Urban Forestry: Growing a Fuller Canopy

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ABSTRACT

This paper reports on the discipline of urban forestry (UF), including an assessment of the current state of UF globally and in Oakland, California as the primary case study. It identifies and analyzes prominent international, national, state, and municipal bodies and presents an original framework for UF success. Oakland is assessed against this framework. The paper concludes with suggestions for how UF can progress in the future. The findings are informed by primary and secondary research, including interviews with government and community actors, analysis of papers written by established bodies like the United Nations, and the author's personal experience participating in grassroots UF efforts in Oakland. The paper asserts that urban forestry is at an inflection point. It is quickly gaining worldwide prominence for its potential to address climate change and improve a multitude of issues facing urban life. The case of Oakland reveals that the city is also hitting an exciting moment with the creation of an Urban Forest Master Plan that is set to dictate UF goals for the next fifty years. While there have been challenges in maintaining and expanding tree canopy in cities like Oakland, the prospect of a fuller canopy seems achievable and imperative.

Introduction

Fifty-five percent of people live in cities globally, and it is expected that this number will rise to sixty-eight percent by 2050 (UN Department of Economic and Social Affairs, 2018). In the U.S., eighty percent of the population already live in cities (United States Census Bureau, 2010). There is constant pressure to develop housing and infrastructure to support this growth. At the same time, climate change is impacting cities in alarming ways, and they are finding themselves woefully unprepared (Einstein, 2022).

Trees offer solutions to a variety of urban problems. Foremostly, urban forests reduce temperatures by providing shade. An analysis done on New York City revealed a full 31-degree Fahrenheit difference between a street-lined block near Central Park and a treeless sanitation lot in East Harlem (Leland, 2021). Lack of trees creates a heat island effect, in which temperatures are significantly warmer in urban areas with less greenery. Impervious surfaces, such as asphalt and concrete, exacerbate temperatures by absorbing and re-emitting heat. The shade of mature trees can lessen the need for energy-intensive cooling techniques like air conditioning, helping to keep energy costs down.

Trees provide many additional benefits. They can improve urban water quality by capturing rainfall and slowly releasing it into the groundwater through their roots, all the while purifying the water of pollutants through the surrounding soil (The Nature Conservancy). Trees can also remove toxic particulate matter in the air, helping to mitigate health risks from air pollution. In addition, trees improve quality of life and associated property values. According to a study conducted by the U.S. Forest Service and UC Davis, trees throughout the state of California add a total of $839 million to property values (The Environmentator). It is much more desirable to spend time on a property surrounded by trees instead of a desolate concrete jungle.

Numerous studies have shown that being near trees can reduce anxiety, stress, and depression in urban citizens. For example, a study done in the German city of Leipzig revealed that people living within 100 meters of a tree on average showed a lower usage of antidepressants (World Economic Forum, 2021).

Lastly, trees are paramount to the health of urban biodiversity. They serve as shelter for birds and other animals and provide food such as acorns. Without trees, cities risk losing wildlife, further harming native ecosystems and the wellbeing of urban residents who look to nature for comfort.

While tending to trees in civilized areas is a practice dating back centuries, urban forestry (UF) is a relatively new term that became mainstream in the mid-late 1900s. UF most simply refers to "the management of trees for their contribution to the physiological, sociological and economic well-being of the urban society" (Municipal Technical Advisory Service of Tennessee, 2021). The United States did not recognize UF officially until 1978, leading to the very beginning of federal funding for UF. Most people outside of the discipline still do not fully understand what urban forestry means. When the author spoke with family and friends, a majority of them asked for a definition of UF. Due to climate change and rapid urbanization, as explained above, UF has risen to prominence worldwide as an interdisciplinary, economically efficient solution.

Despite the compelling benefits of trees, there is concern that cities are losing the tree coverage they have and missing opportunities to do more. This is the challenge that this paper addresses. First the paper gives an overview of the state of urban forestry globally, including key participants in the field. Then, it presents an original framework for success in urban forestry at the city-level. This framework is then applied to Oakland, California as a case study to assess city-level implementation of forestry programs. Lastly, the author explores best practices and ideas for UF in the future.

