NO. 2

SALT LAKE CITY URBAN FOREST ANALYSIS:

STRENGTHS, VULNERABILITIES, OPPORTUNITIES, + CONSTRAINTS

Salt Lake City's urban forest is critical to our quality of life. However, it is currently an undervalued and underused asset. In the past decade, Salt Lake City's record growth has impacted the urban forest. Development has contributed new trees to our streets and private lands. Yet, we have also lost established trees due to tree removal or root damage incurred in the process of accommodating growth.

New construction, changes in technology, and the need to provide services to more residents have increased competition to locate utilities within the park strip. Despite available solutions, these utilities often assume the space required for trees to thrive.

This chapter assesses Salt Lake City's urban forest's current strengths, vulnerabilities, opportunities, and constraints. This analysis creates a baseline for comparison to evaluate the effectiveness of the Urban Forest Action Plan's future implementation strategies.

The rate at which Salt Lake City loses public trees doubled every decade between 2008 and 2018. The hurricane-force windstorm in September 2020 decimated over 1,500 public trees, including many older specimens. Between the Mayor's 1,000 trees initiative and Urban Forestry's scheduled planting, Salt Lake City planted more than 2,000 new trees in 2020.

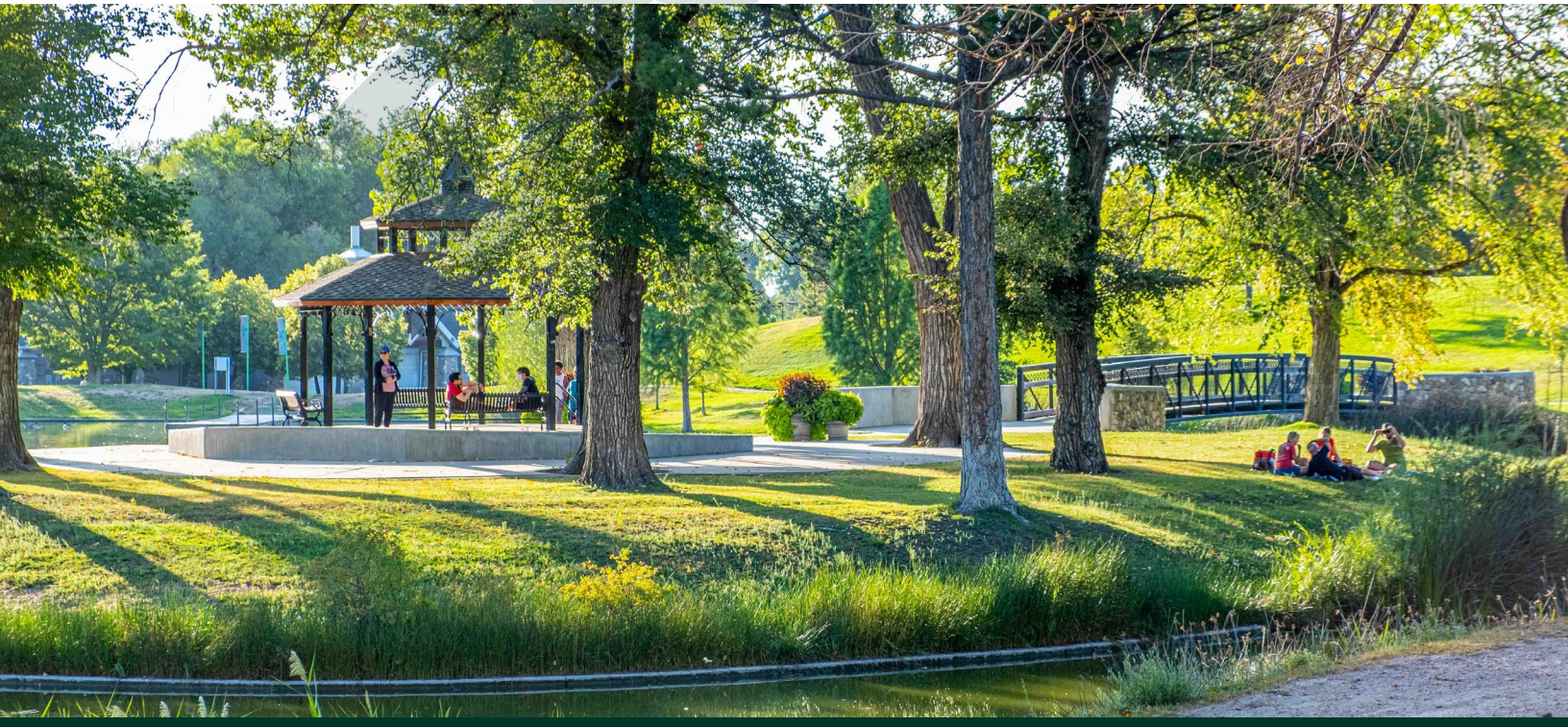
However, replacements for mature, large trees take decades to provide comparable air and water quality mitigation capacity. With continued development and climate change, adverse environmental impacts will increase. At the same time, declines in the City's urban forest impair its ability to mitigate these impacts.

The urban forest has numerous strengths, including existing tree stands, code and policy provisions, public support, and public appreciation for its many benefits. Building upon these strengths can address the vulnerabilities that occur primarily due to a fragmented approach to planning and managing the urban forest.

The urban forest is a living infrastructure system that requires sustained interdepartmental collaboration to optimize its benefits. The urban forest also needs land managers to implement solutions when conflicts occur between infrastructure systems. The handful of constraints on the City's urban forest, while significant, can be addressed through careful planning and mitigation measures and strategic investment in irrigation infrastructure.

The City's existing urban forest cannot effectively meet climate change challenges and growth opportunities without significant, strategic intervention, paired with ongoing planning for the future.

While other means of mitigating environmental impacts are available, most are more expensive than tree planting. And few (if any) of these mitigation measures provide the multiple ecological, social, and urban design benefits that trees do. By prioritizing the many opportunities available to preserve and grow the urban forest, Salt Lake City can build resilience into its urban fabric while fostering healthy communities.



Liberty Park is Salt Lake City's most visited park, and over one-third of visitors describe the trees as their paramount reason for visiting.

STRENGTHS

This plan defines strengths as factors that support the goal of growing and preserving the urban forest. These factors include existing assets, ordinances, policies, skill sets, or other municipal or resident practices.

EXISTING URBAN FOREST

When considering the City's urban forest, it is valuable to note that people intentionally planted nearly all trees throughout Salt Lake City (except those along waterways).

Salt Lake City's **publicly owned urban forest comprises roughly 86,500 individual trees; approximately 75% of these are street trees in the right-of-way (ROW).** The remaining 21,000 grow in City parks and other public lands.

According to a 2019 analysis, these trees create 1,455 acres of canopy cover, or just over 2% of Salt Lake City's total land area of 111.1 square miles (SLC Urban Forest Resource Analysis).

Geographic Information System (GIS) analysis from 2014 EPA Meter Scale Urban Land data that includes private lands expands the City's canopy coverage to 15% of the City's land area (10,778 acres).

