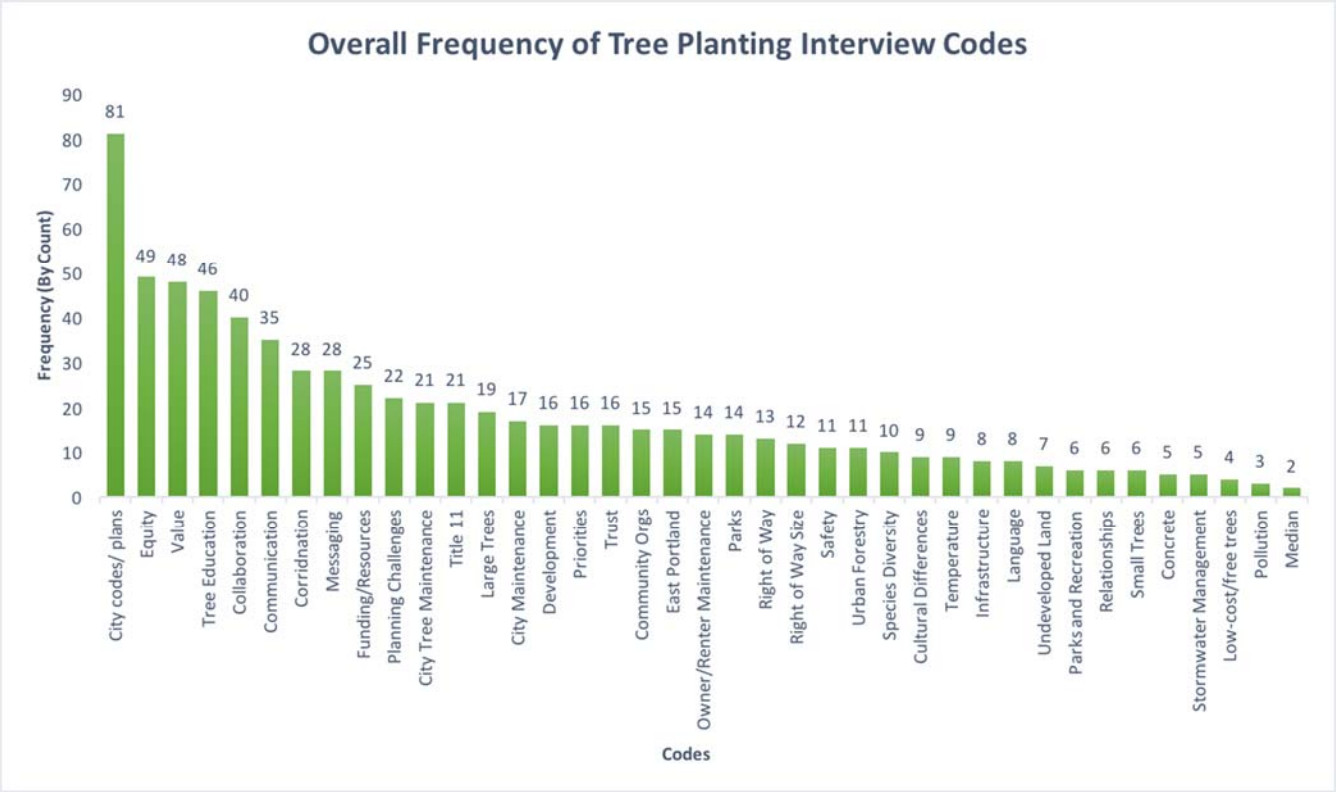
Once approval was granted, interviews took place in-person. Interviews included two people, one manager and one field person. Each interview lasted approximately 60 minutes. The interviewees were recorded (upon written consent) for research analysis. A total of 12 interviews took place, including ten public agencies, Multnomah County, and one nonprofit:

- Bureau of Development Services
- Bureau of Environmental Services
- Bureau of Planning and Sustainability
- Friends of Trees
- Housing Bureau
- Metro
- Multnomah County
- Office of Equity and Human Rights
- Portland Bureau of Transportation
- Portland Parks & Recreation
- Portland Parks & Recreation Urban Forestry
- Water Bureau

The following seven questions were asked at each interview:

1) What is your perspective about the state of trees in the city?
2) In what ways does your group interact with the city's trees, if at all?
3) What do you think are the most important factors that impact the location for planting trees in the city?
4) Of the list of factors, what would you prioritize as the top three most important, and the bottom three least important? Why?
5) What are the barriers that you perceive for expanding the number of trees and in taking care of the existing ones?
6) In what ways does your bureau interact with Portland Parks and Recreation in the management, removal, and/or expansion of the city's trees?
7) In terms of tree plantings, do you have advice or suggestions for helping to support and/or engage residents in historically underserved neighborhoods?