Methods

This research paper examines urban forestry on local, national, and international levels.

Oakland, California serves as a case study. It was chosen because it is a medium-sized, diverse city in an advanced industrialized economy. It has a plethora of competing issues and constantly faces budget constraints. There are active community advocates that attempt to collaborate with government officials. The author resides in Oakland and has direct exposure to key participants in UF.

Figure 1. City Hall, Oakland, California, photo taken by author on August 30, 2022

The author has mostly conducted qualitative research with both primary and secondary sources. Primary sources include four interviews via phone call/Zoom with community members and government officials from the City of Oakland and California's forestry department CalFire; three interviews via email from UF experts in Switzerland, England, and Spain; attendance at the Oakland Urban Forestry Forum on July 20th, 2022 that convened community members and city and state officials; and, firsthand experiences over the last two years volunteering in urban forestry in Oakland, including pruning, watering, and planting trees.

To supplement these findings, national and international UF reports and guidelines; articles evaluating municipal case studies; and UF organization websites were consulted.

State of Urban Forestry Around the World

There are many common concerns expressed by observers of urban forests around the world. With each new development project, trees are removed to make way for buildings and roads. Public spaces that are created often have more impervious surfaces. Even when developers plant new trees, it takes decades to make up for the shade and carbon sequestration capabilities of the felled mature trees.

Trees are also being lost due to extreme weather events, which seem to be occurring more frequently due to climate change. Hurricanes uproot trees. Intense heat is draining water sources vital to trees. Pests that can be deadly to trees are spreading more easily as the climate warms.

There is growing awareness and criticism that municipalities are neglecting to maintain their existing trees and follow through on their commitments. Cities must deal with a variety of pressing issues, such as crime and poverty, that take resources and attention away from tree services. There is often a lack of stable funding from municipalities for trees, which makes it difficult for cities to sustain long term UF programs (United Nations Economic Commission for Europe, 2021).

Even when resources are secured for new plantings, the plantings are often done inadequately. Too often, not enough thought is given to the strength of saplings, species selection, tree placement, and a long-term maintenance strategy for large-scale planting initiatives. Many argue that it would be more economical and time efficient for cities to prioritize and draw up public excitement for tending to its mature trees, which are better fit to withstand extreme weather, provide more shade, and sequester more carbon.

Another critique of urban forests is that there are inequities in the density of trees that correlate with socio-economic and racial differences in areas of cities. One historical explanation in America is the practice of "redlining", in which the government denoted "red zones", which were majority low-income neighborhoods of color, as less desirable places to live and denied people living in those zones the loans needed to move somewhere else. Maps of canopy coverage strikingly show a relationship between affluent neighborhoods and these historical "red zone" neighborhoods. Tree inequity further exacerbates existing disparities as low-income people of color suffer the health consequences of the heat island effect, while people living in affluent and majority white neighborhoods can enjoy a cool, shady environment (S. Samin et al., 2020).

As cities grapple with these challenges to their urban forests, many are taking stock of their situation as a step towards setting tangible goals moving forward. Table 1 below presents UF data from several cities around the world.

Table 1. Tree canopy assessments in selected cities. (Treepedia) (G. Matassa, personal communication, July 27, 2022)

City	Country	Tree Canopy
Tampa	USA	36.1%

Oslo	Norway	28.8%
Oakland	USA	21.5%
Geneva	Switzerland	21.4%
Amsterdam	Netherlands	20.6%
Los Angeles	USA	15.2%
New York	USA	13.5%
Cape Town	South Africa	13.4%
London	England	12.7%
São Paulo	Brazil	11.6%
Kobe	Japan	9.4%
Paris	France	8.8%

Urban tree canopy (UTC) assessments are a first step for developing effective UF initiatives. They are being used to help municipalities establish and implement canopy goals that draw from current data about the state of their urban forest, including the percentage of total canopy cover, amount of publicly owned trees, tree health ratings, and what is the capacity for more trees. Aside from canopy coverage percentages, UTC assessments are limited to data from trees on publicly owned land which make up a minority of total tree cover in a city. Canopy targets around the world are currently being set between 30-40%. From the set of data shared above, nearly every city has work to do to satisfy this goal.

