When planted to cast shade on building windows and sidewalks, trees reduce energy use and cool pavements

NO. 4

BEST MANAGEMENT PRACTICES FOR A THRIVING URBAN FOREST

The Best Management Practices explored in this chapter relate to Planning, Urban Design, and Land Use policy and practice. They intentionally fall outside Salt Lake City's Urban Forestry Division's remit and do not address tree care. These best practices are models Salt Lake City can use to develop the urban forest as public infrastructure and effectively reap the multiple benefits it provides.

This chapter provides evidence-based solutions for future land use and urban design decision-making related to the urban forest in Salt Lake City, with adaptation to local conditions. In addition, many of the practices and policies described here provide examples of solutions that other cities have enacted to address land-use conflicts related to the urban forest.

Best practices were selected from urban areas identified in a U.S. Forest Service-funded study of the ten best urban forests in the United States. The most significant commonalities in these ten cities were sustained investment in urban forest health, partnerships with nonprofit organizations, and community participation.

In alphabetical order, the best municipal forests in the United States, according to a 2013 American Forests assessment are:

- **Austin, TX**
- **Charlotte, NC**
- **Denver, CO**
- **Milwaukee, WI**
- **Minneapolis, MN**
- **New York, NY**
- **Portland, OR**
- **Sacramento, CA**
- **Seattle, WA, and**
- **Washington, D.C.**

For specific issues related to Urban Heat Island Effect mitigation, the Planning Division reviews best practices from cities in the United States desert southwest.

POLICY

The authors selected city ordinance and planning documents based on both environmental and political factors. Climate was a key component used to evaluate ecological criteria, along with stormwater and air pollution impacts.

Sacramento, California shares two essential characteristics with Salt Lake City; both are state capitols and receive similar annual precipitation volumes. Both cities have an area of approximately 100 square miles, although Sacramento has 2.5 times the number of residents. The findings and purpose of Sacramento's tree planting and conservation ordinance (Chapter 12.56) of Sacramento's ordinance foreground the role of trees in public and environmental health:

> The city council finds that trees are a signature of the City and are an important element in promoting the well-being of the citizens of Sacramento...When proper arboricultural practices are applied, trees enhance the natural scenic beauty of the City; increase oxygen levels; promote ecological balance; provide natural ventilation and air filtration; provide temperature and erosion controls; increase property values; and improve the quality of life.
>
> The city council also finds and determines that it is in the public interest to protect and manage tree resources within the City to preserve and maintain the benefits they provide to the community.

Minneapolis, Minnesota, is also known for its thriving, robust urban forests. The first line of the Minneapolis 2016 revision to its urban forestry policy states: **"The urban forest is an integral part of the Minneapolis infrastructure"** (Board, 2016). In this way, the City makes clear that the urban forest will be planned and managed on par with other types of city infrastructure. While ordinance and public policy are critical to the urban forest, departmental policies and guidance play an equally central role.

As the American Public Works Association Notes:

> **The adoption and enforcement of urban forest management policies and guidelines can support a change ... from a problem-specific, crisis management, and reactive approach to a more proactive, professional management response.** The lack of such useful policy statements and guidelines can allow agencies to act independently without regard to efficiency or effectiveness, hinder attempts to coordinate the action of public agencies regarding the proper management of public trees, and can confuse interaction of the public works agency with citizens, businesses, utilities, and other outside entities when dealing with public trees (APWA, n.d.)

URBAN FOREST OVERSIGHT

Portland, Oregon, has an 11-member Urban Forestry Commission, whose members are appointed to 4-year terms by the mayor in consultation with the Parks and Recreation Commissioner and approved by City Council.

At least three commission members "have experience and expertise in arboriculture, landscape architecture or urban forestry." The remaining seven members represent a wide range of neighborhoods. There is also an Urban Forestry Appeals Board which hears appeals related to the City Code provisions for the Trees and Urban Forestry (Title 11).

The Portland Urban Forestry Commission meets at least ten times annually, and its' responsibilities include:

1. Assisting with the development, reviews, and updates to the urban forest plan.
2. Providing review and input on plans, policies, and implementation projects that affect urban forestry.
3. Advising the City Forester, Parks and Recreation Commissioner, and the Citizen's Budget Advisory Committee on annual Forestry Division budget requests.
4. Making recommendations to the city council relating to amendments to the Urban Forestry Program, the urban forestry Code, heritage tree nominations, and other City department budget requests that substantially affect urban forest programming.

PLANNING THE URBAN FOREST

The American Planning Association recommends that planners collaborate with urban foresters to create:

- Requirements for detailing tree-planting plans in site plan submissions.
- Regulations regarding tree preservation procedures in the development process.
- Management guidelines for tree issues arising in the public hearing process on proposed developments.
- Review of site plans, including having an arborist check the plans for compliance on tree-related issues.
- Requirements for tree-planting and tree-preservation requirements in subdivision regulations.
- Development and enforcement of standards for tree planting and maintenance in parking lots.
- Monitoring of tree protection and proper planting during site development. (APA, 2009)

5. Preparing an annual report that addresses relationships with and City Forester concerns with other city departments. The report includes "an evaluation of the opportunities and barriers to effective management of the urban forest, and assessment of progress on these issues identified in prior annual reports." (City of Portland, Oregon, 2021)

URBAN FOREST PLANNING

According to the Vibrant Cities Lab, the best urban forest master (or management) plans address multiple subjects and priorities to manage and sustain the urban forest. In particular:

- Planting strategies for public sites that deliver benefits to neighborhoods where needed;
- Policies and incentives that promote tree preservation and planting on private lands;
- Systematic monitoring;
- Regular, scheduled maintenance;
- Pro-active risk assessment and management;
- Long-term funding and staffing;
- Active support from municipal agencies, volunteers, nonprofits; and
- Disaster response, mitigation, and remediation. (USFS et al., n.d.)

The American Public Works Association series on Urban Forestry Best Management Practices (BMPs) for Public Works Managers notes the importance of creating an Urban Forest Management Plan, stating:

> The existence of an urban forest management plan in a community indicates a high level of commitment to protecting trees, and it indicates a higher level of education and knowledge about natural resource issues in general. The benefits of trees can be maximized when both professional management resources and an educated public coexist.
>
> With a tree inventory and urban forest management plan, a public works agency can objectively consider each specific issue and balance these pressures with a knowledgeable understanding of trees and their needs. (APWA, n.d.)

Urban forest planning (along with other types of green infrastructure) should collaborate between municipalities and counties within a single ecosystem boundary to maximize urban forest benefits, particularly improvements to water quality. Watershed-level tree canopy goals, for example, can be set through regional councils to improve water quality (APA, 2009).

PERFORMANCE METRICS

Urban forest plans should include metrics developed to assess whether or not the urban forest is performing effectively to achieve a targeted outcome. Performance outcomes of the urban forest can consist of many different criteria, such as the "amount of carbon sequestered, localized temperature improvements, reductions in the number of bike accidents," and increased stormwater storage capacity during peak precipitation events. (Canfield J., 2018)

Assessing performance and creating targets can provide data to guide decision-making on future projects and produce findings that demonstrate the urban forest's return on investment (ROI). Sharing this data with partner agencies and the public can effectively justify consistent expenditures for tree stewardship (see Funding, below, for additional details).

EQUITY IN THE URBAN FOREST

Urban forestry programs in the United States tend to be most effective in more affluent areas, creating inequities in urban forest distribution and its' associated benefits. The most successful programs to implement equity in the urban forest employ policies and practices that:

- **Develop strong partnerships between municipalities and nonprofits;**
- **Reduce the responsibility of residents for City-owned trees;**
- **Focus planning in smaller, highly targeted areas; and**
- **Use publicly owned property whenever feasible. (Vibrant Cities Lab, n.d.)**

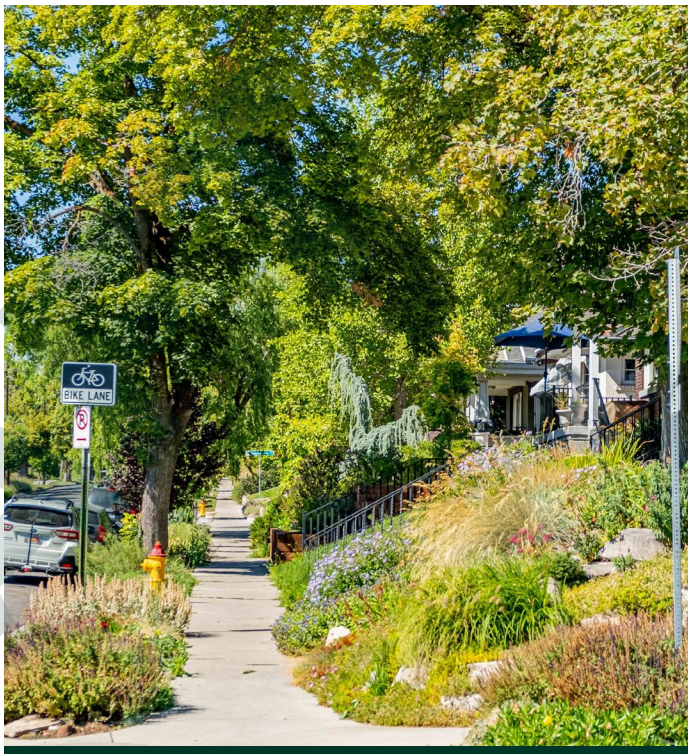
Research on equity outcomes in cities with high-performing urban forests demonstrates that highly integrated partnerships have the best results. When municipalities supply funding, technical assistance, and labor, and partner nonprofits are deeply embedded in cities and provide volunteers, outreach, and education, equitable distribution of public trees is more likely to be achieved. (Ketcham, 2015)