PUBLIC APPRECIATION OF TREES

One of Salt Lake City's urban forest's greatest strengths is the community's high regard for it. The value residents place on the urban forest has been demonstrated through public engagement (see appendix for detail) and current tree care practices.

Plan Salt Lake, adopted in 2015, demonstrates the appreciation residents have for the urban forest, noting: **"Salt Lake City residents and visitors recognize our green network, including our urban forest, parks, and street trees, as one of our greatest assets"** (31).

The Salt Lake City Urban Forestry Division receives between 4,000 and 5,000 requests for service annually. New tree planting requests have also increased in recent years, demonstrating residents' expanding interest in the urban forest.

Salt Lake City requires residents to water street trees. The significant number of thriving trees demonstrate that many residents are willing and able to support the urban forest with time and money.

SALT LAKE CITY PLANS

Plan Salt Lake includes initiatives for incorporating trees in City rights-of-way in nearly one-third of its guiding principles: Neighborhoods, Transportation and Mobility, Air Quality, and Beautiful City.

The Transportation Division's current plans also highlight the need for trees to implement successful, well-used transit routes. These plans also call for more shade trees to create comfortable, beautiful pathways for walking and other active transportation.

The Salt Lake City Transit Master Plan recommends investing in street trees on Frequent Transit Networks as a near-term, high priority strategy related to placemaking and design (SLC Transit Master Plan, 6-8, 2017).

The Salt Lake City Bike and Pedestrian Master Plan (2015) notes that street trees have a "profound effect" on improving street corridors for pedestrians. The plan recommends that the City include street trees, particularly shade trees, in its streetscape designs (43). Additionally, it notes that trees create an important functional and aesthetic buffer between the sidewalk and the roadway (57).

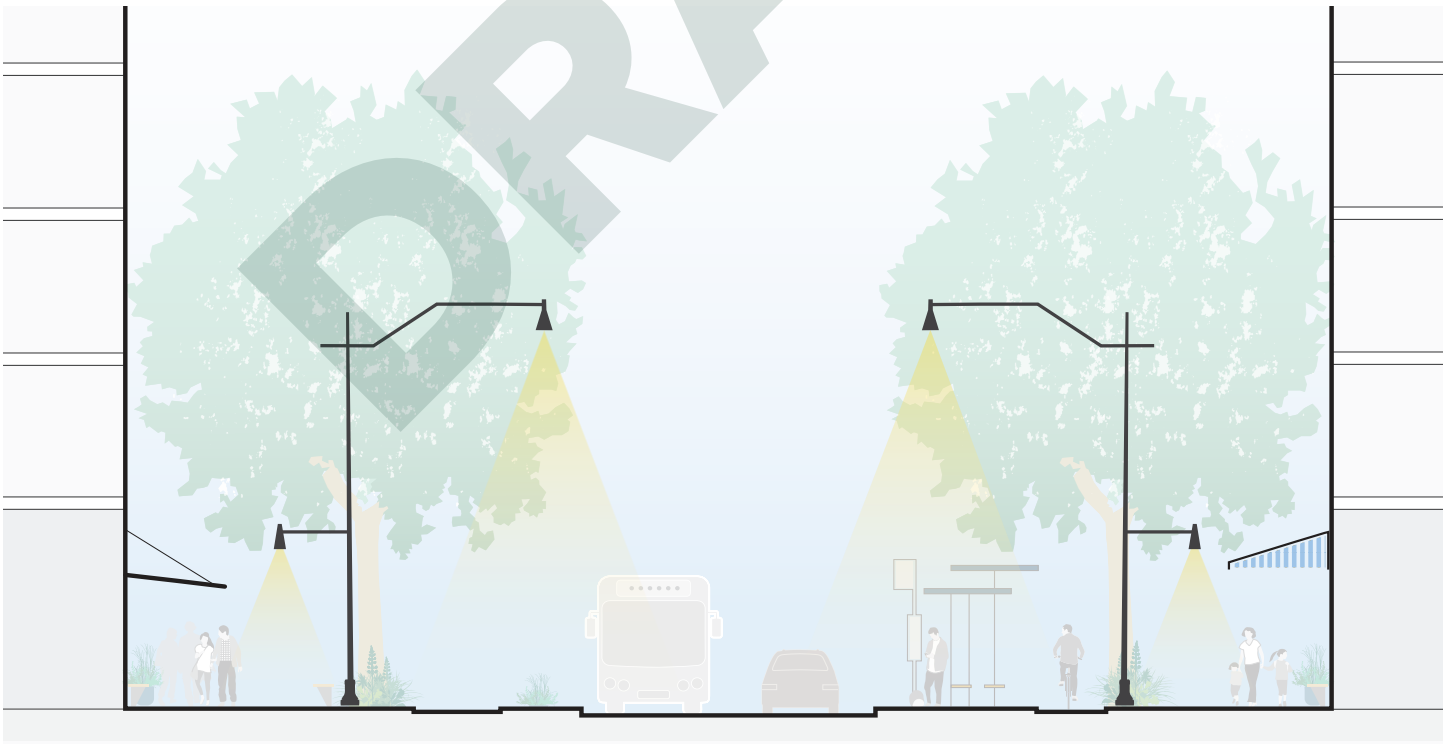
Several Salt Lake City Community Plans also note the importance of street trees, notably the **Downtown Plan** (2016), which emphasizes their importance in establishing district design identity:

> Trees...contribute to the image and identity of districts. Street trees strengthen the image of Downtown, contribute to the character of individual districts, provide comfort and amenity to public spaces, and perform essential ecological services that make a healthy urban environment. ...Street trees that provide a regular, continuous canopy reinforce the formal symmetry, regularity and "grand" landscape-scale of Downtown's main streets. (21)

The Salt Lake City Streets and Intersection Typologies (ongoing) will assist the City in creating place-based streets that work for all users. The guide proposes new classifications and prototypes for a range of Salt Lake City street types. The typologies consider land use, City, and neighborhood goals and allocate the public right-of-way to prioritize people.

Street trees play a significant role in the design guide. The guide acknowledges the urban forest's considerable environmental, transportation safety, retail district improvement, and community functions in making streets attractive, accessible, and equitable places for people.

The Salt Lake City Street Lighting Master Plan (2020) expands upon the Transportation Division's 2006 policy of coordinating new streetlight locations with new trees. The plan recommends using pedestrian lighting in addition to street lights in areas where street trees create shadows to support a safer and more visually comfortable environment (45).



On streetscapes with trees, lighting vehicle and pedestrian pathways at night enhances safety and visual comfort for pedestrians.

Salt Lake City's Urban Forest currently provides a range of air quality, stormwater management, aesthetic, urban design, cooling, and energy-use reduction benefits to the City, along with public health benefits, both physical and mental. While some of the urban forest's benefits can be quantified, others are qualitative and have a significant impact on Salt Lake City's goals for livability, emissions reduction, and placemaking.

QUANTITATIVE BENEFITS

Davey Resources Group extensively detailed and quantified many specific benefits of trees on Salt Lake City property in the 2019 Salt Lake City Urban Forest Resource Analysis. (See Appendix A for details).