Tampa tops the list in Table 1 and this is a source of civic pride. The city has a community tree planting program, called Tree-Mendous Tampa, a permitting process that makes it difficult to remove trees and has an active tree service department. But in 2019, there was a relaxation of the permitting process and residents are now concerned that there will be an increase in tree removals (Frago, 2022).

There seems to be growing interest among the public in support of expanding urban forests with the hope that trees can help mitigate the effects of rising temperatures and deliver the other benefits noted in the Introduction. The media is picking up on this emerging interest. Here is a selection of recent article headlines:

- "A Million More Trees for New York City: Leaders Want a Greener Canopy" *The New York Times* February 15, 2022
- "Editorial: Chicago needs trees, and stronger action to protect them" *Chicago Tribune*, August 16 2022
- "Admiring the Trees of Paris" New York Times, August 9, 2022
- "In Los Angeles, a Tree with Stories to Tell" *The New York Times*, May 28, 2022
- "Tackling climate change one tree at a time" *Toronto Sun*, August 14, 2022

A very encouraging development in the USA is the Inflation Recovery Act that was signed by President Biden on August 16, 2022. This legislation allocates $1.5 billion for the U.S. Forest Service's Urban and

Community Forestry Program. The legislation's investments will further scale up work happening on-the-ground across the country, getting funding directly to communities and local nonprofits.

In summary, there seems to be an inflection point for urban forestry at this time, with government and concerned citizens starting to take notice of UF and action to preserve and expand their canopies. The next section will describe some of the groups behind the positive shift.

Contributions of Support Organizations at The State, National and International Levels

A variety of governmental and non-governmental groups at all stages are active in setting goals and developing UF programs. Below are a few prominent actors organized by affiliation and scope.

United Nations

The Food and Agriculture Organization (FAO) within the UN has taken on urban forestry in recent years. In particular, it initiated a collaborative effort and published a comprehensive set of voluntary guidelines in 2016 titled "Guidelines on urban and peri-urban forestry".

The UN Economic Commission for Europe has also focused on this topic. In 2019 it launched a Climate Action summit. One outcome was creating the "Trees in Cities Challenge" to award cities that met certain criteria. The main focus of this initiative was on planting new trees.

Governmental Organizations

US Forest Service
This is a federally funded department under the US Department of Agriculture with a mission to sustain US forests. It has an Urban and Community Forestry Program that provides technical, educational, and educational support to states and community groups (US Forest Service).

State Entities Such as Calfire
Entities receive funding from the federal government, state general budgets, or specific state climate projects to provide funding and general support to cities and community groups.

CalFire is dedicated to the fire protection and stewardship of over 31 million acres of California's privately-owned wildlands. CalFire used to be solely responsible for forestry, but 30 years ago forestry and fire prevention was consolidated. There is a small division titled Urban and Community Forestry (UCF) that serves to support local communities in UF throughout the state and provide grant opportunities. They receive funding mostly through California's Air Resources Board, which gets its money from California's Cap and Trade program.

Non-Governmental Organizations focused on Urban Forestry

International Society of Arboriculture (ISA)
A leading global organization promoting the professional practice of arboriculture. It is focused on research and promoting public awareness about the benefits of trees. ISA is a global source for scientific information and knowledge about arboriculture and urban forestry. It has over 24,000 members worldwide (International Society of Arboriculture).

World Forum on Urban Forests

Informal global network of UF experts who convene to mobilize finances, raise awareness, share knowledge, and support local governments and communities to advance urban forest strategy globally. Their first meeting was in 2018 at which a Call to Action was produced as to how UF initiatives should be prioritized in cities. The next meeting is scheduled for 2023 (World Forum on Urban Forests).

European Forum on Urban Forestry (EFUF)

Started in 1998, the EFUF has met annually ever since as a meeting place for UF practitioners, researchers, and policymakers to share knowledge, discuss new developments, and address a specific theme in UF. In 2022 EFUF met in Belgrade to discuss adaptation measures in urban forests (European Forum on Urban Forestry).

