

**URBAN
FORESTRY,
EQUITY, AND
CLIMATE
RESILIENCE
TOOLKIT**



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**PLANNING TODAY FOR
A GREENER TOMORROW**



Masters of the Environment
UNIVERSITY OF COLORADO **BOULDER**

PREPARED FOR THE NATURE CONSERVANCY

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EXECUTIVE SUMMARY

The consequences of climate change are being felt in Colorado. As warming intensifies, climate change will exacerbate socio-ecological vulnerabilities that are already present within urban areas. An example of this is demonstrated by urban heat island inequities. The urban heat island effect is a phenomenon caused by an increased use in impervious surfaces and low albedo building materials (e.g., concrete and pavement) that is progressively amplifying the adverse impacts of extreme heat. In addition, urbanization has increased greenhouse gas emissions and anthropogenic heat production from industrial processes and cooling systems. This, in turn, has cascading negative effects on the environment, public health, and the economy in U.S. cities, which become heightened by the impacts of climate change.

Urban trees are effective nature-based solutions that can mitigate the impacts of climate change while providing numerous social, environmental, and economic benefits. However, due to the inequitable distribution of urban tree canopy that can be attributed to historic discriminatory land use practices, low income and some Black, Indigenous, and People of Color (BIPOC) communities are denied the benefits of trees and face greater vulnerability to the effects of climate change.

To enhance equitable and sustainable outcomes in urban forestry management practices, our four-person, graduate student team researched and conducted qualitative interviews to develop this toolkit with guidance from The Nature Conservancy in Colorado.

This toolkit is designed for the City and County of Denver, however, the recommendations and strategies suggested have the potential to be applicable to cities nationwide. Based on our findings, data analyses, and stakeholder interviews, we outlined strategies to (i) develop and support a citywide vision for an equitable and resilient urban forest, (ii) establish and nurture long-term partnerships with organizations and stakeholders who can help support and implement the city vision and management plan, and (iii) establish and strengthen community engagement and stewardship opportunities.



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About the Team

We are a team of Masters of the Environment (MENV) graduate students at the University of Colorado - Boulder (CU Boulder). As part of our graduate degrees, we worked in partnership with The Nature Conservancy in Colorado (TNC) over nine months to complete this capstone project to provide recommendations to the City and County of Denver regarding urban forestry in the context of equity and climate resilience. Our team worked closely with two TNC program leads and an academic advisor to complete this project. Meet our team:

- Melissa Englund is studying within the Urban Resilience and Sustainability specialization of MENV. She is aspiring to be an urban resilience and sustainability planner post-graduation.
- Lorena Gonzalez is specializing in environmental policy within the MENV program. She is committed to remedying historical wrongs within the environmental sector by advancing environmental and climate justice through policy that centers equity.
- Kiana Seto is a first year MENV student specializing in Urban Resilience and Sustainability. She hopes to pursue a career in sustainable urban planning post-graduation.
- Kayli Skinner is studying Urban Resilience and Sustainability within the MENV program. She is dedicated to building regenerative communities by integrating a holistic approach to climate resilience and urban planning.

The Vision For This Toolkit

The team hopes that the City and County of Denver can use these recommendations and strategies to co-create a vision for equitable and sustainable urban forest management. Our goal is to promote coordination and collaboration across agencies, sectors, and the communities of Denver to attain this vision. We highlight the importance of community-driven resilience planning and developing innovative strategies to strengthen stewardship opportunities. The team hopes that this toolkit may also assist other cities that are committed to enhancing equity and resilience within their own urban forest management practices.



INTRODUCTION

The impacts of climate change are already visible in the Front Range of Colorado. As temperatures continue to rise in U.S. cities such as Denver, the urban heat island (UHI) effect will exacerbate the inequities already experienced by lower income neighborhoods and some BIPOC communities. The urban forest can provide a wide range of ecosystem services and risk mitigation against the impacts of climate change. However, research and geographic information systems show that inequities in urban tree canopy (UTC) distribution are linked to socioeconomic and racial demographic factors. Additionally, urban forest management can span across multiple government agencies, but it is not limited to governmental sectors. Challenges associated with lack of coordination and collaboration in urban forest management can limit the success of urban forest initiatives.

To address the socio-ecological challenges presented in urban forest management, our team of graduate students from the University of Colorado - Boulder partnered with The Nature Conservancy in Colorado (TNC) to develop this toolkit of recommendations for the City and County of Denver regarding urban forestry in the context of equity and climate resilience.

How to Use this Toolkit

The initial sections of this toolkit provide the context of our research, the methodology, and the associated findings from our literature review and qualitative interviews. The recommendations section is divided into three subcategories:

- (i) Develop and support a citywide vision for an equitable and resilient urban forest
- (ii) Establish and nurture long-term partnerships with organizations and stakeholders who can help support and implement the city vision and management plan
- (iii) Establish and strengthen community engagement and stewardship opportunities

Each of these three subcategories are supplemented by specific strategies for the City and County of Denver. These strategies include actionable items and associated case studies to demonstrate how the promising practices are implemented in other cities. Additionally, the team identified gaps and opportunities for further research to improve the outcomes of this toolkit. Our recommendations are summarized within the conclusion section and outlined through a table format. Lastly, we provided supplemental information and additional resources within the appendix if readers are interested in learning more about our data collection and analysis.



BACKGROUND

URBAN HEAT ISLAND AND TREES

The urban heat island effect refers to the phenomenon where temperatures are higher in urban settings compared to rural environments due to the significant use of impervious surfaces and lack of vegetation. As solar radiation is absorbed by low albedo materials, heat becomes trapped and is slowly reemitted back into the surrounding environment, thereby raising local air temperatures. Urban tree canopy coverage can mitigate the impacts of UHIs through the process of evapotranspiration and by providing natural shading through morphological characteristics. Moreover, urban trees can improve carbon sequestration, air quality, water quality, energy efficiency, property values, stormwater management, wildlife habitats, and biodiversity. Numerous studies also have found correlations between urban trees and social, physical, and mental health benefits.

CLIMATE CHANGE IN COLORADO

The effects of climate change are becoming increasingly prevalent in Colorado. The state has warmed an average of 2°F in the last 30 years and 2.5°F in the last 50 years (Colorado Energy Office, 2021). In 2021, Colorado experienced its fourth-hottest summer on record. Out-of-state wildfires sent plumes of toxic smoke across Colorado that mixed with local air pollution, which triggered record-high unhealthy air quality days. The state is also seeing an increase and intensity of flooding, extreme precipitation events, and associated debris flows that have resulted in costly impacts to infrastructure and livelihoods.

Furthermore, current climate models project an increase in drought conditions, reduced snowpack, and earlier snowmelt in the Rockies that will continue to threaten Colorado's water supply and growing season (Masson-Delmotte et al., 2021). All of these factors will continue to adversely impact the economy, public health, air quality, ecosystems, natural resources, and overall quality of life for all who inhabit the state. However, the gravest effects are felt by disproportionately impacted communities. Fortunately, the Colorado Legislature has made tackling climate change a state priority at the capitol. The Colorado Climate Action Plan, House Bill 19-1261, was made into law in 2019 that established statewide greenhouse gas reduction targets of 26% by 2025, 50% by 2030, and 90% by 2050 as compared to 2005 levels. In addition, House Bill 21-1266 was passed in 2021 that requires reductions of greenhouse gas emissions from the oil and gas, industrial, and electric sector. This bill also orders the Colorado Department of Public Health and Environment to prioritize near-term reductions of greenhouse gas and achieve reductions of greenhouse gas and co-pollutants in disproportionately impacted communities.



INTEGRATING THE SOCIAL EQUITY IN URBAN RESILIENCE PLANNING FRAMEWORK

To address the emerging issue of tree canopy disparity, a growing number of cities are incorporating equity into their plans and policies. However, our research and stakeholder interviews revealed that only a small quantity of cities use an equity framework to guide their equity analyses.

For this project, our team used the Social Equity in Urban Resilience Planning framework to assess issues of social equity in our analysis of nationwide urban forest efforts. Refer to **Figure 1** to review the Social Equity in Urban Resilience Planning framework. At the center of this framework are three dimensions of equity that shape the resilience of vulnerable communities and determine whether they are equipped to handle shocks and stressors related to climate disruptions. These dimensions include distributional, recognitional, and procedural equity and are further expanded upon below (Meerow et al., 2019).

Distributional Equity: Defined as equitable access to goods and infrastructure, environmental amenities, services, and economic opportunities (Meerow et al., 2019). This includes the equitable distribution of environmental goods, such as tree canopy, and the associated benefits that environmental services provide.

Procedural Equity: Defined as equitable participation in decision-making processes. This includes public participation in the development of the plan, efforts to increase ongoing public participation in city governance, and targeted outreach to marginalized groups who are often underrepresented in traditional public engagement processes (Meerow et al., 2019). In the context of urban forestry, an example of this could be the creation of neighborhood-level greening efforts that include community members in the processes, planning, and implementation of long-term tree canopy goals.