After the audio was transcribed into text, the interviews were evaluated using a list of 40 pre-determined codes to determine common trends among the interview content. The codes included topics such as "equity", "collaboration", and "messaging", among others. The frequency of each code applied was then tallied:



Next, quotes from interviewees were extracted from the transcripts, with a focus on:

- Income
- Barriers
- Representation on committees and participation

RESULTS:

The interview results helped inform the tree planting strategy by providing insight into broader themes, specific focus areas, as well as opportunities and challenges on tree planting in Portland. Analysis of the transcript results was a two-step process. First, creating and applying the codes to the interview transcripts, and then using the frequency of code occurrence to identify broad themes:

City/Bureau Engagement		
Theme	**Code**	**Freq.**
Bureau Responsibilitites		
	City codes/plans	81
	Funding/Resources	25
	Planting Challenges	22
	Title 11	21
	City Tree Maintenance	21
	Priorities	16
	Development	16
	Safety	11
Inter-Bureau Engagement		
	Collaboration	40
	Communication	35
	Coordination	28
	Urban Forestry	11
	Parks and Recreation	6

Community Outreach		
Theme	**Code**	**Freq.**
Community Engagement		
	Equity	49
	Value	48
	Tree Education	46
	Messaging	28
	Trust	16
	Community Orgs	15
	Relationships	6
	Low-cost/Free Trees	4
Cultural Barriers		
	Value	48
	Tree Education	46
	Trust	16
	Cultural Differences	9
	Language	8

Urban Forest Management		
Theme	**Code**	**Freq.**
Tree Responsbility		
	City Maintenance	17
	Owner/Renter Maintenance	14
Type of Tree		
	Large Trees	19
	Species Diversity	10
	Small Trees	6
Planting Location		
	East Portland	15
	Parks	14
	Right of Way	13
	Undeveloped Land	7
	Median	2
Physical Planting Barrier		
	Development	16
	Right of Way Size	12
	Infrastructure	8
	Concrete	5
Environmental Services		
	Temperature	9
	Stormwater Management	5
	Pollution	3

APPENDIX C: TREE PLANTING TOOL

This section of the appendix describes the creation of the online planting tool portion of the outreach phase. The methods for the tree planting tool included research of previous studies and determination of biophysical factors to include in the tool:

PREVIOUS STUDIES

Million Trees LA - Pincetl et al. (2013), "Urban Tree Planting Programs, Function or Fashion?"

Pincetl et al. (2013)'s study was conducted to assess impacts of the City of Los Angeles, California's "Million Trees LA" program, an initiative to plant an addition 1 million trees throughout Los Angeles. The key considerations of the study were:

- Heterogeneous Canopy Cover
  - Initial exploratory analysis by the authors revealed that there is a spatial pattern to the existing canopy cover in Los Angeles, with some areas of the city containing high amounts and others containing low amounts.
- Exact Numbers of Trees

    - The authors held the relationship between tree counts and tree *cover* within the conversation, as they are not interchangeable (i.e., 10 smaller trees could have less of an impact than a single large tree).
- Irrigation Costs
- Due to Los Angeles's arid climate, a primary focus of the authors was on the irrigation costs that could be incurred by the city. In the city of Portland, this is likely less of a concern due to a wetter climate.

Key Findings:

- Trees are a public service in a similar vein to utilities, thus an inequitable distribution of canopy in the City of Los Angeles is unacceptable. With this in mind, the authors present indicators that should guide and/or determine future planting locations:
    - Air quality
    - Urban heat islands
    - Socioeconomic variables (income, race, age)
- Public support was a key factor in successful plantings. The authors found that when the canopy siting process was transparent and accessible to the public, residents were more supportive of the program.
- Public support was increased when framing tree planting in a historical context. In relating the history of the current canopy cover in Los Angeles to continued planting efforts, the City of Los Angeles was able to communicate the important role these efforts have for the future of the city (not only the present).

Million Trees NYC - Locke et al. (2011), "Prioritizing Preferable Locations for Increasing Urban Tree Canopy in New York City."