American Forests

The oldest national conservation nonprofit in the US, American Forests is an overarching organization that works with a variety of stakeholders, from local communities to politicians in Congress, to develop new programs and policies to protect and expand forests throughout America. Notable projects in urban forestry include tree equity score database for cities and Vibrant Cities Lab, a website that compiles scientific and anecdotal UF resources.

State Organizations Such as California Urban Forestry Council

State organizations help spread awareness to the public about the importance of urban forestry and support policymakers and state or municipal governments in developing UF initiatives. Organizations may also mount pressure on key decision makers for stronger action.

The California Urban Forestry Council was founded in 1968 as the first urban forest council in the nation. Its mission is to advance green investment through community outreach, education, and collaborative action on state and regional levels. It organizes conferences, oversees seven regional councils, and advocates for improved public policy, among other things (California Urban Forestry Council).

Arbor Day Foundation

Another overarching organization focused on preserving and growing trees in the US and abroad. As of 2022, it has facilitated the planting and distribution of almost 500 million trees in 50 countries. The Arbor Day Foundation works with local communities and corporations. It runs a variety of UF campaigns like Tree City USA which has recognized 3,652 cities as of 2021 who have met criteria for maintaining and growing tree cover. Oakland is one such city. Similarly, the Arbor Day Foundation created the Tree Cities of the World challenge with the United Nations' FAO as an international effort to recognize cities committed to their urban forests.

There are many other such non-governmental organizations who are involved in UF at different scales and within a variety of specific focuses.

Cities are the only bodies who truly have jurisdiction over urban forestry. The role of organizations whose scope goes beyond municipal governments are merely influential; they have no legal authority. Nevertheless, these organizations play a crucial role by setting standards, monitoring data, creating spaces for collaboration, and ultimately generating momentum for improved UF initiatives that can trickle down to municipal government or impact grassroots community groups directly. It takes action at all levels and from all perspectives for effective, long-term action. This is quintessentially true in urban forests, where nature's offerings to ground level human care and everything in between all help to build a fuller canopy.

Framework for Success in Urban Forestry

Based on common management practices and supported by the primary and secondary research, the author suggests the following framework be used to organize, assess, and plan for success in urban forestry:

Engaged Government and Community Members Willing to Coordinate Efforts

There are various entities with some responsibility for UF within a given city as well as all the organizations described in the prior section. Given there are so many interested parties, it would seem that planning and progress should be well-supported and successful. Alternatively, this can be a recipe for disagreements, misalignment of goals and occasional duplications of efforts that can lead to frustration and dis-engagement. Cities should strive to create a structure for government and community collaboration. It should be clear who sets the goals, who agrees on them, and which groups should actively participate. Community engagement should be nurtured. In some cases, it may be best for one group or individual to lead and facilitate the interactions at the local level. Also, the city representatives should have defined interfaces with state, national and international groups.

Resources That Are Adequate to Achieve Goals

UF needs to have a permanent, reasonable funding source for sustaining the existing forest and to support pursuit of goals for expansion. Government budgets vary over time based on priorities and tax receipts. Goals should be aligned with realistic levels of resourcing and, if necessary, scaled back to match what is achievable. Funding sources outside local city budgets can always help supplement budget shortfalls. There should be ongoing efforts to raise and protect funds.

Situation Assessment Performed Periodically

Measurements against prior goals/targets and community input can inform the UF approach. The results should be reviewed by the established leadership and collaborators to build a shared understanding about what is working and what improvements are needed. Science should be the foundation for most official strategies and programs.

Goals That Are "S.M.A.R.T." and Agreed to by Stakeholders

Specific, measurable, achievable, relevant and time-based goals (Doran, 1981). Clear and realistic UF goals must be established early-on so that a program or guideline stays on track and will actually achieve what it set out to do. The goals should be tailored to the local situation. Broader state, national, and international goals should be considered and integrated when possible.

Strategies/Programs to Expand the Urban Forest Per The Goals

Cities need to act with urgency to implement ways to expand their tree canopy and achieve other goals. Programs can be crafted based on past successes locally and in other cities. Typically, this involves carefully thought-out tree planting initiatives that take into account location, tree species and likelihood of on-going watering.