Recognitional Equity: By definition, this concept: (i) acknowledges the intersecting identities of different community members (e.g., race, gender, class, and age); (ii) recognizes that some of these identities are shaped by historical injustices and can influence individual vulnerability to shocks and stresses, and (iii) fosters respect for different groups (Meerow et al. 2019). In practice, recognitional equity can look like city officials acknowledging the history of redlining as one problem that has led to inequitable UTC and actively identifying pathways towards addressing it.

By using comprehensive and intentional approaches to community-driven resilience planning, practitioners can develop pathways towards achieving more equitable outcomes in the field of urban forestry.



Figure 1. Social Equity in Urban Resilience Planning framework

METHODOLOGY

Research Questions

Our team identified two key questions that guided our literature review, interview process, and the development of this toolkit:

- (i) What promising practices are other cities using to support more equitable urban forestry programs?
- (ii) How can interagency and external collaboration strengthen and clarify the roles and responsibilities involved in urban forestry programs?

Approach

In collaboration with our capstone partner, TNC of Colorado, our team of CU Boulder graduate students co-developed the scope of this research to focus on equity, climate resilience, and clear roles and responsibilities within urban forestry. Simultaneously, a team of CU Denver graduate students were partnered with Design Workshop, a landscape architecture consulting firm, to assist the City and County of Denver in updating their tree-related codes and regulations. Due to a mutual connection, our teams collaborated and shared resources. The CU Denver students and Design Workshop team developed a list of target cities based on their scope and research findings. Our team used this list as a primer to our literature review and added additional target cities that presented promising practices relevant to our scope.

Literature Review and Target City Selection

To identify considerations for promising practices and target cities, our team produced a literature review that examined 178 government documents, journal articles, news articles, and reports. Based on our background research, we highlighted the following criteria for selecting target cities:

- (i) A comprehensive urban forestry strategy or plan, especially if it addresses UTC and establishes quantifiable targets
- (ii) Innovative urban forestry practices and programs
- (iii) Similar climate considerations to Colorado
- (iv) Demonstrates promise in equity, coordination, and/or collaboration within urban forestry

The team selected 15 cities and created a list of potential interviewees from each selected city. To integrate a wide range of perspectives, the team identified stakeholders from city governments, non-governmental organizations (NGOs), consulting agencies, academia, and other key stakeholders.

Outreach and Qualitative Interviews

After identifying potential interviewees, the team initiated the stakeholder outreach phase. We partnered with The Nature Conservancy's "Cities" network, including programs in nearly 25 cities, to leverage existing partnerships in the target cities and reached out to additional stakeholders via email. The interviews were qualitative, virtual, and semi-structured. We prepared a list of questions based on the stakeholder and city interviewed. Generally, these questions examined the topics of equity, tree canopy, collaboration, and climate resilience. In total, we interviewed 53 stakeholders from regions across the United States. The distribution of stakeholder representation is demonstrated in **Figure 2**.

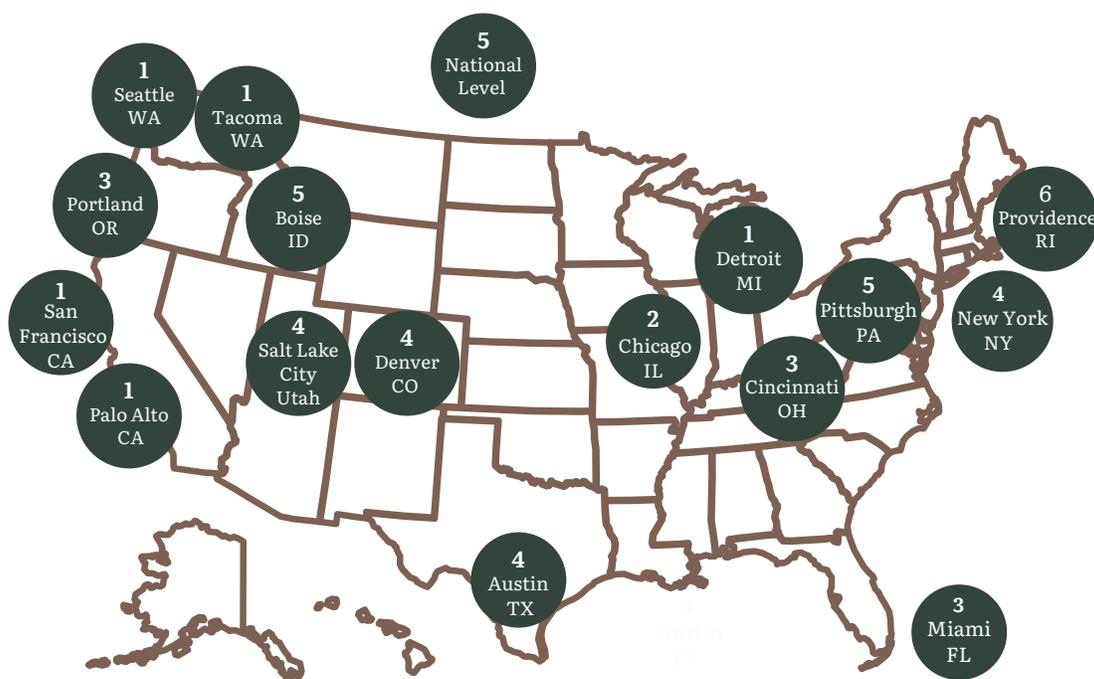


Figure 2. Interviewed Cities and Number of Stakeholder Interviews Per City/Region

A total of **53** stakeholders were interviewed from 15 U.S. cities and national-level organizations. The team interviewed an urban forester from each target city. Other stakeholders included leaders from non-profit organizations that specialize in forestry, urban planners, sustainability and resilience city staffers, community groups, environmental justice organizations, academics, consultants, and more.

Analysis

Each interview was recorded and transcribed with permission from interviewees. Upon concluding our stakeholder engagement phase, we created an interview matrix to identify trends and unique outliers. For additional details on the team's methodology, please refer to the **Appendix**.

FINDINGS

In analyzing the stakeholder interview data, we focused on the practices that best matched the needs of the City and County of Denver which will be discussed in this findings section. The team found that numerous cities are integrating an equity-focused approach to urban forestry programs, practices, and policies. Moreover, our research demonstrates that strong partnerships between a broad range of stakeholders, clear coordination for roles in maintenance, planting, and long-term management contributes to a healthier, more equitably distributed urban forest. Selected target cities present innovative approaches that not only maximize the benefits of the urban forest, but also contribute to a more resilient urban forest in the face of climate change. For a full synthesis of our findings, please refer to the **Appendix**.

DISCUSSION

Our research, literature review, and qualitative interviews findings demonstrate that many major U.S. cities are working towards integrating an equity-focused approach to urban forest initiatives. However, while many cities are planning for equity, there are procedural barriers that limit the effectiveness of community engagement and the implementation of equitable urban forestry projects.

Many of our interviewees acknowledged that historic discriminatory land use practices have contributed to inequities in UTC distribution. Additionally, several interviewees cited concerns regarding displacement associated with green gentrification. A significant portion of interviewees discussed the importance of building trust and rapport within historically disadvantaged communities prior to giving away free trees or addressing UTC inequities. If intentional community outreach and engagement is not prioritized from the start of planning processes, it can result in greater distrust between communities and government entities.

Moreover, our interviews identified additional challenges within urban forest management, which include, but are not limited to, funding, tree maintenance, irrigation (with an emphasis in Western U.S. cities), interagency silos, balancing the pace of development with UTC goals, and tree protections. To overcome these limitations, many U.S. cities are developing promising programs, practices, and policies for equitable and sustainable urban forest management. Based on the team's findings, we developed recommendations and strategies to promote equity and climate resilience within the City and County of Denver's urban forest program.

RECOMMENDATIONS

We identified three overarching recommendations for the City and County of Denver:

- (i) develop and support a citywide vision for an equitable and resilient urban forest,
- (ii) establish and nurture long-term partnerships with organizations and stakeholders who can help support and implement the city vision and management plan, and
- (iii) establish and strengthen community engagement and stewardship opportunities.

Each overarching recommendation has associated strategies and actions suggested to best implement these recommendations. Additionally, examples from cities implementing these recommendations and strategies are also provided throughout.



RECOMMENDATION 1: DEVELOP AND SUPPORT A CITYWIDE VISION FOR AN EQUITABLE AND RESILIENT URBAN FOREST

To initiate and/or strengthen the process of enhancing equity and climate resilience within urban forestry, a citywide vision should be established. Based on the findings from our research, we identified four pertinent areas within this recommendation: (i) developing a comprehensive urban forest vision and management plan or strategy, (ii) creating a task force / coalition to support the development and implementation of an equitable and community-based vision, (iii) create a comprehensive strategy to address and align tree maintenance needs and funding, and (iv) develop and manage urban forestry measures that support community-based equity and resilience.