The analysis found that **the total estimated benefits provided by Salt Lake City's public trees are worth nearly $7.5 million annually.**

ENVIRONMENT

Salt Lake City's public trees currently provide $1.7 million in environmental services annually:

- **Improved air quality** ($140K): Trees absorb pollutants (ozone, sulfur dioxide, nitrogen dioxide) through leaf surfaces, intercept particulate matter (dust and smoke), produce oxygen via photosynthesis, and provide cooling, which reduces ozone formation.
- **Stormwater management** ($330K): Leaves and root masses work to intercept rainfall, which decreases the amount of stormwater flowing into storm drains. Trees also increase soil infiltration capacity, recharging groundwater supplies, reducing stormwater volumes, and improving water quality through pollutant uptake. Soil infiltration provides ecological benefits by filtering water before it enters rivers and streams and economic benefits to the City by reducing the need to invest in gray stormwater infrastructure.
- **Carbon Reduction (**$92K): Trees accomplish this directly via carbon uptake in leaves and biomass. They indirectly reduce carbon by providing shade and passive solar benefits, reducing emissions associated with building energy consumption.
- **Energy Savings** ($1 million): The urban forest reduces energy consumption for heating and cooling in multiple ways. The urban forest:
  - Provides shade, reducing both surface and ambient temperatures on concrete, asphalt, and other paving materials (heat island effect);
  - Transpires (releases water vapor), cooling the surrounding air;
  - Provides passive solar heating, allowing sunlight to reach interior spaces in winter after deciduous leaves fall;
  - Reduces wind speeds and the movement of wind into buildings; and
  - Reduces heat loss on surfaces with high thermal conductivity (21-32).

ECONOMY

Property values and commercial rental rates increase as trees mature and canopies become large. The Salt Lake City Urban Forestry Division compared neighborhoods with many trees to those with few or none. **The analysis estimated that public trees provide a range of socio-economic benefits equaling nearly $6 million annually.** (33)

A national survey of business districts found healthy urban forests correlate with increased retail sales and spending and customers remaining in business districts longer. In addition, patrons are willing to travel longer distances and spend approximately 10% more in business districts with trees. (Wolf, 2009). Salt Lake City's Economic Development department considers the 9th and 9th neighborhood the "showcase" retail district. It has many mature trees both within the right-of-way and on adjacent private property.

RETURN ON INVESTMENT (ROI)

The City invests $2.2 million annually in the urban forest by planting, pruning, irrigation, administration, and other infrastructure management. According to the 2019 assessment, the total annual benefit (environmental and socio-economic) that the urban forest provides is $7.5 million, for a net yearly gain of $5.3 million.

Put simply, **for every $1 Salt Lake City invest directly in the urban forest, it receives $3.40 in benefits** (38).

Urban residents in early Salt Lake City understood that trees were fundamental to a livable city. *(Utah State Historical Society, circa 1877-1880)*

QUALITATIVE BENEFITS

CULTURAL VALUES

Salt Lake City's history as an urban place is closely tied to its urban forest. When emigrants arrived in the Salt Lake Valley in 1847, their first concern was water. The second was shade for thermal comfort. Settlers first planted vines to grow shade over their early, simple earthen homes quickly. They just as promptly planted and cultivated trees to transform the streets and canals of the Plat of Zion into a livable city.

There are notable trees with cultural value throughout Salt Lake City. The locust tree planted near the Beehive House in Temple Square (at the State Street entrance). Harriet Page Wheeler Decker, mother-in-law to Brigham Young, arrived with the first pioneer company in the Salt Lake Valley on July 24, 1847. She carried a locust tree seed on the Mormon Pioneer Trail and planted it near the Beehive House kitchen door. Reputed to be the first residential landscape tree in the Valley, photographs show that a locust tree has remained in that location since the 1850s, even withstanding the impacts of an addition to the house in 1889.

Even tree locations have cultural importance to Utahns. On 600 East, just south of the intersection with 300 South, a center median contains a monument to "The Lone Cedar Tree," erected by the Daughters of the Utah Pioneers (DUP) in 1960. The Lone Cedar may have been a landmark in grasslands that characterized the mid-nineteenth century Salt Lake Valley. In the immense vistas of the western United States, landmarks were critical navigation tools used during the overland migration.

The DUP resolved to memorialize the Lone Cedar Tree after it was "thoughtlessly" cut down (as the plaque notes). Their efforts demonstrate its cultural and historical reputation to residents more than a century after Salt Lake City's founding.

Mayor Erin Mendenhall created a campaign to plant 1,000 trees on Salt Lake City's West Side in 2020 and secured private funding for this effort. The planting kick-off was held on Arbor Day in April 2020, even while the administration addressed the combined emergencies of the global COVID-19 pandemic and a magnitude 5.7 earthquake a month prior. After a hurricane-force windstorm in September 2020, the Mayor worked with non-profit and private sector partners to replant the nearly 2,000 trees lost on City-owned land. (See September 2020 Windstorm below).

RECREATION + ACTIVE TRANSPORTATION

Trees play a critical role in recreation and active transportation activities in Salt Lake City. For example, the 2019 Salt Lake City Parks and Public Lands Needs Assessment surveyed residents and visitors to parks. The Assessment found that Liberty Park is the most visited park in the City, and one-third of survey respondents noted that their primary reason for visiting Liberty Park is the trees (xiii).

The Salt Lake City Bikeways Map recommends selecting routes based in part on street trees and available shade. This guidance demonstrates trees' importance in providing comfort and shade when making active transportation choices.

TREE AGE DISTRIBUTION IN THE URBAN FOREST

Age distribution is critical in the urban forest because single-age tree stands are more likely to die simultaneously. Arborists typically describe a tree's age using its size, or DBH (diameter at breast height). DBH is the standard method used to describe the width a tree trunk at 4.5 feet above the ground. By ensuring trees have a range of DBH, managers can plan for urban forest succession. Planning ensures that new trees have sufficient time to establish to replace mature trees with more extensive canopies.

The current age distribution of Salt Lake City's public trees is nearly optimal from a resource management perspective. 41% of trees are eight inches or less DBH, while 12% are larger than twenty-four inches DBH. This age distribution generally allows Urban Forest managers to anticipate annual maintenance costs and plan the expenditure rate from year to year.

SALT LAKE CITY CODE

The Salt Lake City Urban Forestry Ordinance (Chapter 2.26.210 of the Salt Lake City Code) requires a permit to plant, maintain, or remove trees on public land. It also requires replacements or remuneration for any tree removed. (Removal fees, however, do not capture the value of ecosystem services trees provide).

The zoning code contains provisions to protect some trees on private land (21A.48.135), namely healthy, viable "specimen trees." Specimen trees are defined as either single trees or tree groups that measure at least 10" in DBH (see Tree Age Distribution, above) or more. The code states, "specimen trees shall be preserved to the maximum extent practicable as determined by the city forester, in consultation with the zoning administrator." However, there are some instances where developers can provide cash instead of replacement trees. Salt Lake City Code also preserves and protects urban forests on specific parcels of private land through the Planned Development process detailed in 21A.55.010.A.