Strategies/Programs to Sustain the Existing Urban Forest

Oftentimes, programs tout large-scale planting goals without enough emphasis on maintaining existing trees. Since trees are organisms that take decades to mature, it is crucial that energy is put into ensuring the longevity of older trees, which provide more immediate shade and carbon capture than newly planted trees. Effective efforts are those that have maintenance provisions, such as comprehensive pruning schedules or pest control.

Case Study - Oakland, California

Oakland is the largest city located in the East Bay region of the San Francisco Bay Area with a population of 433,823 (United States Census Bureau, 2021). With a temperate Mediterranean climate, Oakland experiences cool, damp winters and warm, dry summers. As its name suggests, Oakland used to be a region full of oak trees. The original ecological terrain of Oakland consisted of a dense oak forest in the flatlands and dry, barren hills.

Over the past 150 years, trees were planted in the hills as the affluent section of the population moved to these locations. Meanwhile industrial development in the flatlands and disinvestment in remaining neighborhoods with residents of lower socioeconomic status resulted in removal or death of many native trees and their replacement with impervious surfaces. According to the citywide tree inventory conducted in 2020, Oakland has lost 275 acres of tree canopy and has gained 1,300 acres of impervious surface such as concrete since 2014 (Oakland Urban Forest Master Plan virtual presentation). Rapid urbanization, which is leading to more development for housing and businesses, is contributing to the loss of vegetation and the expansion of concrete jungles.

Oakland's tree canopy coverage now stands at 21.5 percent. This degree of canopy is comparable to many other cities of its size or larger, as shown earlier in Table 1. Below is an image of the tree canopy across the city as of 2018. Disparities are starkest between District 4 and District 3.

Figure 2. Oakland Tree Canopy as assessed in 2018 (United States Department of Agriculture)

There is a 34.2 percent canopy cover deficit between these two districts. District 4 is in the Oakland Hills, an affluent neighborhood where the majority of its residents are white. District 3 covers West Oakland, a neighborhood that is predominantly of color and impoverished. The severe inequity stems in part from a history of forced housing segregation via redlining. With such a low canopy cover, residents of District 3 suffer from heat island effects, making temperatures significantly hotter and air less purified compared to shady District 4. This contributes to an increase in health issues such as asthma and heat-related illnesses.

Figure 3. Street level views in two districts in Oakland. Photos taken by author on August 27, 2022.

Looking forward, Oakland has spatial capacity for at least a 56% increase in the number of street trees. The 2020 tree inventory identified an estimated 31,000 vacant planting locations within the control of the city. It is estimated that the City has jurisdiction over just 29% of the potential land for planting. Therefore, there are many more areas that could be targeted if the community and private owners were amenable.

This case study continues below with an evaluation of Oakland against the success factors described in section 5.

Engaged Government and Community Members Willing to Coordinate Efforts

Oakland has struggled in this area, due to distraction from competing priorities, communication breakdowns and community dis-engagement. There are signs that positive change is coming, with a community survey in progress and an effort to create an Urban Forestry Master Plan (UFMP) inclusive of community input.

Below is a brief description of the key players in Oakland:

- City Council offices - There are seven districts in Oakland each with a City Council member. Some districts, like Districts One and Four (B. Harami, personal communication, July 15, 2022), are more focused on trees than others. The City Council approves the budget for Oakland's tree services division and will need to approve the UFMP for implementation.
- City of Oakland Tree Service division - Dedicated to protecting and maintaining the trees in Oakland while educating the public about the history and benefits of the trees in our community. In 2008, nearly half of the Tree Services Division was eliminated due to lack of funding. The tree planting, watering, and pruning services were all eliminated. Currently, the Division is most focused on removals of dead or dying trees.
- Non-government organizations such as Trees for Oakland (TFO) which plants and maintains trees throughout the city. Currently, TFO leads a planting program in which a citizen can request a tree to be planted on the sidewalk immediately in front of their home or on their private property, and TFO will come plant it. TFO has also facilitated the creation of an Oakland Urban Forestry Forum (OUFF) to foster dialogue, networking, community action plans, and recommendations to the City for how to improve their UF services. The Oakland Parks and Recreation Foundation is another prominent non-profit that is dedicated to maintaining

the parks of Oakland and advocating for community usage of green space through public events and programs.