Strategy 1: Develop a comprehensive urban forest vision and management plan or strategy -

Multiple cities interviewed vocalized how co-developing a comprehensive urban forest management plan significantly helped to align a collective vision and break down inter-agency silos. We recommend that Denver develops a citywide, comprehensive urban forest vision and management plan to enhance coordination and establish community-based tree canopy goals that put all neighborhoods on the path to tree canopy equity. We recommend that this plan and process include participation of diverse, community-based voices from across the city to reflect the broad range of urban forest challenges and opportunities specific to Denver. Hiring an external facilitator or consultant could be explored to better align the community and city vision. The role of a facilitator is especially

important when collaborating between agencies that encounter conflicting priorities. An outside facilitator can also bring a new and potentially neutral perspective to help work through existing problems or ones that may arise during the planning process.

Implementation in Practice: Pittsburgh, PA

In 2012, Tree Pittsburgh, a non-profit organization dedicated to protecting the urban forest, spearheaded an urban forest master plan in collaboration with the City of Pittsburgh, relevant state agencies, environmental consultants, and community members. One of the plan's goals is to create "equitable urban forest benefits," aiming for initiatives such as giving priority of urban forestry efforts to underserved neighborhoods. This plan provides a shared vision for the future of Pittsburgh's urban forest as well as resources needed to effectively get there (Tree Pittsburgh, 2021).

Strategy 2: Create a task force / coalition to support the development and implementation of an equitable and community-based vision - In support of the citywide vision and plan, convening an urban forest task force or coalition that has designated seats for community member representation should be explored. This task force can best align community urban forestry needs and wants with city goals while bringing inter-agency groups together. This can also help uncover potential gaps, blind spots, or conflicts early on by the community and inter-agency parties. Conflicting policies could also be addressed within this task force or committee. Additionally, it helps establish ownership and buy-in for the plan and associated efforts from all parties involved.

Implementation in Practice : New York, NY

The Forest for All NYC coalition unites diverse sectors and organizations that are dedicated to enhancing the urban forest. It includes 43 members from the New York City Department of Parks and Recreation, the New York City Environmental Justice Alliance, the New York City Housing Authority, grassroots groups such as El Puente, and more. The coalition provides guidance to the city and helps ensure the actions outlined in the NYC Urban Forest Agenda are achieved, and get other relevant stakeholders to the decision making table. This dedicated coalition can remedy capacity concerns and ensure sustained progress on the agenda.

Strategy 3: Create a comprehensive strategy to address and align tree maintenance needs and funding - A beneficial step for Denver to take would be creating a comprehensive maintenance strategy that considers the maintenance of trees on all properties, those who might be able to maintain them, and associated barriers and opportunities. Our initial research repeatedly showed the burden and inequality within tree maintenance for low-income, underserved communities, especially when dealing with trees in the ROW where insufficient maintenance of trees can lead to fines. Removing the barrier of maintenance can increase equitable distribution of trees due to residents being more open to having the trees on or near their property (Seo, 2020). Another maintenance challenge was funding, with many urban foresters we interviewed expressing frustration and concern about the lack of funding for tree maintenance

due to it not being seen as appealing or “photo opp. friendly” compared to tree planting. A maintenance strategy could help address these issues. Denver’s potential (and needed) increased planting in underserved areas may create a higher need for maintenance funding in the future, which is why setting up a strategy now could help things run more smoothly in the future.

Implementation in Practice : Pittsburgh, PA

Pittsburgh’s Mayor William Peduto came out with a vision to plant 100,000 trees in the city over the next decade. This past March, Mayor Peduto and the Shade Tree Commission — a quasi-governmental entity that promotes the planting, protection, and preservation of trees within the city — came out with their **Equitable Street Tree Investment Strategy** which aims to apply an equity lens to that vision by annually identifying 10 low-income and low-canopy neighborhoods to target with tree plantings, cyclical maintenance, urban forest educational activities, and employment opportunities (City of Pittsburgh, 2021).



Action: Explore implementing block pruning -

Interviewees from Providence, RI and New York, NY shared the maintenance practice of block pruning. This practice involves maintaining public / ROW trees through a predetermined system of block-by-block routine maintenance instead of relying on 311 calls. Block pruning is considered a more equitable system compared to others, since relying on 311 calls requires individuals to directly contact the city with their concerns and those requests are responded to first. One interviewee further described the problem, saying individuals who already have ties with local government feel more comfortable calling the 311 line, therefore prioritizing tree maintenance concerns in an inequitable way.

Implementation in Practice : Providence, RI

Funded partially by a \$50,000 grant, the City of Providence launched a pilot block pruning program in 2015. Six years in, the city's urban forester reflected that the process has been more equitable than the reactionary 311 process they had before. The city's urban forester said block pruning helps increase efficiency of their maintenance processes due to a decrease in emergency calls and the number of requests to prune trees in general. Providence did face challenges, however. One hurdle was working with unions who had a concern about workload, which they overcame by promising overtime. Another challenge was funding, which Providence overcame through securing grant funding which was matched by a city endowment.

Action: Strengthen and grow local tree organization partnerships -

organization partnerships - In multiple cities interviewed, the city partnered with their local tree organization to effectively leverage each other's resources. Local tree organizations often focus on tree plantings with the community — lightening the planting work for the city — while the city focuses mainly on tree maintenance and associated costs. In Pittsburgh, the local tree non-profit, Tree Pittsburgh, receives funds from the city to help with planting. This ensures the program is sustainable while allowing the city to handle maintenance issues. Similarly, in San Francisco, Friends of the Urban Forest (FUF) works closely with the city's Bureau of Urban Forestry to plant and care for public trees. FUF plants trees and maintains them for up to five years. After five years, maintenance is transitioned to the city's street tree maintenance program. The two complement each other's work since the city's maintenance program does not receive funding for tree planting. Both examples show how a city effectively leveraged the relationship and resources of a local tree organization.



Action: Assess current maintenance funding streams and conduct a financial analysis based on the goals of a comprehensive management plan - We encourage Denver to assess current funding streams and explore aligning funding sources with appropriate needs and opportunities, while exploring opportunities for innovation. This could include tapping into current pools of money for similar initiatives such as the Parks Legacy Fund (2018) and the Climate Protection Fund (2020).

Implementation in Practice : San Francisco, CA
San Francisco's 2015 Urban Forest Plan focused on street trees and provided specific recommendations, goals, and actions aimed at exploring sustainable funding opportunities for the city's street tree maintenance. Part of the actions included a **Street Tree Financing Study** that looked into potential ways to fund long-term maintenance required to continue growing and caring for the urban forest. The results suggested that routine maintenance of street trees is a more effective and efficient approach compared to responding to hazardous tree maintenance upon request. The study showed this could potentially save the city costs in the long term (AECOM, 2013) and provide funding alternatives for the city to pursue.

Strategy 4: Develop and manage urban forestry measures that support community-based equity and resilience - Cities indicated that some tree canopy or urban forest goals established in their plans were not initiated or completed. Typically, these dropped initiatives were not conveyed to the general public. Some of the challenges

include capacity and funding, which is why large and seemingly unrealistic UTC and tree planting goals can face more hurdles than accomplishments. Instead, focusing on communities with the greatest UTC need and developing strategies to accomplish community-based tree canopy goals could be a more effective approach. We recommend that the City and County of Denver develop and manage accountability measures to increase transparency with the general public, show progress and room for improvement, and also to increase communication between interagency sectors and external stakeholders.

Action: Establish neighborhood-level canopy goals, especially for low-canopy areas - To complement the citywide urban vision and plan, the City and County of Denver should work with neighborhoods, especially low-canopy ones, to establish target canopy goals and action plans. The absence of place-based goals can exacerbate disparity because tree planting efforts may go to areas that already have ample tree canopy where it might be easier to plant or are not facing socioeconomic hardships (Garrison, 2019).

Action: Use existing and/or develop tools to support community-based urban forestry - Tracking and analyzing urban forestry efforts is vital to understanding what is working and what areas need improvement. Tools such as American Forests' Tree Equity Score Analyzer (TESA) are one option Denver can consider using to support their forestry efforts. TESA is an interactive planning tool that supports both policy and project-level interventions to achieve Tree Equity — a tool that could be helpful as Denver looks at best next steps for increasing their own tree equity. Denver could also develop and track their own metrics based on local needs.

Action: Report on the progress of the urban forest plan's actions and goals in a routine, transparent, and inclusive manner - Once an urban forestry management plan is established, we recommend creating annual progress reports to showcase the year's accomplishments. In Providence, the annual report produced for their Sustainability Plan also served as a way to break down communication silos with other governmental agencies and partners due to having to communicate on the status of progress. This can also help build trust with the local community by letting them know progress is being made.