Some zoning districts and overlays protect natural lands and riparian corridors that the City could amend to include provisions to preserve trees. Namely, the Natural Open Space District, Open Space District, Foothills Protection District, Riparian Corridor Overlay, and the Lowland Conservancy Overlay. That said, currently, the text does not mention protections for forest stands or individual trees specifically.

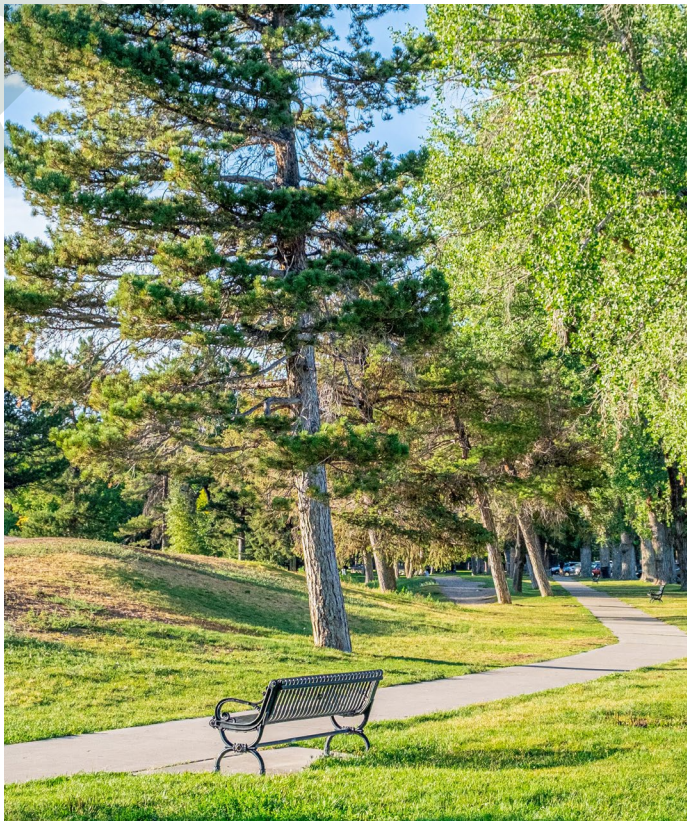
CITY POLICIES

In January 2020, Mayor Erin Mendenhall updated City policy to incorporate sustainability into operational decision-making. She requested all department directors to submit memoranda detailing how their operations could mitigate adverse environmental impacts or improve environmental quality.

PRIORITIZING TREES IN PARK STRIPS

A car-dominated city, Salt Lake allowed paved parking spaces or driveways to occupy prime spots for trees in the public right-of-way for decades. Before 2020, the City regularly granted permits to remove trees to make space for cut-in parking stalls within park strips or to create driveways to existing homes.

At the same time, new parking stalls induce demand for driving, thereby increasing emissions. In 2020, the Community and Neighborhoods Department led an effort supported by other City Departmental stakeholders to address the inconsistency between the environmental impacts of parking policy and the City's commitment to air and water quality. The consensus recommendation was to create a new Salt Lake City policy to eliminate the practice of replacing park strips with parking or any other impervious surface, with rare exceptions.



VULNERABILITIES

The goal of the Urban Forest Action Plan is to develop strategies to preserve and grow the Urban Forest; this plan defines vulnerability in Salt Lake City's Urban Forest as:

- **Unresolved conflicts,**
- **Gaps (in ordinance, policy, guidance, enforcement, or other City practices), or**
- **Loss or absence of skill,**

That undermines the goal of growing and preserving the urban forest.

Chapter 4 of this plan examines best practices in other cities that address these vulnerabilities, and chapter 5 recommends actions to address and correct vulnerabilities and prioritize solutions.

ACCELERATING RATE OF TREE LOSS

The rate at which Salt Lake City is losing urban forest trees has doubled every decade over the past twenty years. Salt Lake City removed 300 trees in 1998, 600 trees in 2008, and 1200 trees in 2018. Salt Lake is not unique in its loss of trees. A recent Nature Conservancy study looked at 27 US cities and found that 85% had declines in canopy cover between 2004-2014. (Kroeger, 2018)

While the City has replaced many of these trees, replacement plantings for a single large tree will take 75 to 100 years to provide enough canopy to mitigate air and water quality impacts and heavy stormwater flows (PAS, 2014). Additionally, many of the City's fastest-developing areas, such as Downtown, are also those that are already the most heavily paved. Thus, tree loss in these locations exacerbates the urban heat island (UHI) effect and localized flooding.

LACK OF COMPREHENSIVE PLANNING FOR THE URBAN FOREST

Salt Lake City lacks an urban forest master or management plan, which would provide comprehensive, prioritized guidance to equitably deliver the benefits trees provide. A master plan focused on the urban forest could address maintenance, management, long-term funding, staffing, disaster response, and mitigation, and provide robust strategies and best management practices to maximize the urban forest's return on investment (ROI).

URBAN FOREST ORDINANCE + POLICY CONFLICTS

Over the past decade, the City has developed at a rapid pace. The pace and scale of development has sometimes left City policies and practices unable to meet current needs. The City has, at times, found itself unable to strike an effective compromise between urban forest preservation and development activity.

Existing policies related to land use in the right-of-way (ROW) sometimes conflict with City policies for the urban forest and make it difficult to plant trees in many areas. For example, Public Utilities Department policy directs trees to be planted at least 10 feet away from water and sewer lines. A recent analysis of tree planting spots in the ROW found that approximately 24,000 suitable locations exist (Davey Resource Group, 2019). When this spatial analysis was paired locations of water and sewer lines using GIS, however, the number of planting locations dropped by more than half -- to 10,000 viable tree sites in the ROW. When sustainability criteria (energy use reduction) are applied to potential tree locations, however, that number drops to less than 200, or 0.8% of the total number of planting locations identified.

While products exist that can direct tree root growth away from pipes, they add additional costs to project budgets. Currently, these are not a line item in either Public Utilities or Urban Forestry's budgets.

Private property owners whose land abuts park strips are responsible for watering and fertilizing trees and protecting them from damage caused by lawnmowers and similar equipment (Section 2.26.190). Yet, Salt Lake City has no mechanism to enforce this policy. The City would need additional revenue streams to enforce this policy equitably, or the cost burden would be more significant on lower-income owners. Additionally, this policy assumes that residents know their responsibilities and have adequate information and experience with tree irrigation, which is not always the case.

Existing city code has conflicting regulations for street trees. If an adjacent property owner challenged the City, it would have limited ability to maintain its public infrastructure. For example, the Urban Forestry chapter (2.26.210) states, "The urban forester must approve any permit for removal of public trees." Permit approval is conditioned on the provision of replacement trees or compensation.

Yet the regulations for existing street trees in the Landscaping and Buffers chapter (21A.48.050) state, "the removal of trees within the street right of way is prohibited without the approval of the zoning administrator in consultation with the urban forester." Without reconciliation, these inconsistencies leave the City open to challenge by property owners who do not accept trees as a public benefit.