Locke et al. (2011)'s study was conducted in order to guide the efforts of "Million Trees NYC". Their analysis primarily focused on targeting priority planting areas throughout the City of New York, New York. Through their process, they determined the following factors to be of greatest importance when siting trees:

- *Air quality*. Operationalized through road density
- *Biodiversity*. Operationalized through existing canopy cover
- *Public health*. Operationalized with data on asthma and diabetes rates (to name two); similar to sensitivity metrics used "exposure - adaptive capacity - sensitivity" frameworks (Turner et al., 2003).
- *Urban heat islands*. Operationalized using 120m^2 Landsat LST satellite data.
- *Socioeconomic status*. Operationalized through income and crime at a Census Block Group scale.

After obtaining data for the above metrics at a Census Block Group scale, the authors employed multi-criteria decision making (MCDM) strategies to weight the relative importance of each variable when considering tree siting. Their final results were static maps displaying a final 'score' for each Census Block Group in New York City.

Baltimore, Maryland - Troy et al. (2007), "Predicting Opportunities for Greening and Patterns of Vegetation on Private Urban Lands."

Troy et al. (2007)'s study assessed the general goal of the City of Baltimore, Maryland to increase overall canopy cover. Unlike the previously-listed studies, the authors were primarily focused with assessing the available planting areas in the city between land use types (i.e. they were not concerned with equitable distribution of canopy cover). At a parcel-level they assessed canopy cover, which was next aggregated to the Census Block Group scale and compared with the City of Baltimore's canopy cover goals. Their key findings were that a large majority of planting areas were in private residential parcels, and that in order for the city to meet their planting goals they must focus efforts on these areas.

Portland, Oregon - Ramsey, "Potential Canopy in Portland - Expanding Portland's Urban Forest"

This study, conducted by J. Ramsey (PP&R Urban Forestry), aimed to locate all potential planting locations within the City of Portland, Oregon. The approach employed is strictly technical, identifying planting locations by removing "unplantable" locations throughout the city by leveraging geographic information systems (GIS) data. One key component of this study was the inclusion of impervious surfaces as 'potentially plantable' areas. The analysis revealed that a majority of the plantable areas in the City of Portland were on privately-owned residential parcels. Though it is noted that the city aims to "provide equitable urban forest benefits for all residents of the city", the results of this analysis currently stop at a 'potentially plantable' GIS dataset and a breakdown of this data's coverage over multiple land uses

KEY CONSIDERATIONS IN BUILDING A TOOL

From the literature reviewed, the following recurring themes are considered in the tool:

- Air Quality - Bodnaruk et al., 2017; Pincetl et al., 2013; Landry and Chakraborty, 2009
- Urban Heat - Bodnaruk et al., 2017; Pincetl et al., 2013; Huang, Zhou, and Cadenasso, 2011; Wu, Xiao, and McPherson, 2008
- Existing Tree Canopy - Locke et al., 2011, Troy et al. (2007)
- Socioeconomics - Nearly ubiquitous throughout the literature.

In order to operationalize these factors, the following variables and data sets are considered:

- Nitrogen dioxide distribution
    - NO_2 is a common air quality cursor produced primarily by combustion and is highly correlated with traffic densities. The NO_2 data incorporated in the tool was proved by the authors of Rao et al. (2014) as a 160m^2-resolution GIS-capable raster file.
- Urban heat island model
    - Evening urban heat, which has the potential to be most impactful on human health, is highly variable within a city. The urban heat data incorporated in the tool was provided by the authors of Voelkel and Shandas (2017) as a 1m^2-resolution GIS-capable raster file.
- Existing tree canopy

    - Existing tree canopy is assessed using a $1m^2$-resolution GIS-capable raster file. This file was provided through Oregon Metro's Regional Land Information System (RLIS, 2017).
- Median household income
    - Median household income data was collected for each Census Block Group in the City of Portland from the American Community Survey 2011-2015 5-year estimates.
- People of color
    - People of color data was collected for each Census Block Group in the City of Portland from the American Community Survey 2011-2015 5-year estimates. It is calculated per-Block Group as:

$$P_C = 1 - (P_W - P_{Tot})$$

where:

P_c *= people of color*

P_w *= people identifying as 'white'*

P_{Tot} *= total population*

- Parcel-level data
    - Right-of-way vs. parcel
    - Owner occupancy
    - Single-family residential vs. multi-family residential vs. all land uses
    - Unimproved roadways

TOOL STRUCTURE

Social-Ecological-Technical System (SETS)

The tool is constructed around the concept of a Social-Ecological-Technical System (SETS) framework. SETS puts the focus on the intersection between the people, infrastructure, and the natural environment within a city. We used this tri-part division to develop the tool – focusing on important factors associated to society, environment, and general description of infrastructure (e.g. current paved areas, intersections, buildings, etc.) to identify areas available for planting. The tool is not meant to conduct final decision, rather as a means for screening the potential areas where tree planting may address the specific social, environmental, and infrastructure systems that need consideration when planting.