Cities in arid regions have had success planting drought-resistant, heat-tolerant tree varieties in financially stressed areas. In Tucson, Arizona, the Sonora Environmental Research Institute piloted a grant-funded project with a local nonprofit, Trees for Tucson, to increase canopy cover in low-income areas. The Pima Association of Governments identified South Metropolitan Tucson as having significantly fewer parks and vegetation, and the area received new plantings. Working with *promotoras* (community health workers) and volunteers, the researchers conducted extensive community outreach to enroll residents and distribute both trees and tree stewardship information in English and Spanish to area residents, including tree care classes. (Foley, 2019)

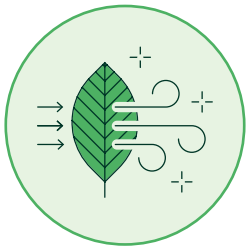
Equity also requires a more significant investment in the urban forest on the part of municipalities. A recent cost assessment of the urban forest in Portland, OR, found that the City needed to make a more considerable investment to ensure equity. The consultant team, Davey Resource Group, noted that the City needed to make "an investment in a programmatic shift of tree care responsibilities. With the unequal distribution of trees and burdens for the costs of tree care left to property owners, the City will be challenged to improve the condition of its street tree populations in lower-income, and lower canopy neighborhoods." (City of Portland, Oregon Parks and Recreation, 2019)

ENVIRONMENTAL IMPACT MITIGATION

Robust urban forest policy and planning should include quantifiable strategies to mitigate negative environmental impacts and associated adverse public health outcomes. (Urban forest planning should also provide approaches to reduce the negative social implications of poor urban design, see Placemaking, below, for detail).



Planting broadleaf trees on the east side of streets to shade buildings can reduce air conditioning costs significantly.



AIR QUALITY IMPROVEMENT

Air quality mitigation measures need to be calibrated to specific pollutants of concern and balanced with needs to reduce energy consumption, manage stormwater, and provide a safe, walkable urban realm. In the broadest sense, this means "planting the right tree in the right place," and following up with testing and analysis to measure outcomes.

According to the US Forest Service, some recommended urban forest management strategies to improve air quality include:

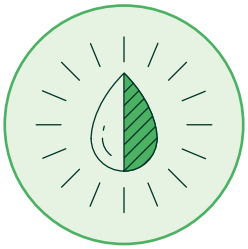
- Sustain the existing tree cover and increase the number of healthy trees,
- Use low biogenic volatile organic compound (BVOC) emitting trees to reduce ozone and CO_2 formation,
- Use long-lived trees to reduce long-term emissions from planting and removing cycle,
- Reduce fossil fuel use in vegetation maintenance,
- Plant trees in energy-conserving locations,
- Plant trees to shade parked cars to reduce vehicle VOC emissions,
- Supply ample water for tree growth - fosters pollution removal and temperature reduction,
- Plant trees in polluted or heavily populated areas, and
- Avoid pollutant-sensitive species. (Nowak, 2002)

Some evergreen trees can remove particulates year-round when planted strategically as buffers in locations with high particulate matter concentrations. However, due to safety issues caused by reduced visibility, evergreens generally are not appropriate street trees. Further, typical evergreens do not produce adequate canopy to achieve comfortably shaded sidewalks. Evergreens can provide too much shade to sidewalks in winter, preventing sunlight from reaching sidewalks, and resulting in loss of human comfort and potentially icy (slippery) conditions. Cities should consider evergreens for strategic planting on public or private property bordering freeways (or other high-emissions traffic routes), provided that safety concerns are addressed.

ENERGY CONSERVATION

Planting deciduous trees to shade windows can provide significant reductions in energy use. "In a study of the impacts of street trees in California, Lawrence Berkeley National Laboratory and Sacramento Municipal Utility District found that trees placed around houses to shade windows yielded between 7 and 47% energy savings. Other studies suggest energy savings from properly planted trees may be closer to 5–10%." (American Rivers et al., 2012)

Trees Charlotte, a North Carolina public/nonprofit partnership, recommends planting deciduous trees on residential buildings' southern and western facades. Strategically locating trees reduces air conditioning use in summer and decreases the need for heating in winter via passive solar gain. "Strategically placed shade trees – a minimum of three large trees around [a] home – can reduce air conditioning costs up to 30 percent." Evergreen trees, when correctly located, can block winter winds and reduce energy consumption for heating between 10 and 50 percent. (Trees Charlotte, 2015).



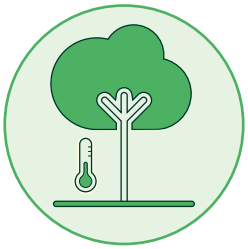
WATER QUALITY + STORMWATER MANAGEMENT

Like Salt Lake City, Boise is a Mountain West capitol, the largest city in the state, and has a similar climate. Boise experiences air pollution associated with winter temperature inversions and often has high summer ozone levels. Although it receives less annual precipitation than Salt Lake, Boise has made the urban forest the centerpiece of its stormwater management strategy.

Boise's 2015 Urban Forest Management Plan incorporates water quality and stormwater management goals by increasing canopy cover to intercept rainfall and subsurface stormwater retention and infiltration. The plan prescribes large trees to achieve a 15% increase in canopy cover from existing conditions.

Large trees require a greater soil volume, which can be challenging to achieve in highly paved areas. Boise used suspended pavement systems downtown to address this problem, supporting large trees and creating underground areas for root mass and stormwater retention and infiltration. (Vibrant Cities Lab, 2015)

(See Suspended Pavement Systems, below, for more information.)



URBAN HEAT ISLAND

In the desert Southwest, metropolitan governments have expanded their urban forests to address the interconnected issues of livability and equity in their cities. One of the guiding principles of Tempe, Arizona's 2017 Urban Forest Master Plan is "Expand Shade to Maximize Urban Cooling." Shade is the central strategy for Tempe's 2040 General Plan Goal of becoming a "20-Minute City." In this type of city, all services and amenities are accessible to residents within a 20-minute walk, bike ride, or transit ride from their neighborhood. The Urban Forest Master Plan directs the City of Tempe to: "Create a vibrant, walkable 20-Minute City that benefits public health and economic development by planting trees and building structured shade. Designers can augment this principle by planting trees [on private property] and using construction materials that reduce the urban heat island (UHI) effect." (ASU Sustainability Solutions Initiatives, 2017).

Tempe's big-city neighbor, Phoenix, developed a Tree and Shade Master Plan in 2010, demonstrating the critical importance of providing shade in arid, sunny urban climates. The plan examined regulatory hurdles preventing shade structures over public sidewalks to quickly add shade to pedestrian routes and outlined strategies to increase the tree canopy. The vision set forth is for shade canopy coverage over 25% of the City in the two decades between 2010 and 2030. (Phoenix, 2010)

The City of Phoenix's Zoning Ordinance's general landscaping standards (Chapter 13, Walkable Urban Code - Section 1309.A) requires street trees to be planted in the public right-of-way, with exceptions for public utility easements. When projects cannot include trees, they must use architecturally or artistically integrated public amenities to provide shade. Public amenities can include structural shade, seating, artwork, and wayfinding signage. See Transitional Elements, below, for more detail and examples of public amenities used to provide shade.

The Downtown Code includes shade standards, which require that building orientation minimize heat gain and consider the impact of shade on adjacent areas. Buildings over 5,000 square feet or building additions of over 500 square feet are required to provide shade over 75% of the public sidewalk, 50% of which must be provided by trees or trellised vines. The shade calculation is based on the summer solstice and may include shade cast from a building. (Phoenix, Zoning Ordinance, n.d.)

PRESERVATION

The American Planning Association (APA) advocates a balanced approach to preservation and development. The APA recommends ordinances recognizing which trees require protection and reasonably account for all the benefits trees provide when removing healthy trees.