Implementation in Practice : Portland, OR

*The “Growing a more equitable urban forest: Portland’s citywide tree planting strategy” was developed after performing rigorous community outreach, “including feedback from **Community Advisory Committee members** and **culturally-specific focus groups**” (Portland Parks and Recreation, 2018). This strategic plan acknowledges that Portland’s distribution of trees is unequal and linked to socioeconomic factors. Portland Parks and Recreation also partnered with Portland State University (PSU) to identify barriers, opportunities, and recommendations to enhance inclusivity in procedural processes while bolstering tree equity (Portland Parks and Recreation, 2018). Additionally, the City of Portland tracks the geographical location of street trees and overlays this data with race and socioeconomic data using GIS software to identify priority areas. The city produces annual urban forest progress reports that highlight accomplishments and guide action*

plans for following years. Portland also updates their implementation strategies within the urban forest action plan on an annual basis based on progress, priorities, and community feedback. Since Portland has a strong community-driven volunteer program, the city is able to expand their tree surveying capacity. This allows the city to develop neighborhood-level canopy goals, especially for low canopy areas.



RECOMMENDATION 2: ESTABLISH AND NURTURE LONG-TERM PARTNERSHIPS WITH NON-CITY ORGANIZATIONS AND STAKEHOLDERS WHO CAN HELP SUPPORT AND IMPLEMENT THE CITY VISION AND MANAGEMENT PLAN

A 2013 study summarizes the importance of partnerships in achieving urban tree canopy goals well by stating, “Independent action is inadequate: no agency, organization, single landowner or business has sufficient funds or land to achieve a city’s [urban tree canopy] goal. Coordination and collaboration are needed and depend upon identifying common or complementary interests, categories of programs, or areas for action” (Locke et al., 2013). This also applies to achieving equity and climate resilience — no one sector can remedy and tackle these issues alone. Our team identified three pertinent areas within long-term partnerships that appear as promising practices: (i) build a network of diverse partnerships, (ii) consider non-traditional/innovative partnerships to collaborate towards common goals, and (iii) explore partnerships that support tree planting and innovative funding opportunities.

Strategy 1: Build a network of diverse partnerships - Achieving an equitable tree canopy in Denver will require a vast, diverse network of partnerships. This network should include various people and organizations, such as community members, non-profits, government agencies, and the private sector.

various public, private, and nonprofit organizations that look to bolster tree canopy through a variety of initiatives. A few of TVCN’s projects include the City of Trees Challenge, Canopy Continuum, and the Urban Wood Network. The City of Trees Challenge integrates a multitude of industry partners, such as nurseries, arborists, supply companies, landscape associations, and more to raise community awareness and strengthen regional urban forest initiatives. Canopy Continuum consists of a partnership between TVCN and Portland State University to monitor air quality, urban heat measurements, and examines the links between environment and public health to guide urban forestry strategies. Lastly, the Urban Wood Network is a program designed to maximize the value of the urban forest by developing a local urban timber industry through effective multi-sectoral partnerships.

Implementation in Practice: Boise, ID
The Treasure Valley Canopy Network (TVCN) located in Boise, Idaho is a strong example of collaborative partnerships that enhance urban forestry efforts and secure diverse funding sources. The TVCN is comprised of



Strategy 2: Consider non-traditional / innovative partnerships to collaborate towards common goals - Increasing tree canopy necessitates a multifaceted approach. Both non-profit tree organizations and city governments shared promising partnerships they established with non-traditional partners, such as partnering with affordable housing and multi-family complexes to address the barrier to obtaining trees in high renter properties. The City and County could explore opportunities to align urban tree canopy goals with affordable housing developments to work towards more equitable canopy distribution and access to tree cover. Additionally, some cities spoke about partnering with local businesses who were interested in supporting tree planting efforts — such as the City of Cincinnati partnering with a local brewery to plant trees in their neighborhood. This not only provides additional funding, but also draws attention to the importance of trees within communities. In Denver, this could look like partnerships with culturally robust and community relevant businesses or nonprofits addressing environmental injustices.

Implementation in Practice : Seattle, WA

The Seattle Housing Authority partners with the City of Seattle to encourage more trees within affordable housing developments. The partnership also helps facilitate conversations with the residents about the benefits of urban trees through tree walks and youth group activities. Through this partnership, both parties achieve their common goals of addressing urban tree inequity and bringing trees and their benefits to people who need it the most.

Strategy 3: Explore partnerships that support tree planting and innovative funding opportunities - During our research and interviews with stakeholders, there were examples of partnerships across all sectors to increase tree plantings. In the City of Cincinnati, the local government partnered with the non-profit Groundwork around tree plantings to reach Groundwork’s main goal (addressing environmental injustice) while also addressing the city’s main goal (reaching their sustainability plan goals). Potential partnerships in Denver could take shape in various ways. One example of an optimized partnership could be with Xcel Energy. The City of Grand Junction has already received a \$4,000 grant from the Xcel Foundation for tree planting in 2021 (City of Grand Junction, 2021). The City and County of Denver could explore if a similar partnership is feasible, especially around increasing tree planting in the inverted L neighborhoods.

Implementation in Practice : Boise , ID

The Shade Tree Project is a partnership between TVCN, Idaho Power Company, Idaho Department of Lands, and the Arbor Day Foundation’s Energy Saving Trees program that is designed to encourage shade tree plantings for energy conservation. This program provides free shade trees to Idaho Power Company customers and includes a tool that estimates energy savings based on where the tree could potentially be planted. To date, the program has given out over 13,000 shade trees on residential properties throughout the Treasure Valley in Idaho (Treasure Valley Canopy Network 2021).

RECOMMENDATION 3: ESTABLISH AND STRENGTHEN COMMUNITY ENGAGEMENT & STEWARDSHIP OPPORTUNITIES

A major theme that emerged in stakeholder interviews is that much more must be done to adequately engage and include communities in the planning, design, and implementation of urban forest initiatives. This can help ensure that decision makers provide services and solutions that are better suited to people’s needs, which is critical among residents who lack political, economic, and social capital to engage in the same ways that others can. When given the opportunity to have input into decisions that affect their daily lives, community members are more committed and empowered to get involved in the difficult work of making their community better after the planning process ends (Lachapelle, 2008).

The following section outlines four key strategies within this area: (i) operationalize best practices for engaging communities from underserved neighborhoods, (ii) use a multi-pronged approach to community engagement in the development of an urban forest management plan, (iii) continue to develop and support equitable pathways to green careers, and (iv) cultivate relationships with private property owners to promote planting and stewardship in under-resourced neighborhoods. These recommendations heavily draw from stakeholder interviews and the recently passed legislation House Bill 21-1266 that codified best practices for engaging disproportionately impacted communities in Colorado.

Strategy 1: Operationalize best practices for engaging communities from underserved neighborhoods - The vast majority of stakeholders indicated that healthy, thriving, and equitable communities require engaged community members. But due to the uneven distribution of power, resources, and bandwidth,

not all communities have access to the same opportunities for public participation as others.

Charting a path towards effective community engagement means that decision makers must first work to overcome procedural barriers to engagement. For that reason, it is imperative that these best practices transcend barriers related to power, feelings of distrust, language, and competing demands for time and attention. These best practices include:

- Acknowledge the inequity of power and resources that underserved communities hold in Denver and commit to redress harmful government processes of the past.
- Establish strong working principles to help prevent uneven power conflicts when engaging with stakeholders, such as the Jemez Principles for Democratic Organizing (please refer to **Table 1**).

Table 1: Jemez Principles for Democratic Organizing

Jemez Principles for Democratic Organizing

On December 6-8, 1996, six "Jemez Principles" for Democratic Organizing were adopted by participants of the "Working Group Meeting on Globalization and Trade" in Jemez, New Mexico. The meeting was hosted by the Southwest Network for Environmental and Economic Justice with the intention of establishing common understandings between participants from different cultures, politics and organizations. These principles are a pillar of environmental justice that lay the foundation for successful collaboration and movement-building.

- 1. Be Inclusive**
- 2. Emphasis on Bottom-up Organizing**
- 3. Let People Speak for Themselves**
- 4. Work Together in Solidarity and Mutuality**
- 5. Build Just Relationships Among Ourselves**
- 6. Commitment to Self-Transformation**

- Share power by co-creating solutions based on community needs.
- Engage with communities through open and transparent processes that clearly articulate how public input will inform decision making.
- Compensate community members for their time and participation in committees, the development of urban forest management plans or other large-scale local government urban forest plans.
- Use a variety of methods of outreach and ways to promote urban forestry action, including disseminating plain-language information in non-traditional places such as schools, clinics, local stores, civic groups, community-based groups, and other local services.
- Translate public-facing physical and digital outreach materials and provide interpretation during public meetings in the relevant language of the community.
- Schedule public engagement opportunities at various times of the day and days of the week, including one weekend time and one evening time. Provide several methods for communities to give input, such as in-person and virtual meetings, online comment portals or email.