Additionally, the City has yet to establish clear, definitive thresholds for conserving the urban forest. Without clear conservation guidance, it is more challenging to preserve and maintain the collective benefit they provide. The code typically regulates individual trees rather than the entire urban forest as a modified natural system.

INADEQUATE TREE REMOVAL MITIGATION POLICY

Currently, Salt Lake City's tree replacement policy does not account for a tree's total ecosystem value. City ordinance requires replacements for trees removed for construction or that the cash value of the timber is paid into a revenue account to plant and preserve the urban forest. Therefore, the City does not receive the full benefit when cash or replacement trees are provided for removed trees.

Small trees (2-inch caliper) are the best to establish in Salt Lake City's difficult growing conditions. Bigger trees are generally more costly and prone to early mortality when transplanted. Therefore, if a large tree is removed, the "in-kind" replacement is made with an equal number of 2-inch caliper trees. For example, a 20-inch caliper tree replacement consists of ten 2-inch caliper trees. However, ten young trees can take decades to provide similar ecosystem services as a single mature tree. Given the challenges and stresses of urban growing conditions and climate change, new trees may never offer the same ecosystem services as those they replaced.

While Salt Lake City's urban forest's age distribution is generally healthy, 56% of trees in Salt Lake City are on the younger end of the spectrum. These young trees require adequate care and water to ensure they reach maturity and provide maximum benefits.

With the growth and construction rate Salt Lake City has undergone in the past decade and climate change impacts, the urban forest is becoming younger. As a result, the urban forest is less equipped to mitigate the environmental impacts of rapid development and increased emissions related to population growth.

NEED FOR MORE PLAN REVIEW CAPACITY

There is inconsistent attention to tree roots' size and location in site plan review, notably in demolition and construction staging plans. Plan reviewers outside the Urban Forestry division are not trained to assess conditions for tree growth and survival. Evaluation and correction by a qualified reviewer during these initial stages are critical to ensure that trees need not die unnecessarily. Furthermore, Urban Forestry has limited resources to allocate to plan review, presenting real challenges to tree preservation given the expanding pace of development in Salt Lake City.

City ordinance (21A.48.050) prohibits "the removal of trees within the street right of way ... without the approval of the zoning administrator in consultation with the urban forester." Yet, in most cases, when tree removal is requested, the application does not come before the zoning administrator for consideration, breaking a vital link between Planning and Urban Forestry.

UTILITY + URBAN FOREST CONFLICTS

Conflicts between overhead and underground utilities and trees have become increasingly frequent during the City current period of rapid development. While many utilities are located underneath the roadway, the City permits others to be installed the park strip, where they compete for space with tree roots. Trees are regularly removed or damaged to accommodate underground utilities in the park strip.

The most significant tree and utility conflicts in the Salt Lake City area are between root systems and water and sewer lines and between tree canopies and above-ground electricity infrastructure. These conflicts occur frequently and lead to tree removal and damage, unaesthetic pruning, and loss of (otherwise viable) tree planting sites.

Overhead utility lines often prevent appropriately scaled trees from being planted along Salt Lake City's wide streets. Electric transmission lines are costly to bury and are typically only cost-effective to place underground when there is at least a mile-long section. Typical development on a single parcel is a much smaller scale. Currently, transmission lines prevent the City from planting trees that can adequately shade our large rights-of-way.

INADEQUATE SOIL VOLUMES

Areas that are most heavily paved, such as Downtown streets, require more shade to offset the increase in pavement surface and ambient temperatures. The same is true of bus shelters built on concrete pads. However, standard paving practices reduce the amount of available soil required to provide sufficient root space for large shade trees. Salt Lake City has made advances by introducing structural soils under the pavement in some areas. However, soil cell (or suspended pavement) systems are generally preferable. They tend to produce sizable, healthier trees while also managing stormwater. (See Chapter 4, Suspended Pavement Systems, for additional details).

NEED FOR MORE SUSTAINABLE APPROACHES TO FIRE ACCESS

Both life safety and sustainability are the foremost priorities in Salt Lake City. Still, the City has yet to fully explore the wide range of solutions to create a both/and approach to fire access requirements and sustainability.

Requirements for unobstructed area for fire apparatus (ladders, etc) access have led to developers removing large trees and soil, and the introduction of more pavement into the right-of-way (ROW). The Department of Community and Neighborhoods and the Fire Department worked closely to find a range of alternative means of fire prevention. However, these are optional to the developer and typically cost more than simply paving more area for fire truck access. The result is often large volumes of surface soil that once grew trees are paved over to support a fire truck's weight.

LIMITS ON ENFORCEMENT CAPACITY

The lack of a consistent City-wide approach to tree protection during construction has led to a decline in the urban forest. Although the City has policies to protect trees during construction, these are too often overlooked during construction. Building inspectors who examine the trees on installation and civil enforcement officers are not arborists trained to spot potential tree problems. Thus, they are at a significant disadvantage in detecting issues that may lead to early tree mortality.

Although required by ordinance (2.26.300: Protection of Public Trees Near Construction Activities), construction sites often lack fencing or signage related to tree protection. Both Civil Enforcement and Urban Forestry need additional capacity to monitor and enforce regulations actively or issue stop-work orders to correct the situation.

NON-COMPLIANCE WITH PROTOCOLS FOR NEW TREES

When the zoning code requires new or replacement trees, the new plantings are often subject to severe stress because applicants do not follow tree health and irrigation protocols. Inspectors only determine if the correct number of trees have been installed and are not trained to evaluate tree health or planting conditions.

When trees are planted at the height of summer, heat stress creates difficult growing conditions, resulting in more significant disease and mortality. Furthermore, once planted, contractors often do not water during the establishment period, leading to excessive rates of new tree mortality.

RIGHT-OF-WAY CONFLICTS

Multiple City departments are charged with overseeing land uses related to public health, safety, and welfare in the right-of-way (ROW). When land use policies conflict (for example, tree roots with water lines), insufficient funding means trees often lose out. Tree loss occurs despite potential solutions which might accommodate a robust urban forest alongside other land uses.

Simultaneously, there is no clear arbiter for final decisions in the ROW nor a straightforward process by which different land uses are allocated. Given the wide streets in many parts of the City's ROWs, ample space for trees exists. However, tree planting locations are sometimes lost due to lack of communication or clear decision-making authority regarding allocating space in the ROW.

INADEQUATE IRRIGATION

Irrigation considerations are always prominent in Utah's arid climate. With a growing population and climate change concerns, the need for water conservation is ever-present. Currently, the City will plant trees in park strips at resident request, provided residents agree to irrigate them. Additionally, the City requires trees to be preserved or planted for all new development. The developer is also required to irrigate the trees. In many cases, however, irrigation never happens or happens for a short period, leading to the decline and death of trees.

It is challenging to enforce watering requirements. People move, developers sell properties, and new residents may not be aware, inclined, or able to meet their responsibilities. As a result, healthy, viable trees go without sufficient water and never establish and have a dramatically shortened lifespan.