> The best tree preservation ordinances recognize that it is unnecessary to preserve all trees to allow for desired types of development. These ordinances place significant trees in the site design and review process.
>
> ...When trees are destroyed during development, a good tree preservation ordinance provides methods for quantifying the value of the lost benefits provided by those trees and creates a mechanism for that value to be returned to the community (APA, 2009).

The (APA) recommends that to preserve trees and maximize the urban forest's performance; municipalities should:

1. Integrate tree protection and planting requirements into the zoning ordinance and not rely on a separate tree or urban forestry ordinance;
2. Foster collaboration between planners, interdisciplinary city-staff, decision-makers, developers, environmental advocates, and other community stakeholders to draft ordinances;
3. Develop performance standards for Planned Development approvals; and
4. Create clear, realistic means to enforce tree preservation regulations with a process driven by internal city department collaboration. (APA, 2009)

URBAN ECOSYSTEM HEALTH

The urban forest should be considered holistically in terms of its relationship to built systems and other parts of the urban ecosystem, including waterways, wildlife, and social spaces.

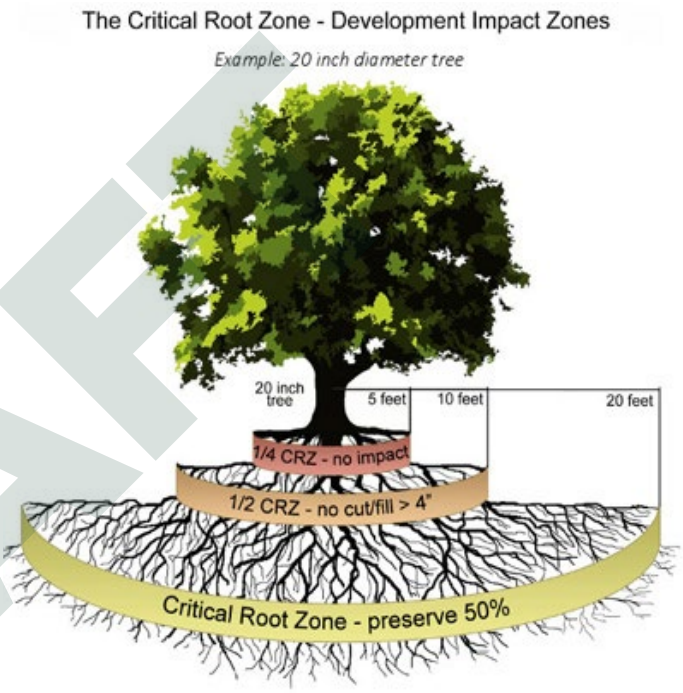
MINIMUM SOIL VOLUME ORDINANCE

Adequate soil volume is critical to the size, health, and longevity of urban trees. Although some cities regulate planting space with surface area, many cities now require minimum soil volumes by ordinance, guidelines, or streetscape specifications. These cities include Boise, Denver, San Diego, Seattle, Chicago, New York, and the state of Minnesota requires minimum soil volumes. (Marritz L., 2020).

In areas with extensive pavement, such as downtowns, cities increasingly use suspended pavement systems to maximize growing conditions and comply with required soil volumes. (See Suspended Pavement Systems below for more information and examples of this technology).

ROOT PRESERVATION ZONE

The Arborist for the City of Austin, Texas, notes that "Tree preservation is effectively defined as root system preservation," and assigns a "Critical Root Zone (CRZ) Area "to each tree based on the diameter of its trunk. Austin requires that 50% of the CRZ remain undisturbed to ensure minimum compliance with its Environmental Criteria Manual (3.5.2 – Tree Preservation Criteria), adopted as part of its city code. (City of Austin, Texas, 2020).



City of Austin Tree Preservation Guidance
http://austintexas.gov/page/tree-and-natural-area-preservation

LEAF LITTER REMOVAL + WATER QUALITY

City land managers can mitigate the impacts of urban forest leaf litter on water quality (described in Chapter 2) through various means, the most common practice being street cleaning paired with robust leaf litter removal programs. (Selbig, 2016)

Sacramento designates a "leaf season," between November and January, when people are allowed to rake leaves into the street, along the curb, in addition to using yard waste bins. During leaf season, Sacramento's Recycling and Solid Waste division have "10 to 15 crews using 'The Claw' and rear loader trucks to scoop over 26 million pounds of leaves and yard waste debris off of city streets. Crews work up to six days a week, rain or shine, including holidays." (City of Sacramento, 2017). During leaf season, the Recycling and Waste Division will collect up to 13 containers of leaves from houses. Each street gets a visit from "the claw" 7 times to collect curbside leaf litter. (City of Sacramento Public Works, 2020)

Minneapolis does not permit leaves to be swept into the street and requires yard waste to be bagged or bundled. In addition to yard waste bins, the City allows residents to use kraft paper bags and BPI-certified compostable plastic bags. Conventional plastic bags are prohibited for yard waste. (Minneapolis, MN, n.d.)

The City of Boise uses a combination of yard waste bins and large paper bags for leaf litter collected through its unlimited compost program. Boise then composts the material and provides the finished product to residents for free. (City of Boise, n.d.)

Denver's street sweeping program has a monthly schedule. It enforces posted parking restrictions so that both sides of the street are cleaned. Denver's Department of Transportation and Infrastructure (DOTI) notes: "Street sweeping plays a critical role in keeping Denver's streets, air and water clean. DOTI's street sweeping program removes dirt, leaves and debris from city streets, which reduces air and water pollution and supports a clean environment." (Denver, 2020)

INCENTIVES

Many cities provide incentives to developers to enhance and protect the urban forest or provide other types of green infrastructure. These include:

- **Density bonuses;**
- **Flexible development standards;**
- **Reduced development fees;**
- **Streamlined approval processes; and**
- **Permit fast-tracking.**

The APA notes that "In practice, localities often provide these incentives to projects that qualify for specific green building or neighborhood certifications." (American Planning Association Green Communities Center, 2016)

Another preservation incentive that many cities provide is a Tree Memorial program, which can also serve as a funding source for urban forestry programs. Boise, for example, runs a Tree and Bench adoption program which focuses on resources in City parks. The adoptions have a 20-year term, are renewable for a second 20-year term, and can commemorate people, dates, and events.

A personalized plaque (designed using City standards) is attached to a tree or bench in either a neighborhood or "premiere" park. Plaque pricing is based on location, tree size, or bench material. Eligible trees must be at least two years old, ensuring that the tree will thrive for the adoption period. (City of Boise, 2020)

By associating a tree with a person or event, it becomes imbued with cultural and personal meaning. It is, therefore, more likely to be quickly understood as an essential resource and preserved.

ENFORCEMENT

Many municipalities use tree Protection (or Preservation) Bonds throughout the United States to protect trees during construction activities.

According to Alpha Surety and Insurance Brokerage,

> A Tree Preservation Surety Bond is a license. It permits surety bond required by certain jurisdictions for individual and commercial property developers. The bond typically ensures one of two things. It guarantees that the construction project will not harm specific trees considered to be protected, and, if damaged, the developer will reimburse the jurisdiction for [its] loss. Two, it guarantees that the developer will plant replacement trees for protected trees that they must tear down for the construction project. Once the project is complete and the jurisdiction verifies protected trees are unharmed and [healthy] replacement trees are in place, a municipality can release the bond.

Bonds are often held for two to three years after a Certificate of Occupancy is issued. This time span gives new trees time to establish and incentivize the developer to water and care for the plantings.

Fines assessed for violations of Tree-related ordinances can be relatively high in some cities. In Sacramento, for example, breaches of the Tree Planting, Maintenance and Conservation Code incur civil penalties between $ 250 and $ 25,000 per day. (City of Sacramento)

Case studies demonstrate that cities are most effective in protecting the urban forest when they take a collaborative, interdisciplinary approach between departments to creating and enforcing ordinances. (APA, 2009)

TREE REPLACEMENT MITIGATION

According to arborist Dr. R.J. Laverne, Manager of Education and Training for Davey Tree, the best approaches to tree replacement costs factor ecosystem services and public health benefits into their fees. He notes:

> An inventory of the trees lost during construction can be used to calculate a monetary value that fairly represents the lost benefits to the community. Cities can then require the developer to pay the "lost benefit" sum into a community fund to plant and maintain trees. It is necessary to develop a method that fairly translates the environmental, social, and economic value of trees into a dollar amount. (APA, 2009)

Sacramento requires that private protected trees and all public trees be replaced either on or off-site. Fees in lieu of replacement are only permitted through a resolution adopted by City Council. Those fees and civil penalties for violations are deposited into a Tree Planting and Replacement Fund, which can only be used for that purpose. (City of Sacramento)

Some municipalities use a different approach when developers cannot provide the required number of trees on private property to establish an off-site mitigation bank. In Fulton County, Georgia, these are referred to as "tree banks," and defined as "a site such as a school or public park, where the owner/developer shall donate and plant the required trees when it is not feasible to plant the required trees within their site's project area." (Fulton County, 2020)

SOLUTIONS FOR UTILITY + TREE CONFLICTS

Conflicts between trees and utilities (both above and below ground) are commonplace in municipalities. There are various ways to either avoid or mitigate conflict. First, avoiding conflict by proactive planning for utility and tree placement during the project design phase. Proactive approaches ensure trees are located and sized appropriately and are generally the most cost-effective approach; this is common practice for above-ground utilities. However, avoiding utility conflict is not always possible for below-ground utilities, particularly with urban infill projects.