Multi-Level Mapping

In order to capture the benefits-at-scale seen in the literature, the tool uses two separate 'levels' to display geospatial information in an interactive and dynamic mapping platform. The first level is a Census Block Group (CBG) view of the City of Portland, incorporating demographic information from the American Community Survey. CBGs are the second-finest resolution spatial geography available from the U.S. Census Bureau. At this scale, the American Community Survey (ACS) provides richly detailed demographic information. This information was joined to the spatial data within the tool. Additionally, this layer contains information on tree coverage, air quality, and the Urban Heat Island effect (UHI). The second level is more granular, and allows users to assess suitable planting locations within a Census Block Group at the sub-parcel level. This parcel-scale level includes detailed information on air quality, UHI, canopy cover, and more. Parcel data was provided by RLIS in polygon format with detailed information on land use. An

additional analysis was performed to convert adjacent right-of-way areas into address-specific polygons. This allows a further division of parcel data into “Lot” and “Street”, as to differentiate between suitable planting locations within the right-of-way.

Multi-criteria decision making (MCDM)

Previous analyses of suitability often employ a strategy of MCDM, wherein expert opinion is used to ‘weight’ the importance of variables in determining suitable locations (Locke et al., 2011). Once the importance of a factor is determined, the resulting analysis is often static. This tool allows users to dynamically weight the importance of different social, environmental, and technical aspects of the City of Portland in order to create customized analyses. In doing so, the tool is accessible to a broader range of users as well as being adaptable to changes in tree planting strategies.

Mailer Button

In order to provide a reasonable and lightweight method to track potential planting sites, the tool includes a button to download displayed data. After filtering parcels to a set of user specifications, a .CSV table can be downloaded listing all information required to send mail correspondence. The .CSV includes variables to allow for joining into a department's GIS, in the event it is necessary. This functionality makes it possible to reach out to private residential owners in order to facilitate enhanced communication with owners of private residential parcels (where a majority of planting spaces are)

“ACTUAL PLANTABILITY” CONSIDERATIONS

Decision to Omit

In continued conversations with stakeholders and PP&R Urban Forestry, it was decided to limit the amount of analysis displayed by the tool. As an aim of the tool is to provide hands-on interaction for the public, concerns arose that the multi-criteria-nature of the tool could be misleading to users. For example, a user could specify many variables to show that their parcel is not a candidate for planting, even if the professional judgement of PP&R Urban Forestry concludes that is suitable. Included in the omitted variables is “plantable area” - this was removed due to the multiple perspectives on where trees can be planted (such as the aforementioned Ramsey study on plantable area including parking lots and other impervious surfaces). Even with all possible variables added to the map, members of PP&R Urban Forestry expressed that it would still be necessary to view a planting area before a final decision was made - the omission of any “actual plantability” metrics helps to ease any pushback that might be experience PP&R upon finding a suitable planting location.

Impervious Surface

An impervious surface data set was created during the initial phases of the tool creation. These data are in GeoTiff format, cover the City of Portland, and have a 6-inch resolution, which was important when identifying Right-of-Way areas for potential plantings. An accuracy assessment of the classification revealed an overall accuracy of 95.6%, with a Kappa of 0.911. These measures provide confidence in determining location where our ‘remotely-sensed’ data prove accurate when compared with on-the-ground conditions.

APPENDIX D: POLICY REVIEW

This phase of the project included analysis of the City of Portland's citywide plans to compile tree-related policies.

METHODS

The following city plans were researched:

- City of Portland *Climate Action Plan*
- City of Portland *2035 Comprehensive Plan*
- City of Portland *Watershed Management Plan*

A basic search of city plans was utilized with a keyword search for the word "tree". The category and a summary of the policy was noted and the policies compiled. See the report for summarized findings.

APPENDIX E: WEBSITE

The website (http://www.branchoutpdx.org) was not used in the formal research findings, however, it did provide a platform for communication, and for interested parties to reach out to Portland's Parks and Recreation Bureau with questions or concerns through the Contact Us form. Additionally, visitors to the site could sign up to receive news and updates from the bureau.