Implementation in Practice: Austin , TX

The Austin Climate Equity Plan was developed in September 2021 with support from the City's Equity Office to ensure Austin meets the goals in the 2015 Climate Action Plan (CAP) in an equitable manner.

*The city piloted the **Community Climate Ambassador Program** as a way to reach the city's historically underrepresented groups whose voices were previously left out of citywide plans (City of Austin, 2020). The program sought out applicants from underrepresented communities who would be*

*paid to talk to their friends and neighbors about climate-related issues in order to identify challenges, barriers, and opportunities to engage in climate action work. To create a safe space where participants could feel comfortable openly expressing their opinions, meetings and interviews were facilitated by the ambassadors without city staff present. Through these meetings and interviews, the ambassadors identified key community priorities that are now **reflected in the goals and actions of the Equity Plan.***

Strategy 2: Use a multi-pronged approach to community engagement in the development of an urban forest management plan - Cities that are well underway with incorporating equity into their planning processes underscored the importance of employing new tools and strategies to engage community members who have been traditionally left out of planning decisions. During interviews, non-city stakeholders overwhelmingly reported that conventional approaches have been limited in their effectiveness at reaching broad and diverse community members.

Action: Adopt creative engagement actions that are responsive to the diverse needs of the community - This could include the following:

- Contract a third party cultural equity facilitator to build psychological safety and help communities engage openly and meaningfully.
- Advertise online surveys on print materials at public places and on social media in the relevant languages of the community.
- Partner with community artists to create creative placemaking spaces.

- Host pop-up events in different neighborhoods to meet communities where they are.
- Hold community focus groups to support a psychologically safe, smaller group setting that may enhance participation.



Image source: SLC Public Lands Master Plan Engagement Window #1 Summary Report

Implementation in Practice: Salt Lake City, UT

*Salt Lake City has foregrounded equity as a core value in its community-driven “Reimagine Nature” Public Lands Master Plan that includes its urban forest. Slated to be released at the end of 2021, the plan includes three community engagement windows in its development process. Over 7,000 “intercept interviews” were conducted by the city in the second community engagement window by way of ice cream and food truck pop-up events and snack bike trailers stationed along trail sides. The city also hosted focus groups with community councils that provide services to underserved populations. The city reported that **intercept interviews were hugely successful at reaching more diverse respondents** compared to an initial online survey that reached respondents who were overwhelmingly white.*

Strategy 3: Continue to develop and support equitable pathways to green careers - With the Denver Office of Climate Action, Sustainability and Resiliency’s recent \$2.1 million investment in creating green careers in clean energy, there is an opportunity for the city to continue developing a green workforce that extends beyond the clean energy industry. Hiring local talent for tree maintenance and other urban forest work presents an opportunity to advance equity and create living-wage jobs for underserved communities who often face barriers to employment. It can also help diversify the urban forest workforce, since BIPOC are severely underrepresented in the field (American Forests, 2021). Research also shows that job training and mentorship in urban forestry bolster economies, improve health and wellbeing, and can create a new wave of environmental stewards who otherwise may not have had the exposure to this field (Vibrant Cities Task Force, 2011). During interviews, cities shared that workforce development programs can fill gaps in maintenance needs such as watering and, in some cases, pruning city trees. The City and County of Denver could continue to expand their investment and opportunities for equitable pathways to green careers, specifically related to urban forestry.

Action: Support local organizations that already have workforce training or are in the process of developing new programs - *We recommend that the City and County of Denver continue to support local organizations that already have workforce training or are in the process of developing new programs related to urban forestry. Denver could explore how to best collaborate with these organizations to maximize the partnership and determine what the partnership would look like in practice. Furthermore, the city could explore the feasibility of utilizing participants of these programs into city tree maintenance work.*

Implementation in Practice: Detroit, MI

The Greening of Detroit has a certified Federal Apprenticeship Program through the U.S. Department of Labor. The nonprofit offers two training programs: Certified Landscape Technician and Certified Tree Artisan. The program welcomes individuals with barriers to entry into the workforce including felony convictions. The Greening of Detroit also has a Green Corps summer youth program that exposes urban youth to careers related to science and urban forestry. The youth corps is involved in watering trees planted by the organization as well as other enrichment activities such as standardized test preparation and financial literacy.

Various stakeholders noted in their interviews that an increase in time and resources for tree canopy education can help cultivate a sense of collective pride and ownership of neighborhood tree canopy. Furthermore, Denver is uniquely positioned to leverage the resources from the Climate Protection Fund to build climate resilience that is community-led and helps strengthen the economic foundation of those communities. Ultimately, this can help Denver build a new type of mutually beneficial relationship with the community and help alleviate possible concerns with participating in local government initiatives.

Strategy 4: Cultivate relationships with private property owners to promote planting and stewardship in under-resourced neighborhoods-

Denver's local government manages between 13 to 15 percent of the city's canopy and the rest falls on the shoulders of private property owners (Sach, 2021). Since a substantial percentage of plantable space for urban trees is located on private property, promoting tree planting and stewardship among property owners is crucial to the future of the city's urban forest.

Action: Partner with local community organizations to understand the challenges, values, needs, and opportunities related to the urban forest across Denver -

Denver could deepen partnerships with local, community-based organizations as a first step to start building trust and rapport with private property owners. Partnering with local organizations with strong existing social ties can provide an "in" with the community and a basis for understanding community values and needs.

Implementation in Practice: Tacoma, WA

The Tacoma Mall neighborhood in Tacoma, Washington has one of the lowest tree canopy densities in the city. The City of Tacoma, in partnership with The Nature Conservancy of Washington, is conducting a long-term monitoring project around the public health impacts of increased green infrastructure in the Mall neighborhood using a combination of air quality and temperature sensors and resident surveys. Additionally, the Urban Forestry Department partnered with the city's arts office to develop two public art installations in the Mall neighborhood as a way to engage the community in greening projects and tree planting in the area. A panel of community members will choose from local artists who will then create unique artwork for the initiative.



Image source: Tacoma Murals Project

Action: Enhance at-risk tree maintenance program and free tree giveaways by building trust with communities - In 2021, the Office of the City Forester established the Denver Forestry Neighborhood Initiative for the purpose of pruning or removing trees that pose a risk to public safety. It also functions to plant trees in the public right-of-way, as space allows. Property owners who are eligible for a free tree or for tree maintenance receive mail correspondence from the Office of the City Forester that details the service they qualify for and how to claim them. But a recent article from a local news source shows that the office only gets a 40 percent response rate (Sachs, 2021). While we acknowledge that this is the first year of the program, we recommend that Denver prioritize trust-building initiatives to increase that response rate. By doing this, Denver can ensure that all community members can benefit from these programs, not just the well-resourced communities who may feel most comfortable interacting with the government.

Moving at the Speed of Trust

Cities including Salt Lake City and Detroit cited instances of residents from underserved communities declining tree maintenance assistance and sometimes even refusing city-sponsored free trees. Some interviewees attributed this to a lack of education on the benefits of trees and the absence of established trust between local government and residents.

Our research and interviews suggest that city initiatives that encompass maintenance for at-risk trees and free tree giveaways may only find success after decision makers establish trust with private property owners and have a positive presence in the community. While not an exhaustive list, the actions outlined in this section could help Denver build a strong foundation of trust with underserved communities.



Image source: Greening of Detroit

Our team set out to answer two questions that guided the creation of this toolkit: What promising practices are other cities using to support more equitable urban forestry programs? How can interagency and external collaboration strengthen and clarify the roles and responsibilities involved in urban forestry programs? Based on our extensive literature review and 53 stakeholder interviews, we developed these recommendations that are summarized below.

We foresee many positive outcomes from implementing the recommendations listed within this toolkit. First, urban forestry is complex and looks different in every city — there are a lot of organizations and agencies involved, which makes breaking down silos important. With improved collaboration between city agencies and external partners, we hope to see silos around urban forestry broken down through more effective communication and an increase in overall engagement from city agencies and the community at large. Second, Colorado just experienced its fourth hottest summer on record in 2021 and current climate models project higher frequencies of days over 95°F by the turn of the century (Sakas, 2021). If we hope to make streets safe and usable during these extreme heat events, we need to consider incorporating nature-based cooling that can reduce detrimental public health impacts. Ideally, urban trees would be prioritized and seen as valuable and important infrastructure that enhance the city's climate resilience, especially considering the roles of trees in extreme heat abatement, air quality, carbon sequestration, stormwater management, and energy conservation. Some of the promising initiatives we saw in other cities were increasing tree canopy along transit corridors,



utilizing urban trees in green infrastructure, and linking climate policies to urban forestry projects. Lastly, in the long-term we hope to see a strong network of diverse stakeholders that support sustainable and equitable urban forestry practices. Equitable urban forestry initiatives require sharing power with community members who lack it, dedicating adequate time and funding to community education and engagement, and allocating sufficient resources to properly care for trees.