Cities can develop a geographic information system (GIS) analysis of utility locations to model the outcome of their current policies to determine if canopy or tree stocking goals can be met using those criteria.

For example, Salt Lake City's current policy is that trees must be located at least 10 feet from existing or proposed water lines. The city also requires street trees to be planted (or replaced) at approximately every 30 feet based on zoning code requirements related to building frontage.

By spatially locating both on a map, areas of conflict become evident. These areas can then be overlaid with maps of proposed projects or city code amendments, along with priority areas for tree preservation and expanded planting.

In high-priority tree planting locations where utility conflicts are unavoidable, there are a variety of technologies and techniques to either resolve disputes or mitigate potential problems. These costs should be factored into project planning in locations where tree planting or preservation is highly prioritized. Additionally, city land managers can further analyze utility lines scheduled for abandonment to plan for trees in those locations on the appropriate timeline.

MITIGATION TECHNIQUES

Mitigation measures for underground utilities include a range of actions and technologies:

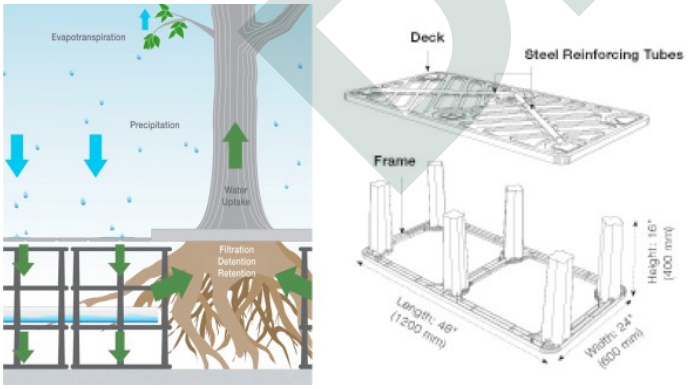
1. Locate utilities in a designated utility corridor that will not conflict with tree roots.
2. Place utility lines in the street instead of the park strip (particularly as opportunities become available during road reconstruction projects).
3. If cities must locate utilities in park strips (without existing trees, they should place utilities directly behind the curb and not in the center of the park strip, where trees are typically planted.
4. Place conduit that resists tree-roots during new construction to accommodate current and future proposals for utility lines as technologies change.
5. Plant trees with non-invasive roots or trees with a small root ball.
6. Use physical or (non-toxic) chemical barriers near utility lines to inhibit root growth. (Teske, 2013)
7. Combine utilities by using suspended pavement systems for stormwater management and planting trees. (In locations with clayey subsoils, an underdrain for overflow stormwater can be placed below the tree root zone).
8. Consolidate utilities and stack them vertically in one predictable location (City & County of San Francisco, 2015).
9. Place utilities in precast concrete vaults underground.

Suspended pavement systems allow roots to thrive, growing large, healthy trees, while also storing overflow stormwater.
Photo above shows a Silva Cell™ System being installed in Toronto, Canada 2010 *(Deeproot.com)*

SUSPENDED PAVEMENT SYSTEMS

In densely paved urban areas where soils are typically heavily compacted, suspended pavement systems have become a go-to solution to providing soil volumes that support healthy, large trees.

Suspended pavement systems, often referred to by the brand name Silva Cell, support pavement loads while creating space for tree roots without soil compaction. **These systems also store overflow stormwater, which eventually waters the tree and infiltrates into the soil, recharging groundwater supplies and improving water quality.**



Silva Cell™ System
(Ecological Engineering, Vol. 82, September 2015).

A 10-year study in a commercial area in Toronto demonstrated that supported pavements systems:

- Increased the tree canopy while using a small surface area;
- Provided stormwater management through reduced water volumes;
- Improved water quality through increased infiltration and pollutant removal by soil; and
- Promoted Low-Impact Development (LID), or Green Infrastructure, without the higher maintenance costs incurred by surface bioretention swales. (Sustainable Technologies Evaluation Program (STEP), 2018)

A 2006 study that compared structural soils, non-compacted soils, and suspended pavement systems found that

> "Suspended pavement over non-compacted soils provided the greatest amount of tree growth and health and should be considered when designing urban planting sites for trees."

Trees in suspended pavement systems were also "larger, faster-growing, had better color, and more root growth." (Smiley, 2006)

PROMOTION

FUNDING

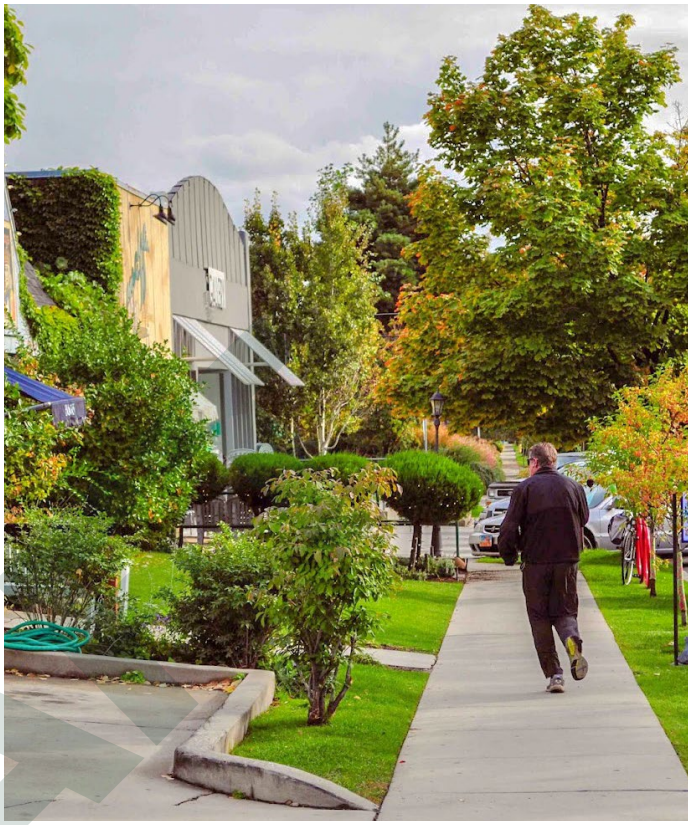
Urban forestry programs require stable, adequate funding sources to maintain the benefits trees provide throughout their lifespan. The American Planning Association notes that urban forestry programs are most often underfunded based "on perceptions of its benefits to the community," which are usually only considered in terms of aesthetics. One of the best ways to ensure stable funding is to document the multiple benefits of the urban forest over the long term and ensure that those benefits are regularly and effectively communicated to the public. (APA, 2009)

In the past urban forests were viewed as expensive aesthetic benefits, in which individual trees were relatively disposable resources. Now, however, municipalities are increasingly quantifying the value of the ecosystem, public health, and social benefits urban forests provide, as well as their contribution to economic development. The urban forest becomes a profit center by viewing the urban forest as infrastructure that generates follow-on economic benefit (in the same manner as roads, light rail, and other infrastructure).

While general fund allocations are typically the primary funding source for urban forestry programs, there are other possibilities for consistent funding streams dedicated to the expansion and preservation of the urban forest. For example:

- Olympia, Washington uses a capital improvement plan fund derived from real estate excise taxes and utility taxes, with interest, to underwrite its program.
- Salem, Oregon funds its care of street trees through the municipal portion of the state motor fuel tax while funding some tree preservation through fines and donations.
- Urbana, Illinois, also uses fines to aid its program, particularly for motorists who damage trees in crashes.
- Other cities have carved out a role for nonprofit organizations in supplementing tree funding. For example, the Sacramento Tree Foundation is substantially funded by the local Municipal Utility District. (APA, 2009)

Development and impact fees can also play a role in funding tree programs, supported by regulations that "establish fees related to permit processing and enforcement." By including these fees in the zoning, subdivision, and landscaping codes and then linking these to the parts of the urban forestry program that benefit redevelopment or new development, cities can leverage growth to expand the urban tree canopy. Given the demonstrable evidence that urban forests add value to further economic development, "another option is to dedicate a portion of revenue from a tax increment financing district to urban forestry improvements." (APA, 2009)



Partnerships between cities, chambers of commerce, and philanthropists are another route to generate funds for urban forest expansion and maintenance. Denver, Colorado, has created an Urban Forest Initiative to grow the downtown area's urban forest canopy from 4% to 10% cover. The Initiative is jointly funded by the Downtown Denver Partnership, City and County of Denver, Downtown Denver Business Improvement District, property owners, and the philanthropic community. It provides grants to property owners to improve tree-growing conditions.