Furthermore, City maintenance budgets currently limit the amount of usable irrigation from precipitation, which will be increasingly important as climate change brings more rain. For example, the City lacks funds to support the cost of maintaining previous paving, which would benefit both trees and groundwater supplies.

CAPACITY CONSTRAINTS ON URBAN FOREST MAINTENANCE

Because the urban forest is living infrastructure, its maintenance needs, while generally predictable, are becoming less so with climate change. Summer thunderstorms can break tree limbs and create debris in the right of way, and winter ice storms do the same – both are increasing as the climate changes. In turn, this can increase impacts on other infrastructure, such as streets and aboveground utilities.

LIMITED URBAN FOREST DATA GATHERING + SHARING

The City lacks a defined schedule for urban forest surveys. Using GIS and aerial photography, the City has the tools to create and update canopy cover maps regularly; however, this requires investment or agreement to share resources with other Utah government agencies.

The City is possesses reasonably comprehensive and accurate tree inventory data. However, as this inventory data changes daily, it is imperative that inventory update strategies be developed and implemented to ensure lasting data accuracy.

When applicants look at Salt Lake City Maps to determine project needs and requirements, existing tree and planting spots are not available.

Additionally, the Urban Forestry Division requires permits for tree planting and removal, but currently these are difficult to track for a given year because of past inconsistencies. Further, residents are often unaware permits are required for park strip trees, and when they plant or remove trees without a permit, the Urban Forestry Division does not have a means to track these.

LIMITED RESIDENT ENGAGEMENT

Salt Lake City lacks a balanced public outreach effort that educates and motivates the community around the urban forest citywide from residents to business owners.

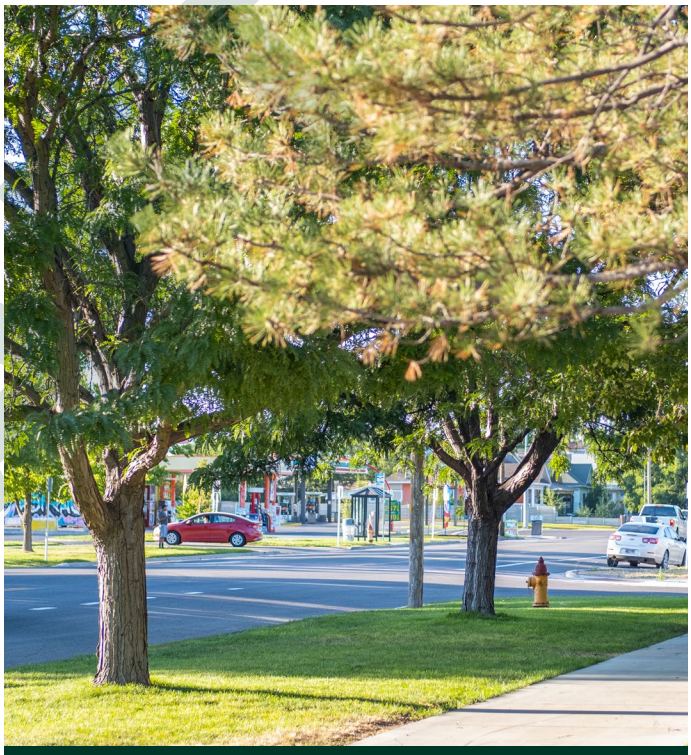
The City needs data regarding the most effective means of public outreach and engagement to our residents, including the approximate number of residents informed about our Urban Forestry Division's services and their responsibilities related to watering street trees.

Many residents are eager to be good stewards of their neighborhood trees, but the City's lack of data and capacity to provide effective outreach creates missed opportunities.

SPECIES OVER-REPRESENTATION

When private property is included, too many Norway maples (*Acer platanoides*) are present in the urban forest. The urban forest also has many green ash (*Fraxinus pennsylvanica*) and Modesto ash (*F. velutina*) trees.

A generally accepted rule is that a single species should never exceed 10% of the urban forest as a whole and that no genus should exceed 20%. Norway maple exceeds this rule at the species level, and the *Acer* (maple) genus represents 19.9% of Salt Lake City public trees.



Large park strips can provide ample space for tree roots to grow when underground utilities are carefully co-located.

LOSS OF CLIMATE-RESPONSIVE DESIGN CULTURE

In the era before air conditioning, the people of Salt Lake understood the need for shade during the summer months and planned and legislated accordingly. In 1923, Salt Lake City passed an ordinance creating a Shade Tree Department, overseen by the Shade Tree Commission. The Shade Tree Department had authority over tree planting, pruning, and removal on City lands. The penalty for violating the ordinance was a $299.00 fine (nearly $5,000 in 2020) or six months in jail, or both. In the early 20th century, City officials understood trees as critical components of Salt Lake City's urban life.

The loss of climate-responsive design approaches is not unique to Salt Lake City but has occurred worldwide. Architects abandoned design responses intended to mitigate weather impacts or harness the cooling properties of shade and breezes. When climate control became prevalent, architects designed buildings where temperatures could adjust with the touch of a dial.

By the 1960s, the widespread adoption of air conditioning contributed to the notion that urban forests were only aesthetic and served no real function in US cities.

ENVIRONMENTAL INEQUITY

A significant weakness in Salt Lake City's Urban Forest is related to a sparser tree-canopy in working-class and industrial areas of the City, as well as business districts. The lack of trees is most evident in the West Side (with less than half the canopy cover of neighborhoods on the east side) and downtown.

Lower tree canopy can intensify adverse public and environmental health impacts and increase energy costs. Inequity in the urban forest is common throughout US cities, which several are now trying to remedy (Los Angeles and Tempe, AZ, for example).

In Salt Lake City, inequity is inadvertently exacerbated because residents must both request a tree in their park strip and are required to water it. While this program has many positive outcomes, this policy generally privileges homeowners. Renters may feel they need to ask their landlord's permission or may not have ready access to a means of irrigation.

For those already cost-burdened by housing, the cost of a sprinkler system or the time and planning needed to water by hand simply adds to the burden. And while shade trees can significantly reduce both energy and water costs to residents, this is not common knowledge. It is typically 10-15 years from planting until trees provide adequate shade to houses.

Cost-burdened households then end up in a vicious cycle of inequity, as they incur physical and economic costs related to adverse health impacts from hotter summer temperatures and localized spikes in air pollution. Furthermore, to access trees' emotional and social benefits, cost-burdened residents are often required to travel to parks or public lands. In contrast, higher-income residents are more likely to have trees available when they look out the window or open the door.

Today, natural systems are increasingly understooded as cost-effective solutions in cities to enhance both environmental and public health.

OPPORTUNITIES

This plan defines opportunity in Salt Lake City's Urban Forest as factors contributing to growing and preserving the urban forest. These factors have yet to be explored, acquired, funded, or implemented. They include assets, policies, skill sets, and other municipal or resident practices.

Subsequent chapters of this Action Plan will assess some of these opportunities in more detail and prioritize strategies for decision-making and implementation.