Denver has an opportunity to set the bar high as a national model for community-based, equitable climate resilience. With Denver's recent planning efforts, the passage of the Parks Legacy Fund and the Climate Protection Fund, and the local and national renewed focus on the urban forest, the time is ripe for action. The planning Denver does today will lead to a greener, more equitable tomorrow.

Recommendations	Strategies	Actions
Develop and Support a Citywide Vision for an Equitable and Resilient Urban Forest	Develop a comprehensive urban forest vision and management plan or strategy	Explore the option to hire an external facilitator or consultant to align a collective vision between the community and the city.
	Create a task force / coalition to support the development and implementation of an equitable and community-based vision	Ensure community seats on task force / coalition.
	Create a comprehensive strategy to address tree maintenance needs and funding	Explore implementing block pruning.
		Strengthen and grow local tree organization partnerships.
		Assess current maintenance funding streams and conduct a financial analysis based on the goals of a comprehensive management plan.
	Develop and manage urban forestry measures that support community-based equity and resilience	Establish neighborhood-level canopy goals, especially for low-canopy areas.
		Use existing and/or develop tools to support community-based urban forestry.
Report on the progress of the urban forest plan's actions and goals in a regular, transparent, and inclusive manner.		
Establish and Nurture Long-Term Partnerships with Non-City Organizations and Stakeholders Who Can Help Support and Implement the City Vision and Management Plan	Build a network of diverse partnerships	Include various people and organizations, such as community members, non-profits, government agencies, and the private sector.
	Consider non-traditional / innovative partnerships to collaborate towards common goals	Partnering with local businesses, culturally robust organizations, affordable housing units, multifamily properties, etc.
	Explore partnerships that support tree planting and innovative funding opportunities	Consider partnership with Xcel Foundation / Energy, etc.
Establish and Strengthen Community Engagement &	Operationalize best practices for engaging communities from underserved neighborhoods	Acknowledge the inequity of power and resources that underserved communities hold in Denver and commit to redress harmful government processes of the past.
Stewardship Opportunities		Establish strong working principles to help prevent uneven power conflicts when engaging with stakeholders, such as the Jemez Principles for Democratic Organizing.
		Share power by co-creating solutions based on community needs.
		Engage with communities through open and transparent processes that clearly articulate how public input will inform decision making.
		Compensate community members for their time and participation in committees, the development of urban forest management plans or other large-scale local government urban forest plans.
		Use a variety of methods of outreach and ways to promote urban forestry action, including disseminating plain-language information in non-traditional places such as schools, clinics, local stores, civic groups, community-based groups, and other local services.
		Translate public-facing physical and digital outreach materials and provide interpretation during public meetings in the relevant language of the community.
		Schedule public engagement opportunities at various times of the day and days of the week, including one weekend time and one evening time. Provide several methods for communities to give input, such as in-person and virtual meetings, online comment portals or email.
	Use a multi-pronged approach to community engagement in the development of an urban forest management plan	Contract a third party cultural equity facilitator to build psychological safety and help communities engage openly and meaningfully.
		Advertise online surveys on print materials at public places and on social media in the relevant languages of the community.
		Partner with community artists to create creative placemaking spaces.
		Host pop-up events in different neighborhoods to meet communities where they are.
Continue to develop and support equitable pathways to green careers	Hold community focus groups to support a psychologically safe, smaller group setting that may enhance participation.	
	Support local organizations that already have workforce training or are in the process of developing new programs	
Cultivate relationships with private property owners to promote planting and stewardship in under-resourced neighborhoods	Partner with local community organizations to understand the challenges, values, needs, and opportunities related to the urban forest across Denver.	
	Enhance at-risk tree maintenance programs and free tree giveaways by building trust with communities.	

Further Research and Emerging Innovations

There are a number of gaps in our knowledge around urban forestry at the intersection of equity and climate resilience that would benefit from further research. We anticipate these gaps as potential barriers to reaching desired outcomes, and also important areas of research that we were unable to fully address within our work due to time constraints and limited literature on some research topics. Additionally, a number of promising innovations related to climate resilience and green infrastructure were identified throughout our research. Our team determined that they were not within the scope of our final recommendations, but some innovations are integrated into the list below. Further research topics and notable emerging innovations include:

Explore the Potential of Transitioning to Municipal Maintenance of Right-of-Way Tree

In 2016, San Francisco passed Proposition E which allocated money from the city's general fund to create a street tree maintenance program. According to our research, this is one of the only recent examples of a city transitioning right-of-way tree maintenance. We were interested in learning more about San Francisco's process from initiation to completion, including a Street Tree Financing Study that helped assess the feasibility of this funded program. For the City and County of Denver, we believe this is a strategy worth exploring, especially considering tree maintenance is a large financial barrier for underserved communities. Since adjacent property owners are responsible for maintaining trees and sidewalks in the public right-of-way, private property owners may encounter significant costs related to tree root growth causing damage to sidewalks and other required tree maintenance. During this research, the city could also consider whether providing tree maintenance contracts for local, small businesses promotes economic activity and supports small businesses.

Green Gentrification

Green gentrification was repeatedly brought up in our research and acknowledged as a major problem by many of our interviewees. No stakeholders interviewed had a specific solution and few were in the preliminary stages of developing policies and other initiatives to address the issue. A combination of anti-displacement tools and equitable green development practices, such as tenant protections and inclusionary zoning, are starting points for developing effective policies. Newly developed toolkits such as Greening in Place and Policy and Planning Tools for Urban Green Justice are also useful guides to strategy development (Gibbons et al., 2020; Oscilowicz et al., 2021). While literature around effectively mitigating gentrification is limited, some researchers note that the solution lies in involving community members in every stage of the planning and implementation of new green infrastructure projects (Hart et al., 2019). Even so, approaches to mitigating the effects of green gentrification vary depending on geographical context, and there is no one size fits all solution. Further research is needed to aid practitioners in the process of initiating green projects without resulting in the displacement of the very people they are trying to serve.

Complete Streets and Planting Along Transit Corridors

Researchers suggest that tree planting initiatives should be concentrated along public transit corridors to provide cooling relief for transit users (Georgetown Climate Centers, 2021). Many individuals who rely on public transit also reside in neighborhoods that lack adequate tree canopy and are vulnerable to heat-related illnesses. To address this, trees can thoughtfully be integrated into the streetscape through Complete Streets designs. Complete streets are "streets designed and operated to enable safe use and support mobility for all users" (U.S. Department of Transportation, n.d.). This strategy can improve pedestrian safety by providing shade along pedestrian and biking corridors. This is critical in communities with high transit ridership to ensure people can safely travel to bus stops even during extreme heat events. Denver has recently updated their Complete Streets guidelines and could continue to build off these designs.

This makes it challenging to quantify true progress in achieving the procedural and recognition dimensions of equity that are also critically important in advancing tree equity. Furthermore, our interviews and research suggest that empowering communities to shape metrics related to equity could be a way to encourage more engagement, give them the opportunity to define what success looks like, and ultimately get community-buy in for urban forest projects. We recommend that the city continue to explore the development of equity metrics and effective accountability measures to ensure they meet objectives related to equity.

Carbon Credits

Several interviewed stakeholders referred to carbon credit programs as an important tool to offset carbon emissions and finance urban tree efforts. A number of cities specifically spoke about City Forest Credits, a nonprofit carbon registry that manages carbon and impact standards for metropolitan areas in the U.S., although most were only in the beginning stages of integrating this strategy into their city's work. We recognize that carbon credits are a growing field, and if Denver is not already pursuing a similar approach, City Forest Credits could be a beneficial program to further explore, especially considering its focus on human health, social equity, and environmental impact standards. Moreover, a carbon credit program could secure diverse funding sources to support urban forest initiatives. Some cities that are using the City Forest Credits verification process include Boise, Austin, and King County in the Puget Sound region.

Stormwater Management

Street trees can play a significant role in stormwater management and may complement the city's strategy for green infrastructure. Some cities, such as the Puget Sound region, have invested in developing interdisciplinary handbooks that highlight the benefits of urban trees, strategies for linking UTC to stormwater management, and opportunities for interagency collaboration (Better Ground, 2021). For drought-struck areas, proper stormwater management can help communities meet their future water needs.

Moreover, stormwater management is linked to social inequities. Stormwater contamination and mismanagement disproportionately impacts underserved communities due to the high percentage of impervious surfaces and pollution in these areas. If stormwater cannot be captured or diverted, it results in flooding. If there is a lack of green space or adequate infrastructure, the stormwater is left contaminated and it may result in damage to electricity, property, restrict access to public services, and expose residents to harmful toxins and bacteria (Aboelata and Yañez, 2021). As such, we recommend exploring the potential for coupling urban trees with other understory vegetation and amended soil to reduce stormwater runoff and enhance water quality (Better Ground, 2021).