Another method to provide funding for the expansion and ongoing maintenance of urban forests is creating Community Benefit Districts or CBDs (known as Business Improvement Districts in Salt Lake City). Cities can create these districts in commercial areas and mixed-use neighborhoods, developing a public/nonprofit partnership to supplement existing public funds used to maintain and improve those areas. Communities vote to establish CBDs, and then "local property owners are levied a special assessment to fund improvements [and maintenance in] their neighborhoods. The funds are administered by a nonprofit organization established by the neighborhood." (City and County of San Francisco, n.d.)

INVESTING IN THE URBAN FOREST IS INVESTING IN PUBLIC HEALTH

A 2016 Nature Conservancy white paper, Planting Healthy Air, found that street trees are a cost-competitive solution to reducing concentrations of particulate matter (PM) as well as lowering temperatures.

> The benefits that trees deliver, in terms of $ per ton of PM removed or $ per degree of temperature mitigation, are in the same range as major built infrastructure alternatives. More importantly, street trees are able to deliver benefits both to PM and temperature mitigation, while grey infrastructure alternatives generally are not. (McDonald, 2016)

The return on investment is greatest when neighborhoods with the highest residential density are targeted for tree planting. For example, in Los Angeles, researchers found that by investing an additional $6.4 million annually in street tree planting in central LA, Santa Monica, and Long Beach, an estimated 400,000 residents could experience a reduction of 2.7° F (1.5°C) in summertime temperatures. (McDonald, 2016)

Investigating cities across the globe, the Nature Conservancy found that approximately $4 per city resident spent on urban forests can significantly mitigate air pollution and provide urban cooling.

COMMUNICATION

Communication and education about the urban forest and its benefits is a crucial aspect of gaining public participation in the stewardship work. Information about the Urban Forest's value to multiple parts of community building should be disseminated to all City departments, plan reviewers, developers, and Salt Lake City residents.

The Salt Lake City-based nonprofit TreeUtah incorporates education into every aspect of its work. Volunteers run workshops, guided tree identification hikes, and provides curriculum to second-grade students through their Discovering Trees program. The organization has approximately 30 team leaders and would like to increase the volunteer group to 50.

Volunteers range from one-day participants to team leaders and professional arborists. TreeUtah plans to expand its online presence by recording online workshops, live streaming in-person events, and educating the public through social media storytelling to reach a broader and more diverse audience. (Personal Communication, May, 2021)

The Sacramento Tree Foundation (SacTree) plays a significant role in the success of the City's urban forest. Pamela Frickmann Sanchez, the Education Programs Manager for the Sacramento Tree Foundation, attributes the organization's success to forming partnerships with utility companies, which has allowed them to expand their educational outreach efforts. The organization works closely with Sacramento Municipal Utility District (SMUD), a publicly owned utility company, and Sacramento's water company.

The water company uses its platform to invite residents to classes on tree irrigation and tree care conducted by SacTree. The ongoing partnership and SMUD funding allow SacTree to provide professional consultations to property owners who receive free shade trees through the Sacramento Shade program. SacTree assists the owners in picking out an appropriate tree, delivers the trees, and plants them. Working with the utility companies ensures the trees are planted in proper locations and do not conflict with existing or planned infrastructure, provides a free service to residents, and promotes the mission of the Sacramento Tree Foundation. (Sanchez, 2021)

Cities can also use graphic design, social media, and place-based campaigns to communicate the benefits of and threats to the urban forest. For example, The City of Denver uses a tongue-in-cheek marketing campaign (below) to educate its residents about the danger of Emerald Ash Borer, an invasive pest introduced in 2002 which has decimated millions of Ash trees, primarily east of the Mississippi River. (Ash is a widespread species for street trees and timber use whose presence was first detected in Colorado in 2013).

URBAN FOREST + ECONOMIC DEVELOPMENT: ADDED VALUE

A healthy urban forest adds value to both retail and residential development in cities of all sizes, as demonstrated by numerous studies and surveys (for additional information, see the University of Washington's website on the Human Dimensions of Urban Forestry).

A combination of user-friendly regulations and effective communication of added value to developers, investors, and nonprofits is key to creating the partnerships needed to sustain a thriving urban forest.

Retaining trees during development can be an effective way for developers to increase profit margins. As multiple studies cited on the Green Cities: Good Health website demonstrate:

> "Understanding potential market values in different forest conditions is an important step in understanding the economics of urban forest protection. Market price studies of treed versus untreed lots show a range of value enhancements:

Price Increase	Condition
18%	Building lots with substantial mature tree cover
22%	Tree-covered undeveloped acreage
19-35%	Lots bordering suburban wooded preserves
37%	Open land that is two-thirds wooded

> Generally, trees and forest cover in development growth areas add value to parcels. One study found that development costs were 5.5% greater for lots where trees were conserved. Given increased lot and home valuations, builders have reported that they were able to recover the extra costs of preserving trees through a higher sales price for a house, and that homes on wooded lots sell sooner than homes on unwooded lots."

Communicating this to decision-makers and developers can assist both in the ordinance amendment process and demonstrate that existing trees are often an asset to the development and should be managed and protected.

The City of Boise aims to become "the most livable city in the country." It has made street trees a centerpiece of their LIV district strategy (LIV is an acronym for Lasting environments, Innovative enterprises, and Vibrant communities).

Boise's central addition LIV district, a 50-acre area downtown, used a combination of pervious paving and Silva Cells™ (see Suspended Pavement Systems, above, for details) for stormwater management as a strategy to attract development by adding amenity (large trees) and increasing developable land area.

Boise requires private property owners to manage all stormwater volumes from 50- or 100-year storms on-site, while the Ada County Highway District manages stormwater runoff from rights-of-way and public streets in Boise. Stormwater is typically infiltrated into soils due to local soil characteristics and low annual precipitation levels.

The Urban Land Institute (ULI) interviewed Boise's stormwater program coordinator, Steven Hubble, about the economic benefits of using suspended pavement in the right-of-way.
He noted:

> "In the Central Addition, we adopted the idea of using space in the public right-of-way for stormwater management both for [City] and private property, given that there would be a benefit to the public by treating the roadway runoff and allowing an opportunity for private development to focus their stormwater in those areas. [This allows] an easier pathway to more vertical development on those sites." (Urban Land Institute, 2018)

ULI's recent assessment of the impact of rising temperatures and heatwaves on urban development examines the growing risk posed by extreme heat. The authors note that "Widespread adoption of mitigation strategies could help reduce the urban warming trends currently occurring in cities, leaving them to contend with a more manageable 1-degree to 2- degree Fahrenheit increase, rather than the 5-degree to 10-degree increase currently projected for some cities due to the urban heat island effect." (Burgess, 2019)

The report explores a range of heat mitigation practices, including providing additional shade through canopy, and note the significant return on investment, including:

- Improved tenant experience,
- Reduced operating costs,
- Enhanced likelihood of business continuity,
- Enhanced branding, and
- Additional foot traffic in pedestrian and retail environments.

In addition, ULI notes that

> Being "heat-resilient" can reduce the likelihood of construction delays caused by extreme heat, increase support from investors, public officials, and other stakeholders, and reduce stress on public infrastructure. ...Heat resilient projects can reinforce the developer's reputation for high-quality, green design; and they can become heavily patronized places of refuge during extreme-heat events, leading to enhanced asset value, higher rent premiums and lower vacancy rates.
>
> ...Operating costs can decline due to less frequent replacement of heat-damaged materials, lower utility costs, and higher chance of sustained operations during extreme heat events. (Burgess, 2019)

PUBLIC/NONPROFIT PARTNERSHIPS

Our City Forest, a San Jose, California nonprofit urban forestry and environmental stewardship organization, works closely with the municipality to provide native and drought-tolerant trees, shrubs, and grasses at wholesale pricing. Our City Forest runs a community nursery and training center where certified arborists and tree experts assist residents in choosing the right tree for their property and obtain a planting permit from the City if the tree is to be planted in the park strip. The nonprofit also has an award-winning partnership with AmeriCorps, where service members are trained to be urban forestry and outreach specialists who go into the broader community to educate residents on best practices.