TREES ARE PUBLIC INFRASTRUCTURE

Cities with thriving urban forests, such as Minneapolis, understand that trees are critical public infrastructure and plan and protect them accordingly. Salt Lake City has an opportunity to investigate and apply a range of policies and practices that could achieve the goal of elevating the urban forest to the level of public infrastructure. When trees are valued on par with our storm-water pipes or streetlights, the City can more easily ensure an equitable distribution of its benefits.

STRENGTHENING OF TREE PRESERVATION STRATEGIES + REQUIREMENTS

There are conflicting directives related to tree preservation in the Salt Lake City Code. Few fully account for trees' social and environmental health benefits. Reassessing these codes and amending them to remove conflicts and inconsistencies could resolve these conflicts. In addition, creating urban forest regulations intended to improve growing conditions, urban design, and public health would provide multiple environmental and social benefits.

There are multiple ways to amend the ordinance to strengthen tree protection and codify ecosystem service value.

The Salt Lake City Open Space Acquisition Strategy, last updated in 2010, could be revisited to incorporate more specific guidance related to trees. This guidance should be based on the findings of more recent analyses of the administration's urban forest and goals set. In partnership with scientists and environmental managers, the City could identify an approach to urban forest expansion that cleans both the air and the urban watershed.

EXISTING PLANTING LOCATIONS

The Urban Forestry Division's recent inventory identified 36,000 vacant planting sites on City-owned land. A City-led initiative in partnership with other government agencies and non-profits could fill those spots. Partners can identify low-water-use tree species and irrigation infrastructure funding sources to provide the greatest equity and water conservation benefits. **These planting locations represent the potential to increase the tree canopy by 600 acres and grow our urban forest by 40%.**

CREATE COOLING ISLANDS IN GOLF COURSES + PARKS

Salt Lake City has several opportunities to maximize the "cooling island effect," created by parks and golf courses through planting trees in optimal locations. Research demonstrates that parks cool ambient temperatures in neighborhoods surrounding them.

Strategically locating large trees on the borders of parks and golf courses, in collaboration with urban ecologists and atmospheric scientists, could help mitigate urban heat island impacts as summers grow hotter.

PLANTING "RIGHT-SIZED" TREES: CONSIDERING ABOVE + BELOW GROUND NEEDS

Overhead utility lines often prevent the use of appropriately scaled trees. In Downtown areas with buildings above three stories, the City needs taller trees to mediate between the human and tower scale. Trees do this, and with appropriate selection can create human-scaled spaces the ROW. In Salt Lake City's expansive rights of way, towering trees with generous canopies promote better urban design and needed shade for summer cooling.

Electric distribution lines are relatively inexpensive to bury, and existing trees are usually removed and replaced to bury these lines. Developing a policy to accommodate buried electric lines, adequate soil volumes, and soil quality improvement to grow large trees would add value to developers and residents.

THE URBAN FOREST'S ROLE IN URBAN DESIGN + PLACEMAKING

Salt Lake City can link its Urban Forest with urban design and placemaking to strengthen the City's image and identity. Introducing urban forest districts with species selection based on form and scale would help to define neighborhood character. Integrating aesthetics and ecological function into plans for the Urban Forest can creating inviting community spaces.

With a comprehensive approach, planting requirements can consider physical characteristics, growing needs, regular spacing for the creation of continuous canopies, visual separation from moving vehicles for improved perception of safety, and alignment of street trees to add definition and imageability to neighborhoods and business districts.

CREATING A RESILIENT URBAN FOREST

Salt Lake City can create a resilient urban forest that addresses multiple impacts created by climate change. In addressing climate change at the local level through urban forest design and planning, Salt Lake City has a national opportunity to lead by example.

PUBLIC HEALTH IMPACT MITIGATION + ENVIRONMENTAL JUSTICE

Salt Lake City has an opportunity to link the urban forest with a broad range of public health outcomes, including improved outcomes for mental and physical health, and specifically with respiratory disease. Explicitly relating the urban forest to public health also presents an opportunity to implement environmental justice and systemic racism. Trees are an important part of a strategy to address adverse impacts among historically marginalized groups disproportionally impacted by poor health. The City could develop metrics to quantify the effects of tree plantings on these public health objectives, providing transparent data to assess whether it is meeting its goals.

ENVIRONMENTAL EQUITY

More shade trees in lower-income neighborhoods can save energy consumption and address public health concerns related to urban heat islands and air pollution. The City's existing tree planting program can be expanded and revisited to ensure equitable outcomes. (See Chapter 3, Equity in the Urban Forest, for examples from other US cities).

INCREASED ACTIVE TRANSPORTATION USE

Introducing shade trees at transit stops and on critical active transportation routes can make walking, biking, and transit the most attractive, obvious, and comfortable choice. Making non-auto transportation modes attractive can reduce the stigma often associated with taking public transit or walking. More shade could also make cycling and walking more appealing during the hot summer months, reducing emissions from private vehicle use.

ENERGY SAVINGS

The 2019 Resource analysis found that SLC saves $1.1 million in energy consumption annually. As our summers get hotter because of climate change, the City has an opportunity to locate trees strategically and increase energy savings substantially.

FOOD ACCESS

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.

INTEGRATING THE URBAN FOREST INTO STORMWATER MANAGEMENT STRATEGIES

By storing rainfall on the leaves and branches, trees reduce or eliminate localized flooding. Tree roots retain soil in place so that it is not washed away in severe storms. The tree roots keep soil in place so that it is not washed away in severe storms. Trees also clean water as it flows through roots and into groundwater. One hundred mature trees can retain approximately 250,000 gallons of rainwater per year, decrease polluted runoff, and decrease erosion, improving water quality. Integrating trees fully into Salt Lake City Stormwater Management practices would make the City more resilient to climate change-induced summer precipitation events.

EXPANDING BIODIVERSITY IN SALT LAKE CITY'S PARKS + STREETSCAPES

While there are 200 species of trees within Salt Lake City's urban forest inventory, nearly 50% of all public trees consist of seven species. Salt Lake City can expand the biodiversity of its urban forest further, providing both habitat and urban design benefits. Increased biodiversity provides additional insurance against the risk of large areas of tree die-off created by species-specific threats due to pests and climate change impacts. Many of the over-planted species are now nearing removal age. New plantings provide an opportunity to expand biodiversity on public lands and educate landowners about the importance of maintaining diverse tree species on private lands.

IMPROVING HABITAT FOR BIRDS

The City could assess its existing bird habitat, with focus on important migratory flyways, like the Jordan River, using commercially available GIS tools, or through partnerships with institutions or nonprofits. When the assessment is complete, and habitat revitalization opportunities are identified, the City could look to the model created by Vancouver, B.C., an "adopt and promote voluntary Bird Friendly [Urban Forest and] Landscape Design Guidelines for developers, planners and designers and public and private landowners." (City of Vancouver, 2015)

EDUCATION ON IRRIGATION COSTS + WATER CONSERVATION

Salt Lake City can educate residents on the costs of tree irrigation. The City can also disseminate information on which species are low water use and contribute to City water conservation goals. While the cost of watering varies by tree species, they are typically lower than expected. Based on the recommended watering schedule Urban Forestry prescribes, the total cost of watering trees during the 6-month growing season works out to two dollars per month. An average, healthy tree uses 225 gallons of water a week for about half the year. In comparison, a single person typically uses 700 gallons of water per week all year round.