Suspended Pavement Systems

To enhance the health and growth of urban trees, Denver could explore the use of suspended pavement systems. Suspended pavement systems, such as Silva Cells, increase the amount of available soil volume by constructing underground bioretention systems within constricted urban spaces. The open interior design optimizes the spread of root systems and water infiltration. The greater the root system, the larger and healthier the tree can grow, thus enhancing interception and evapotranspiration as well. Some suspended pavement systems can further improve water quality by incorporating a biofiltration system (Hunter, 2021). While suspended pavement systems are costly, many cities have recognized the value in investing in this infrastructure.

Equity Performance Metrics/Indicators

Our research and stakeholder interviews revealed that equity metrics for urban forestry have yet to be fully understood and adopted in the field. While many cities already track the (in)equitable distribution of UTC, other metrics to assess community leadership opportunities or social and economic impacts related to urban forest efforts are lacking.

Research Challenges and Limitations

Our research process presented various challenges that included the project timeline, our team's capacity, and scheduling interviews. Reaching interview candidates and scheduling meetings during the summer months was challenging and this may have contributed to the difference in stakeholders interviewed in each city. Interviews ranged from 30 minutes to one hour. Due to this, interviewees were not always asked the same set of questions. In shorter interviews, for example, our team prioritized the stakeholder's focus area instead of covering the issues broadly. It should also be noted that each interview varied based on the stakeholder's role and the target city. Furthermore, some of our questions were intentionally designed to gain additional insights on best-in-class implementation techniques for specific programs, partnerships, and policies. As a result, the data presented in the findings and results section does not accurately represent all of the concerns or promising practices shared by interviewed participants. Instead, we note the frequency count of each referenced theme.

Challenges and Barriers in Urban Forest Management

To improve the outcomes of urban forest initiatives, the team identified common challenges and barriers in urban forest management. A few key themes are highlighted below.

Funding & Maintenance

Budget cuts, changes in leadership, and shifting priorities may impact funding availability. City-wide tree maintenance requires substantial funding and changes in funding can negatively impact the overall health of the urban forest by reducing the funding available for routine maintenance such as hazardous tree removal.

Maintenance responsibilities for urban trees often vary by where the trees are located (e.g., public property, private property, etc.) as is the ability and expertise of people responsible for maintaining urban trees. In many municipalities, adjacent property owners are responsible for maintaining trees and sidewalks in the public right-of-way (ROW). However, this can pose barriers for urban residents due to the additional financial burden lower income property owners may face with expensive maintenance costs. The path forward must both alleviate these financial burdens as a matter of equity and ensure that trees still get the care they need for their survival.

Equity-Focused Efforts & Tracking Progress through Metrics

Embedding equity into urban forestry practices is a relatively new principle in the field. While various cities are charting a path towards centering equity in urban forestry, many practices and initiatives are in the planning vs. implementation phase. Stakeholders indicated that achieving true equity goes beyond putting words on a paper and implementing the strategies and actions that have the potential to change the living conditions of those on the margins of society.

Additionally, standardized equity metrics that fully capture the impact of local urban forestry efforts are absent from the majority of cities. Metrics tracking the (in)equitable distribution of UTC are primarily used by cities, but other metrics to assess community leadership opportunities or social and economic impacts are lacking. This makes it challenging to quantify true progress in achieving the procedural and recognitional dimensions of equity.

Enforcement & Accountability

Many cities have urban forest management plans and tree protection ordinances, but there are barriers to implementation and enforcement. This may include a lack of staff, funding for staff, conflicting interests within city agencies, or no accountability measures if UTC goals or projects are not achieved. There is also often a lack of enforcement on the regulations requiring tree care for private citizens and property owners. This lack of enforcement is often because of limited resources to help lower income property owners, potential political pushback, and other socio-ecological factors that can reduce the overall health of the urban forest.

Climate Change

Rising temperatures linked to climate change will impact urban forestry management strategies and how cities approach their current and future tree inventory. While many cities aim to increase biodiversity and resilience within their urban forests, they also must prepare for drought conditions, invasive pests, and extreme weather events.

Stewardship & Engagement

Stewardship and care for urban trees is a shared responsibility. Although cities and nonprofit organizations play an important role in urban forest management, community members and property owners are also pivotal in maintaining the health of the urban forest.

However, there is a lack of widespread educational awareness about the benefits of trees, risk factors (e.g., falling trees), and maintenance requirements among community members. Without having this foundation of understanding, community members may be less likely to be engaged or show support for urban forestry initiatives. There are also few models of (and rarely funding for) compensating community members to maintain the urban forest, especially in areas of public interest (e.g., the public right-of-way, not private property).

Silos & Lack of Collective Vision

Municipal governments and partners often face competing responsibilities and priorities for managing city infrastructure, which often leads to a lack of a shared vision and challenges coordinating resources to manage the urban forest.

Available Planting Space

Not all available land in cities is suitable for trees. For many U.S. cities, physical space available for trees and/or soil health may be a challenge. The available planting area may be concentrated on private property, which poses another challenge for government agencies around tree planting and maintenance strategies. The soil may not be suitable for growing trees. Both cases present challenges to increasing tree canopy in areas that need it most.

Green Gentrification

New research shows that greening projects in historically underserved communities can be associated with gentrification. The rising cost of living as a result of greening can displace long-time residents, despite initial intentions to improve the built environment for the benefit of current residents (Jelks et al. 2021).

Promising Programs and Practices in Urban Forestry Management

Based on the team's findings from the literature review, we designed a list of promising programs practices within urban forest management to guide the qualitative interviews. Key points are outlined below.

Multi-Sectoral Partnerships

Interagency coordination and external collaboration are essential components to effectively managing the urban forest. Developing partnerships between NGOs, community groups, and additional stakeholders can enhance urban forestry efforts through collaborative tree planting initiatives. Hosting regular meetings, seminars, workshops, and additional coordination techniques can reduce overlap between external entities. Planners, politicians, and relevant stakeholders should encourage knowledge sharing between departments and partake in collaborative training events to strengthen relationships between agencies. Urban forestry and climate equity should be integrated in cross-sectoral planning efforts to ensure longevity and resilience.

Assess UTC Distribution & Spatial Connections

A common promising practice for advancing equity within a city or town's urban forestry program is collecting data to identify: (i) if there is a need for increased tree canopy (e.g., identifying the disproportionate concentration of environmental burdens vs. amenities in communities), (ii) if so, where the need for increased tree canopy is, and (iii) the severity of the need (e.g., a neighborhood with 7% coverage would potentially be at a higher severity need of tree coverage than a neighborhood with 15%).

Urban Forestry Commission/Task Force

Establishing an Urban Forestry Committee or Advisory Council could help guide decision making, planning, advocacy, and outreach efforts. Numerous cities have developed Urban Forestry Councils composed of diverse knowledge experts, social justice groups, and community members that promote interdisciplinary approaches to urban forestry governance.

Demonstrate Coordination for Roles & Responsibilities in Urban Forest Management

Clearly identifying the various roles and responsibilities related to urban forest management improves coordination between agencies, NGOs, and other organizations to maximize efficiency and ensure that efforts are complementary rather than conflicting.

Social Equity in Urban Resilience Planning Framework

While cities are increasing their efforts to enhance resiliency, critics argue that the urban resilience agenda inadequately addresses social equity and benefits remain inequitable (Meera et. al., 2019). According to research, incorporating an equity framework into urban forest projects can be one way to improve equitable outcomes. An equity framework can be used to critically analyze the intended and unintended impacts of urban forest efforts and help departments create solutions that address present and future disparities. One of the frameworks that we used for the purpose of this project is the Social Equity in Urban Resilience Planning framework that was designed to assess urban resilience planning efforts and the inclusion of social equity considerations, namely the distributional, recognition, and procedural dimensions of equity (Meerow et al., 2019). Urban forest departments can use frameworks like this one to ensure they are holistically addressing disparities and achieving equitable outcomes.

Develop Equitable Pathways to Green Careers

Maintaining and growing a city's urban forest is an ongoing process that requires a variety of skilled workers (urban forester(s), maintenance crews, etc.). Hiring local talent for tree maintenance and urban forestry work presents an opportunity for cities to involve local community members in the creation of sustainable green jobs related to urban forestry, from tree planting to routine maintenance.

Interagency Collaboration Towards Common Goals

Co-developing a collective vision for urban forest related plans and projects can enhance the outcomes of urban forest initiatives. When multi-sectoral government agencies collaborate towards common goals (e.g., co-creating solutions for tree related sidewalk damage or co-developing tree related codes and ordinances) urban forest efforts can become more coordinated, and conflicts can potentially be avoided.