The Sugar House Park Authority, a local nonprofit, has a successful 50-year partnership with Salt Lake City and County. The Park Authority was deeded the park property, in trust, from Salt Lake City and Salt Lake County after Utah relocated its State Prison in the 1950s. The Board of Trustees consists of seven volunteers and one representative from Salt Lake City and Salt Lake County agencies.

The Park Authority has a 99-year lease to own, maintain, and operate the park with funding provided by the government. (Authority, n.d.) TreeUtah partners with the Park Authority to plant trees as a part of their Commemorative and Memorial Tree Program. The Park Authority maintains a list of preferred trees, and residents work with TreeUtah to select and plant the tree in memory of a loved one.

Vancouver, British Columbia, has a popular and successful Green Streets program where residents volunteer to maintain small gardens in traffic circles, medians, and other small plots created for traffic calming in neighborhood rights-of-way. The City provides the capital investment, and all maintenance, including pruning and weeding, is performed by the volunteers.

PARTNERSHIPS FOR FOOD ACCESS + URBAN AGRICULTURE

Urban forests can be a source of fresh, accessible produce and an opportunity for education on food and nutrition. Incorporating collections of food-bearing trees, either as a supplement to landscaping in parks and playgrounds, as street trees, or in an orchard format (commonly called a food forest), can be an added layer of long-term support for communities.

Another aspect of urban forestry programming that can support food access is providing shade on sidewalks and bike lanes. Shaded pathways for short trips to grocery stores and farmers' markets are more comfortable and inviting, particularly in low-income neighborhoods.

Currently, most fruit tree programming in cities across the United States (including Salt Lake) is through the collection of fruit on private property. Independent nonprofits typically manage fruit harvests with some support from the municipal government, such as the local Green Urban Lunch Box. In Salt Lake City, Green Urban Lunchbox volunteers also pick fruit from trees on government properties.

Municipal fruit trees and edible landscapes are predominantly located in city parks or small, publicly accessible orchards. These are often managed via partnerships with community garden organizations. The City of Durham, North Carolina, has a 5-acre City-owned park in their downtown that a nonprofit organization entirely operates. The park has an edible public garden that grows publicly accessible fruit trees along with other edible plants. While a 501c3 organization manages Durham Central Park, the City of Durham and other partners provide funding support. (Durham Central Park, 2013). Programs like this allow for long-term funding support and management while including public partners with a broad community reach.

Additionally, it is vital to have an appropriate policy supporting the public use of these trees, as exemplified by Minneapolis' recent ordinance change to allow the foraging of fruits in most public spaces (Minneapolis Parks, 2018). Alternatively, some cities have taken on most of the funding and management of planting fruit trees and other food plants in public spaces throughout the City (Vicenti, 2020). Copenhagen is implementing municipal fruit trees and shrubs in parks, playgrounds, sports fields, and churchyards throughout the City (Geddo, 2019).

The key to having fruit trees become an integrated and utilized part of the community is making information available both digitally and on-site for education purposes and creating opportunities for communities to engage with the trees. Workshops, cooking lessons, tree planting and maintenance classes, harvest festivals, and art creation can bring a deeper connection to the landscape and disseminate information about publicly available food resources.

PLACEMAKING

URBAN DESIGN

Urban design that integrates the urban forest into streets and publics enhances livability for all residents of a city, both through principles of environmental psychology and biophilia put into practice by design, and through incorporating and enhancing the ecosystem services trees provide.

Thoughtful urban design plays an essential role in creating livable cities, in large part by responding to wide streetscapes and tall buildings in downtowns through the creation of human-scale spaces. Trees play an essential role in urban design, particularly when planted to subdivide larger areas. Street trees create a "linear sequence," making an architectural (or spatial) rhythm for passers-by. (Gehl, 2010)

This linear sequence of tree trunks serves as a visual vertical plane and separates pedestrians from other modes of transportation, promoting a pedestrian's sense of safety from moving vehicles. The regular spacing of trees builds continuous tree canopies over sidewalks and streets, creating a ceiling plane and providing shade for pedestrians. Both offer a reassuring sense of enclosure and human comfort on city streets and in neighborhoods.

Trees in parks, plazas, and other public spaces are also significant contributors to urban environments and are typically included holistically in the initial design of those places; in contrast, streetscapes tend to evolve with changing development. Street trees provide a wide range of urban design benefits.

These benefits include:

- **The creation or continuation of vistas;**
- **Establishing a more human scale at street level in cities where the built scale is very large;**
- **Providing a visual contrast in form, texture, color and seasonal changes to the buildings; or**
- **Contributing to the element of mystery by hiding and revealing city elements. (Bell, 2005)**

Trees can also provide windbreaks either from downdrafts from tall buildings or protection from cold winter winds.

SCALE + FORM

The scale and form of trees play a significant role in creating a balanced streetscape and inviting places for people to socialize and gather. Typically, large trees with broad canopies are best in both dense urban centers and neighborhoods because their height balances that of tall buildings, creating the effect of a "step-back," and the broad trunks and spreading canopies tend to create more human-scaled spaces, as described above.

Most tree forms are appropriate in streetscapes, with a significant exception being columnar trees. These do not create a ceiling plane or provide adequate shade on sidewalks and streets and are generally better suited for specific purposes, such as creating hedges on private property or within parks.

By evaluating the permitted building heights, form-based codes, and available soil volumes for tree planting, designers can propose a range of tree scales, forms, and species to meet municipal design and environmental goals. (See Neighborhood Urban Forest Districts, below, for additional information).

In areas where existing soil volumes are small, such as highly-paved downtowns, suspended pavement systems provide opportunities to achieve the best urban design outcomes. Boise, Idaho, has used this approach in their Downtown Streetscape Standards & Specifications Manual.

Trees mediate between tall buildings and human-scale spaces in Salt Lake City's Downtown, and help reduce glare impacts.

STREET TREE SCALE

By requiring street trees of a specific scale related to urban design criteria, such as building height and street width, Salt Lake City's public realm can become more livable and inviting.

Building height in residential and commercial areas follows a predictable pattern in Salt Lake City, with the greatest heights allowed in the Downtown and Sugar House Business District areas (Height Zone C, below), where most buildings are permitted a height of 6-10 stories, and up to 25 stories at block corners. Intermediate heights of 3-5 stories are generally permitted along major corridors leading from downtown and in East Downtown (Height Zone B). Typical single-family districts (Height Zone A) are one to two stories.

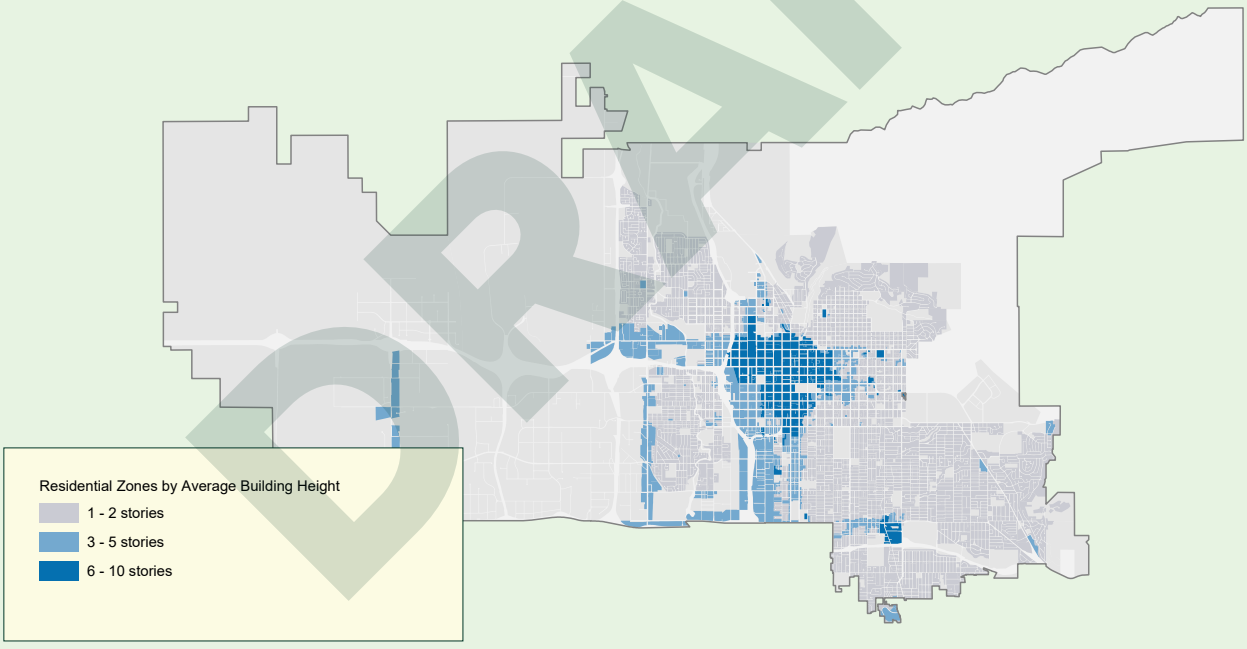
Street width also impacts scale requirements for trees, both for urban design and practical considerations, such as providing shade to asphalt streets to extend their lifespan. See the drawings at right and on the following page for proposed tree scale by height zones.