EDUCATING RESIDENTS ON URBAN FOREST BENEFITS

Providing education on the urban forest can assist Salt Lake City with its stewardship. With some education, many residents could help care for our urban forest. Urban Forestry staff could provide training like a "Master Gardener" program that results in neighborhood-based volunteer foresters. These "tree stewards "could assist with minor tree care, provide best practice advice to neighbors, and help flag more extensive tree care needs to urban forestry staff.

INTEGRATING URBAN FORESTRY INTO SALT LAKE CITY GIS

The Urban Forestry Division maintains a tree inventory in a proprietary geographic information system (GIS), accessible to the public on the division's web page but maintained by a national arboriculture consultancy.

The City would benefit from improved integration of a tree inventory data layer into Citymap, Salt Lake City's publicly accessible GIS. Ideally, tree inventory data updates should automatically push to the City's other GIS mapping software. That way, applicants and reviewers can consider trees and planting spaces in the earliest stages of project planning. Sharing the inventory updates on a regular basis with utility companies, could help the City anticipate and avoid conflicts.

Currently, no accurate maps of park strip dimensions and other tree planting locations exist in the City GIS. An accurate survey of these areas would assist multiple City departments by providing precise measurements to plan tree planting and additional sustainable infrastructure measures, including proactive planning for areas where additional soil volumes are needed.

RETHINKING THE ROW: PLANNING EARLY + ALWAYS FOR THE URBAN FOREST

Salt Lake City's rights-of-way represent our largest and most widely distributed public spaces throughout the municipality. Integrating space for trees to prioritize the quality of life in these public spaces could be transformative, both socially and environmentally.

We have many existing large park strips that would give ample space for large trees, even alleés (double rows) of trees. Additionally, removing asphalt during road reconstruction and planting trees could significantly reduce the extent of paved surfaces and increase asphalt lifespan.

A critical opportunity for the City is to assess all plans and implementation projects in or adjacent to the ROW alongside the tree inventory. Proactive planning between the departments should incorporate the total value of the urban forest. A proper appraisal of our living infrastructure will retain trees and tree-planting locations and maintain adequate soil volumes as the City grows and changes.

DEVELOP AN URBAN FOREST MANAGEMENT PLAN THAT INTEGRATES ECOSYSTEM SERVICES

The urban forest's ecosystem services are incidental to tree regulations in the Salt Lake City Code and policy. A comprehensive urban forest management plan that strategically considers all the benefits trees provide could address environmental impacts. A management plan could also evaluate multiple factors to prioritize tree plantings where they are needed most.

PUBLIC-PRIVATE PARTNERSHIPS

The City can continue to explore a range of public-private partnerships with institutions, corporations, schools, health care providers, and non-profit organizations. More broadly, communicating the broad range of the urban forest's benefits widens the range of potential partners whose goals may also be addressed by planting trees. These partnerships present opportunities to pursue a wide range of grant funding to implement the recommendations of this action plan.

SEPTEMBER 2020 WINDSTORM

On September 8, 2020, a windstorm brought hurricane-force winds that felled more than 1,500 public trees and many more private trees. While catastrophic, this spotlighted the importance of the urban forest. People across the City recognized the loss of large, older trees in parks and neighborhoods. Residents were moved to donate or volunteer to replant trees. This event may motivate more residents to become involved in the preservation and growth of the urban forest and actively seek education on tree maintenance practices.

CONSTRAINTS

This plan defines Salt Lake City's Urban Forest constraints as external or structural factors inherent to planting and managing trees in urban conditions.

These factors limit the urban forest's growth and preservation and may also restrict the City's ability to effectively utilize the urban forest's ecosystem services.

WATER QUALITY IMPACTS

Increasing the number of trees in Salt Lake City can increase the volume of leaf litter in our waterways, depriving the aquatic life of needed dissolved oxygen. Because the Jordan River is a heavily engineered system in a highly urbanized area located at the base of a closed watershed, adverse impacts to water quality can be magnified.

ARID CLIMATE

Salt Lake City's arid climate, with its hot summers and cold, snowy winters, creates stressful growing conditions for trees. The City's trees need additional irrigation to thrive, unlike those in cities with abundant precipitation. Our urban forest is mainly hand-planted, except for along riparian corridors, and requires climate-specific care to thrive.

WATER CONSERVATION CONCERNS

Water conservation, however, remains vital in Salt Lake City's arid climate, and the Urban Forest requires careful planning and management to achieve adequate protection. Many well-meaning residents have reduced landscape irrigation to conserve water, which has resulted in tree death in some cases. **Xeriscaping, the practice of planting primarily low water use vegetation and zoning plants by water usage, has too often been misinterpreted as "zero-scaping."** Zero-scaping consists of placing rocks and perhaps a few plants within park strips and yards--or laying petroleum-based artificial turf over the soil.

While xeriscaping works with many tree species, "zero-scaping" and artificial turf increase the urban heat island (UHI) effect, leading to tree stress. Ultimately, lack of water often results in early mortality. Much of the discussion of water use and conservation has been oversimplified as few to no plants providing conservation benefits.

In addition, residents often desire "no-maintenance" landscapes or see neighboring "zero-scapes" as a model for their land. These perceptions will likely continue to result in tree damage and death in the near term, along with increased UHI.

Educating the public on the role of the urban forest in water conservation, and importance of tree watering (deeper but less frequently) is necessary. Shade provided by tree canopy reduces evaporation, particularly over turf grass, reduces waste and evaporation and plays a critical part in water conservation.

While a concerted education campaign is essential, the realities of cost and competing budget priorities impose limits on the City's ability to mitigate impacts from "zero-scaping."

CLIMATE CHANGE

As the climate changes and summer temperatures increase, stress on trees will also increase. Climate change can contribute to tree mortality through increased exposure to disease, pests, and extreme weather events.

To adapt to climate change and increased urban heat island impacts, the City may need to evaluate its list of preferred species and make updates on an as-needed basis. Climate change could also impact the amount of water some public trees require or require designed microclimates in specific locations to accommodate beloved species better.

BIOGENIC VOLATILE ORGANIC COMPOUNDS

Some tree species are high biogenic volatile organic compound (BVOC) emitters, which can contribute to ozone pollution during the summer months. According to the City's recent resource analysis, "Over 11,173 pounds of BVOCs are emitted annually from Salt Lake City's public trees, reducing annual benefits to air quality by -$2,123."

While this is a naturally occurring constraint, arborists and ecologists can mitigate these impacts through species selection and careful attention to planting locations of BVOC-emitting species.

PROPERTY DAMAGE

Some degree of property damage is inevitable with trees (and with precipitation patterns fluctuating due to climate change, this may increase). And while Urban Forestry removes dead or dangerous trees, commitment to funding adequate pruning and maintenance cycles can minimize tree damage and decline.