Comprehensive Climate Resilience Planning

Integrating urban forest efforts into comprehensive climate resilience planning (e.g., stormwater management, heat abatement strategies) can help cities achieve UTC goals. Additionally, co-creating plans with multi-sectoral agencies can improve coordination and collaboration in urban forest management practices.

Urban Forestry Policies & Ordinances

Tree preservation ordinances can provide insight on how a municipality values the social, economic, and ecosystem services associated with the urban forest (Lavy and Hagelman, 2019). By integrating tree related ordinance regulations and standards into the city code, a municipality can balance the pace of development with UTC goals.

Equity Performance Metrics/Indicators

Establishing equity performance metrics and or indicators can help track the long-term success of projects. A promising practice is to link tree canopy goals to current equity goals in other community plans, such as utilizing tree canopy to assist in energy-related equity goals (Daley, 2020).



Promising Practices from Target Cities

Our interviewees emphasized the importance of building and maintaining long-term partnerships with external stakeholders. Some cities are developing networks of partnerships that span across government agencies, non-profit organizations, and private sectors to strengthen urban forest initiatives. Additionally, cities are establishing urban forestry commissions, councils, or task forces to bolster coordination, collaboration, and advocacy for the urban forest. These groups can bring together relevant community stakeholders that can guide strategic design, inform policy, and raise awareness for funding purposes.

To balance the pace of development with UTC goals, many interviewees noted the significance of tree-related ordinances and protections. Some cities are co-creating ordinances with additional interagency groups, such as planning, sustainability, transportation, or utility bureaus. Several interviewed cities hire external consultants/facilitators to align equity and/or sustainability goals. This allows cities to balance power between different agencies when developing a citywide vision for the urban forest. Moreover, having an equity specialist can ensure that policies and strategies produce beneficial outcomes for historically disadvantaged communities.

Several interviewed cities have comprehensive urban forest management plans that establish quantifiable targets on a neighborhood scale. Some cities are producing annual reports that demonstrate community-level progress. In addition, cities are integrating urban forest initiatives within other city plans, especially in relation to climate resilience. Finally, a few cities are adopting formal social equity frameworks designed for policy and strategies. This practice allows city leaders to orient their plans around equity rather than having it be an afterthought. Refer to **Figure 3** to review the frequency distribution of referenced promising practices from interviewed cities.

Promising Programs from Target Cities

Nearly all of our interviewees cited the benefits of developing long-term partnerships with NGOs to enhance equity and city-wide UTC. Establishing partnerships with external entities allowed city leaders to broaden their impact and enhance relationship building within historically disadvantaged communities. Developing interagency collaborative projects promoted coordination and a breakdown of silos within urban forest management. Additionally, these projects allow different agencies to address conflicting interests and design strategies to overcome challenges, such as sidewalk management, planting along transit corridors, or co-creating ordinances.

Many cities are developing education programs that teach residents how to care for urban trees, such as pruning techniques. Interviewees cited that free tree giveaways allow the city to enhance the equitable distribution of UTC, especially if they target areas that lack adequate canopy. However, some cities noted that free tree giveaways should be coupled with educational materials to ensure the trees survive. Moreover, some interviewees recommended culturally-competent techniques to improve community engagement in low canopy areas.

Additionally, some interviewees noted the benefits of partnering with NGOs to increase the effectiveness of tree giveaways, particularly when trust and rapport is required. Other cities utilize their partnerships with NGOs to provide maintenance assistance for the first two to three years after the tree is planted. Many urban foresters stated the value of cities being responsible for the maintenance of street trees rather than placing the burden on adjacent property owners. Property owners may be unaware of the responsibility that comes with trees, or they may not know how to properly care for them. Furthermore, socioeconomically disadvantaged communities may not be inclined to plant trees if they have to cover the cost of removing at-risk trees or associated sidewalk damage. When the city maintains trees in the right-of-way, they can strategically create a cycle of pruning and watering to enhance the longevity of urban trees.

Note: While we share the quantitative outcomes of the interviews, many of the interviews were limited by time. As a result, the highlighted promising practices are by no means representative of the only promising practices from interviewed cities.

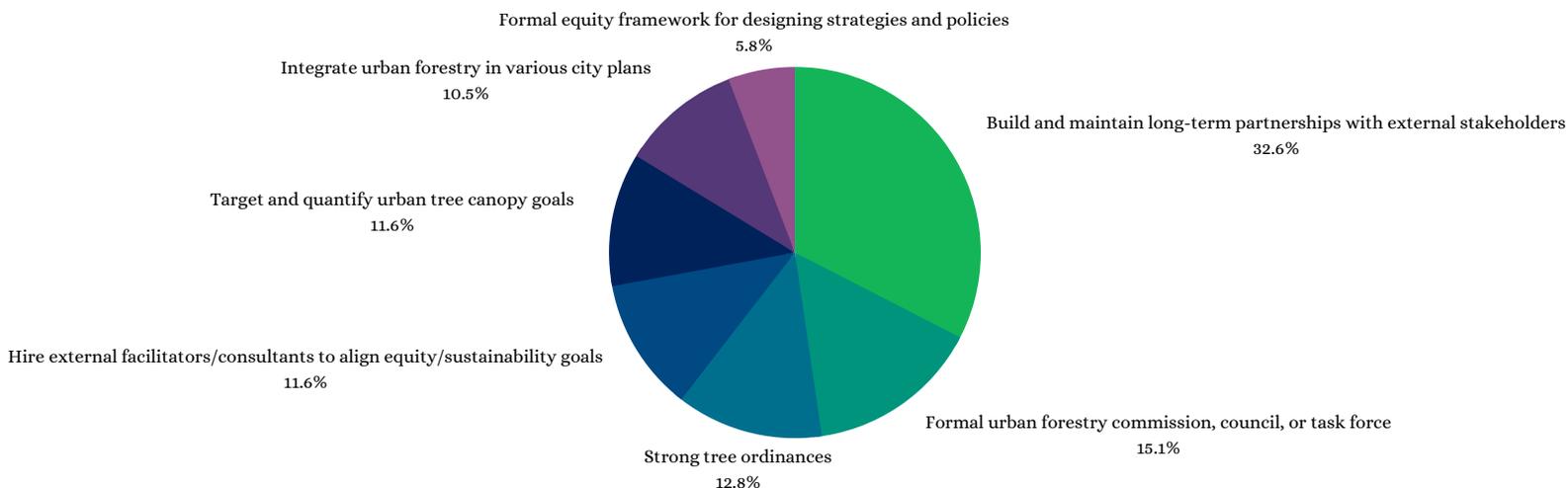


Figure 3. Frequency distribution of cited promising practices from interviews.

Finally, some cities are taking a holistic approach to increasing equity and UTC by creating workforce development programs. These programs allow residents to gain experience in green careers while promoting local economic activity. A few cities specifically target BIPOC or socioeconomically disadvantaged groups for workforce development programs. This strategy can create community leaders that advocate for urban forest initiatives in areas that lack adequate canopy and address barriers to employment that these communities often face. Refer to **Figure 4** to review the frequency distribution of cited promising programs from interviews.

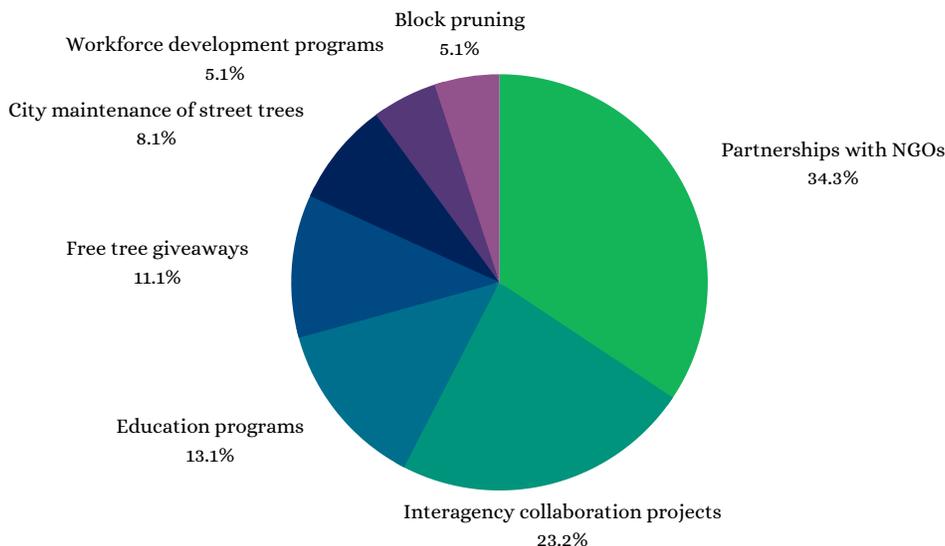


Figure 4. Frequency distribution of cited promising programs from interviews.

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