TREE SPACING

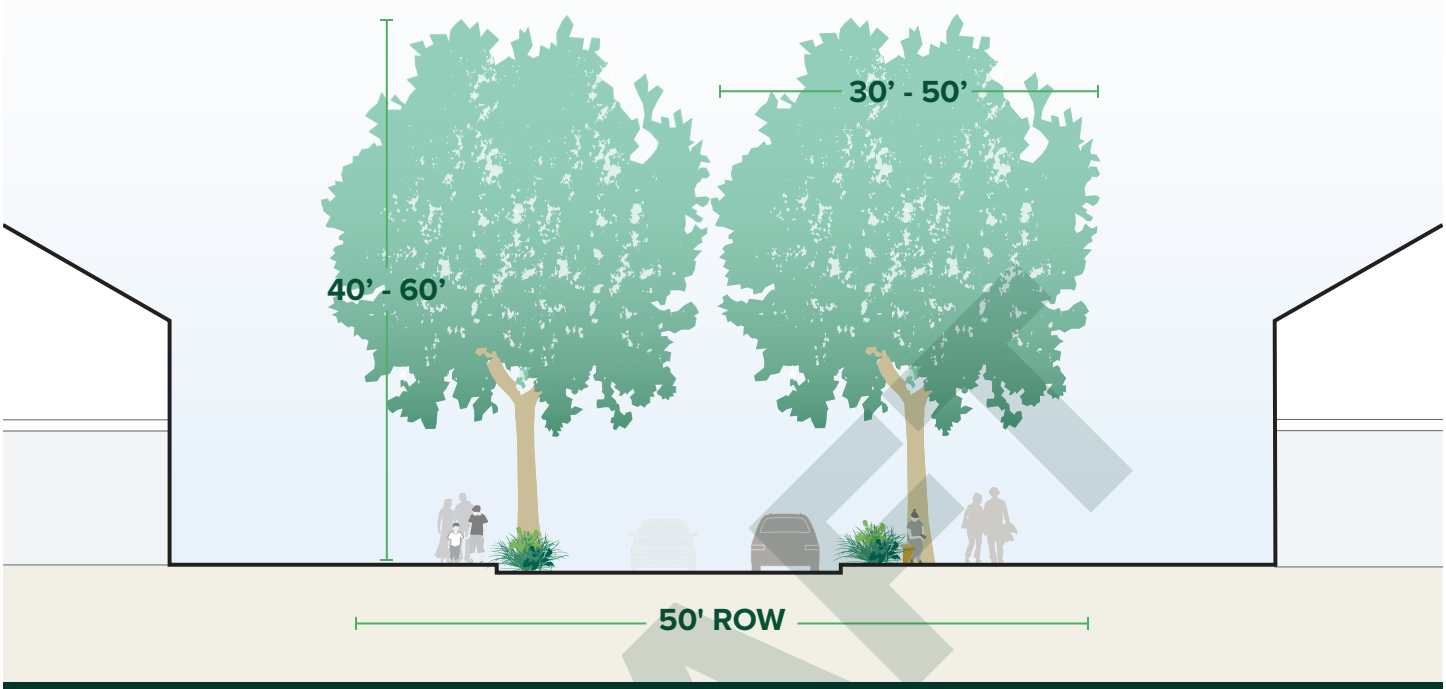
Trees spacing requirements range considerably, from 15 to 40 feet apart in different cities. Criteria for tree planting are often created without attention to the impact of street trees on urban design or resident perceptions of safety and accessibility.

> To be effective, street trees need to be reasonably close together. If one objective is to create a line of columns that separates visually and psychologically one pathway from another, and if a further objective is to provide a canopy of branches and leaves to walk under, then the trees have to be planted close enough to do that. (Jacobs, 1995)

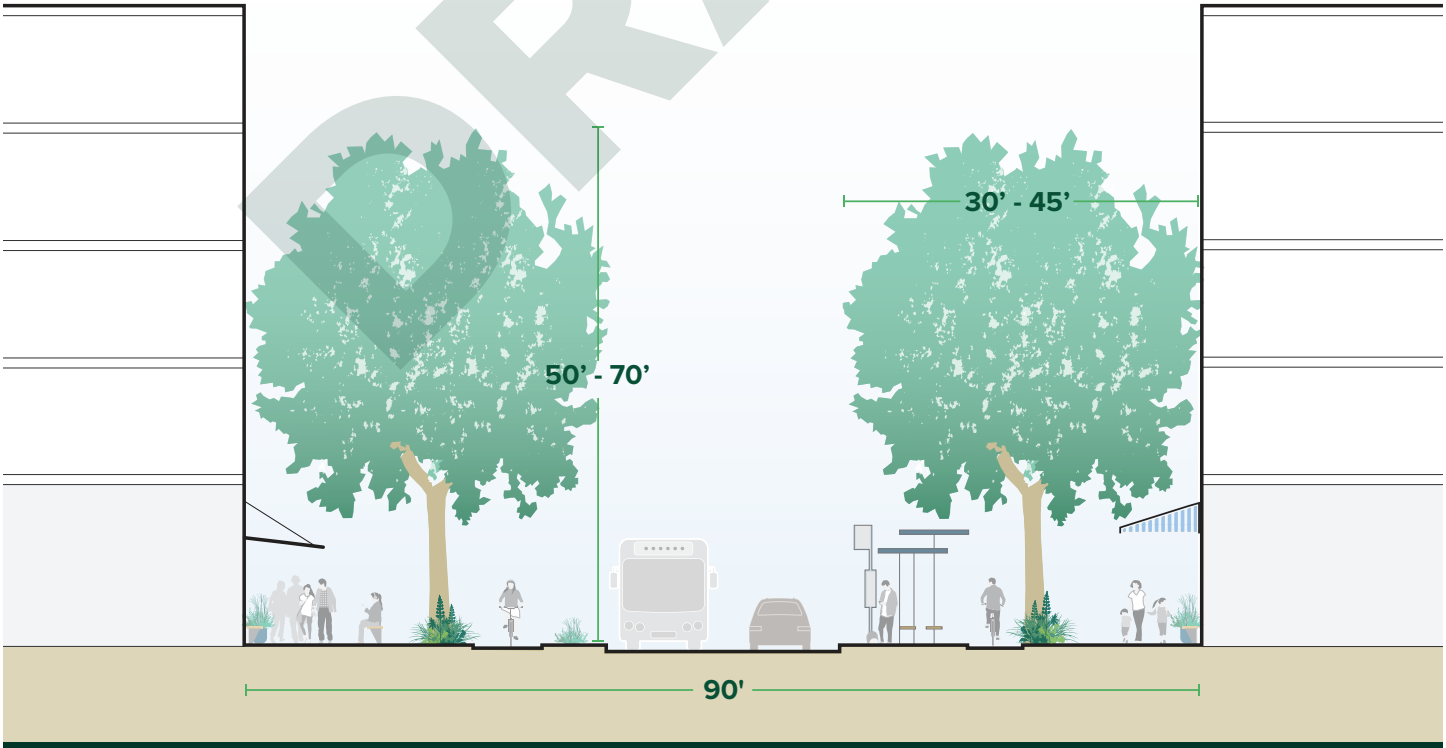
James Urban, a landscape architect and expert in urban arboriculture and soils, recommends using 20-foot on center spacing for trees as a general rule (James Urban, 2003). Tree canopy, longevity, and land-use and urban design contexts should also be considered when developing spacing guidelines.



Residential Zones by Average Building Height



Recommended Minimum Mature Tree Scale for Height Zone A (1 - 2 story buildings)



Recommended Minimum Mature Tree Scale for Height Zone B (3 - 5 story buildings)

Recommended Minimum Mature Tree Scale for Height Zone C (6 - 10 story buildings)

TRANSITIONAL ELEMENTS

All urban forestry programs plan for "succession," to achieve a balance of differently-aged trees throughout the City. However, thoughtful, well-designed structural elements can perform similar functions in areas where many new trees need to go in or even where a pronounced "gap" in a row of street trees occurs. Judicious use of these elements can provide a transition as young trees mature over decades or become more permanent elements in locations where tree planting is simply impossible.

While no single structural element can simultaneously provide the multiple benefits that a tree can, there some single functions that can be replicated, namely:

1. Providing shade for energy conservation and cooling (enhanced by misters, when feasible)
2. Creating vibrant, human-scaled social gathering places to improve public health and community cohesion
3. Imbuing spaces with cultural meaning or "sense of place" (public art, for example)
4. Enhancing active transportation routes and traffic calming by adding visual interest and diversity to the streetscape
5. Growing vines on structures can provide limited air quality and carbon sequestration benefits.

However, it is notable that there is a difference in the quality of shade provided by trees and that supplied by structures. Trees contribute to the enjoyment and complexity of the public realm through movement, leaf patterns, and modulation of light. (Jacobs, 1995) While some materials can mimic the translucence of leaves, the biophilic response created by tree canopies is practically impossible to replicate with built shade elements.

In response to the City's immense need for shade and its goal of achieving 25% canopy coverage by 2030, Phoenix, Arizona, requires trees to be planted in what it calls the "Streetscape Zone." Phoenix defines the streetscape zone as the area located behind the right-of-way curb with either landscaping or public amenities. If a public utility easement prohibits trees from being planted in the Streetscape Zone, then architecturally or artistically compatible public amenities, including structural shade elements, must be provided for the area (Section 1207).

Shade elements may include trellises, covered walkways attached to buildings, or detached, architecturally compatible shade structures. Structures must contain at least one side that is 50% open. (Phoenix, Zoning Ordinance, n.d.)

When new development cannot include trees, or when newly planted trees are too small to provide shade or other benefits, public amenities can act as either permanent or temporary installations to provide similar aesthetic, environmental, and community benefits.

The Phoenix Office of Arts and Culture has commissioned multiple public art installations that act as shade canopies and are typically included in more extensive infrastructure or urban design projects. Commissioned works include bus shelters, pedestrian bridges, and seating areas.

Matter Architecture Practice and landscape architects Gavan & Barker Inc. integrated landscape architecture and civil engineering to create "Bloomcanopy," a hybrid public art/shade structure. The canopy provides shade, and the plaza below was designed to accommodate stormwater runoff. (Bloomcanopy, 2021)

Bloomcanopy. Photo by Matt Winquist

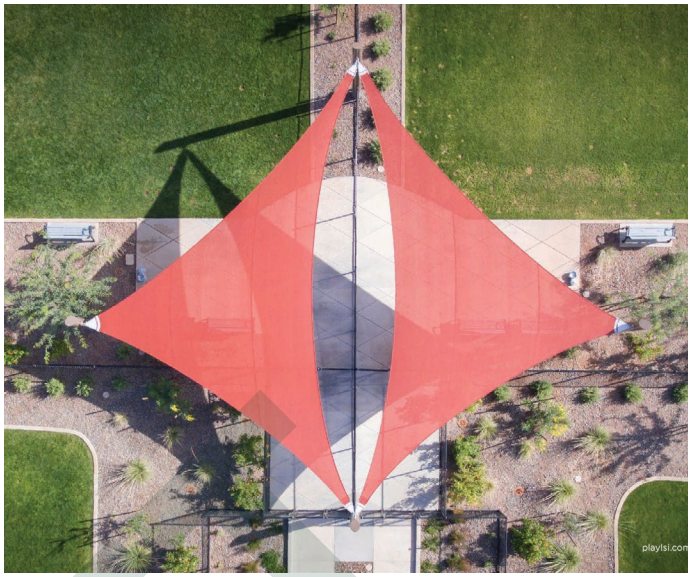
Bloomcanopy. Photo by Matt Winquist

Shadow Play. Photo by Matt Winquist

The 2018 American Institute of Architects (AIA) Small Project Award winner, "Shadow Play" sculpture (above) designed by Howeler + Yoon Architecture, is a cluster of shade structures placed in a former traffic median, providing pedestrians shade and seating in the daytime and solar-powered light at night. (AIA, 2021)

Cities can also use temporary public art installations to provide shade for city residents in areas where planting trees is not feasible due to conflicts with public utilities or narrow street rights-of-way. Originating in Portugal, the Umbrella Sky Project is an open-air museum that its creators describe as "A simple idea that brings color and protection to public spaces while transporting us into a fantasy world!" (Impact Plan, 2021) The project has traveled from Paris and Stockholm to Pittsburgh and Miami, creatively providing city dwellers with both shade and public art.

Shadow Play at dusk. Photo by Matt Winquist



Shade structure, photo by Landscape Structures 2021

The Umbrella Sky Project, 2021

Commercially available shade structures may also be appropriate for some locations, particularly to provide shade as young trees mature. Shade structures should be sited carefully so that they can be removed without damaging adjacent infrastructure. Once the tree provides adequate shade, structures can be removed and relocated where they are needed.

Whimsical shade structure, Landscape Structures 2021

NEIGHBORHOOD URBAN FOREST DISTRICTS

Developing a range of tree species (selected for form, scale, color, and other characteristics) to plant in specific areas of a city can enhance the character of city neighborhoods and urban districts. Economic success and community investment are often linked to an identifiable character, or image, of a place or neighborhood. The 9th & 9th neighborhood in Salt Lake City is an excellent local example of this phenomenon.

Urban designers, landscape architects, and urban foresters can collaborate to develop a selection of street trees defined by shared aesthetic and ecologic characteristics that provide a sense of place and emphasize transitions between different city areas. At the same time, grouping trees in this way can encourage biodiversity while simplifying irrigation and maintenance regimes by creating streetscape tree stands with similar water needs.

A connected grouping of trees selected using form, scale, color, and texture criteria (what designers call a "plant palette,") protects the urban forest's longevity by establishing context-appropriate, durable, easy to maintain, and aesthetically pleasing. The "palette approach" avoids excessive focus on particular species (which can often devolve into preferences and opinions or leave streetscapes vulnerable to species-specific pests and diseases).

Melbourne, Australia, developed Urban Forest Precinct Plans for each of its ten districts (or precincts) to achieve its citywide goals for the urban forest. These plans allowed for greater resident participation in the selection of design and performance characteristics, as well as prioritizing planting areas.

A plant palette can be tailored to a specific project or define neighborhood centers or even street types. Melbourne's Urban Forest Diversity Guidelines provide street tree recommendations based on street location and characteristics. The matrix of tree selection criteria considers street characteristics such as street and sidewalk width, typical building height, number of traffic lanes, and parking. (Melbourne, 2013)

URBAN FOREST STORIES

The City of Melbourne, Australia, adopted a heritage overlay designation and an Exceptional Tree Register, which requires developers to protect and retain trees with assessed cultural significance. New buildings cannot impact the health of existing trees and must be placed far enough away on the site to ensure the tree is protected during construction. (Heritage Design Guide, page 49). To be nominated for the "exceptional tree register," the tree must have aesthetic and horticultural value and be rare or localized to the region. Each tree must be nominated and then assessed by a third-party arborist who provides the assessment to an expert panel to review for accuracy.

The City recognizes each tree designation by adding it to an online interactive map that shows each tree's location and provides details on its significance and age.

Melbourne's urban forest has received considerable attention in recent years, as residents and visitors have been sending e-mail "love letters" to individual trees. The City assigned individual trees identification numbers and associated e-mail addresses to allow more efficient reporting and assignment of maintenance needs or problems. The City soon began receiving e-mail messages to the trees on various topics, some even sent from other countries. One typical example of an e-mail to a Melbournian tree:

> To: Algerian Oak, Tree ID 1032705
> 2 February 2015
>
> Dear Algerian oak, Thank you for giving us oxygen. Thank you for being so pretty. I don't know where I'd be without you to extract my carbon dioxide. (...Probably in heaven) Stay strong, stand tall amongst the crowd. You are the gift that keeps on giving.
>
> We were going to speak about wildlife but don't have enough time and have other priorities, unfortunately.
>
> Hopefully, one day our environment will be our priority. (LaFrance, 2015)

The "positive unintended consequences" of the e-mail ID underscores the connections many city residents find with trees and how much they value them, as one City Councilor noted. And, time permitting, some of the messages get a response from the "tree," which gives residents some insight into the commitment of civil servants who keep the City running. (LaFrance, 2015)

Artists have also used trees in creative placemaking strategies by developing fruit tree sharing programs to reimagine the public realm and revitalize public participation in urban spaces. Fallen Fruit, for example, is a pair of artists who create site-specific installations of fruit trees in public spaces to share. They have also developed "Endless Orchard," a website where participants can map public fruit trees anywhere in the world. Currently, most of the fruit tree locations mapped are in North America, but there are also many locations mapped in South America, Australia, Europe, and the Middle East.

These examples demonstrate how the urban forest provides residents with opportunities to find and make meaning in the places they inhabit and contribute to the stories that give urban places their rich history. Telling and celebrating these stories is another essential way to steward the urban forest.

Trees and other vegetation in Jordan Park create a “cooling island effect,” reducing ambient temperatures on nearby neighborhood streets.