There has been a lack of streamlined communication across City Council offices and between City departments. Brandon Harami, who works as a policy advisor under District 4 of the City Council, said in an interview that he is not sure what most other districts are working on (B. Harami, personal communication, July 15, 2022). Gordon Matassa of the Tree Services Division noted that he and his team have tried to gather input from other City departments, but responses have been sporadic and unfruitful (G. Matassa, personal communication, July 27, 2022).

The City's relationship with the community over the years has been rocky. With strained resources and the COVID-19 pandemic, which complicated modes of communication, there has been little capacity for the City to engage in strong relationships with community groups. According to citizen Kent Wegener, "the City has been resistant to do anything meaningful" (K. Wegener, personal communication, July 12, 2022). This is a popular sentiment among citizens who the author has engaged in volunteer work with over the past two years. Wegener does feel enthused by Oakland's 2030 Equitable Climate Action Plan, which has provisions for urban greening, but it is unclear if any real implementation of the plan has been executed. No mention of this plan was made in interviews with both Harami and Matassa.

To fill the gaps left by the city, community groups have had to step up their efforts. Volunteers often have stopped relying on the City for support and have instead gone directly to the state agency CalFire for resources in order to initiate projects. Others have operated independently, which leads to overlapping initiatives. Some groups have had to suspend organizing efforts because of the lack of consistent resources and ties with the City. For instance, OUFF abruptly ended in January 2019 when tensions arose with city representatives.

There have been some recent positive developments. The development of the Master Plan has also reignited city and community involvement. Within the city government, Matassa said that the Tree Services Division has been working closely with the Race and Equity department to make UF equity an integral component of the UFMP.

The community survey as part of the UFMP process is a welcome step for strengthening the City's ties with its residents. It has shown civilians that the City is not only finally taking steps to improve the public's urban forest, but that it is also genuinely interested in getting community feedback to implement in a plan that will impact residents for the next 50 years. A survey is a helpful means for engaging citizens because it is accessible and easy to complete, helping to ensure that residents of all backgrounds, interests, and capacities can voice their opinions. The Tree Services Division has also worked with several community organizations, such as Common Vision and the Oakland Parks and Recreation Foundation, to increase outreach for the community survey, especially in marginalized communities where the UFMP plans to target the most to ensure tree equity.

OUFF has just recently been re-established, with an introductory meeting in July 2022 and plans to organize regular meetings. The July event had over thirty participants and sixteen speakers. The commentary in the meeting ranged from disappointment in the past but a sense of hope and motivation for the future. Speakers shared their dismay at the minimized tree services capacity and issues they have witnessed firsthand, such as the planting of incompatible tree species and insufficient irrigation for proper watering. However, there was excitement for the development of the UFMP. There was representation from the senior manager of Oakland's Tree Services Division, who tried to be transparent about the process of the UFMP and answer questions from the audience. The regional urban forester from CalFire spoke about state-funded grant opportunities. Community members were satisfied that the OUFF had representation from the people and agencies that are making the key governmental decisions. After the meeting, people networked with one another and discussed collaboration opportunities to strengthen existing programs, avoid overlap, and pool resources.

Resources That Are Adequate to Achieve Goals

Oakland used to have a robust Tree Services Division that "had a dedicated staff for each region, carried out removal and pruning services on a timely basis, planted 1,500 trees a year through annual tree planting and arbor day events, addressed service requests made by residents, and funded High School summer and watering programs" (City of Oakland, 2022). After the 2008 recession, the Tree Services Division experienced significant budget cuts that eliminated over half of its services. Unable to tend to trees in need of care, there has been a much higher rate of tree death, tree removals, and a backlog of service requests. From 2008-2020, the City sponsored virtually no planting activities and tree removals have been its main activity.

Oakland is supported by CalFire predominantly through grant opportunities. CalFire also provides general support through a regional forester that provides technical knowledge, spreads the word about grant opportunities, and helps city governments or organizations through the grant process. The money Oakland received for the UFMP is from CalFire, and many local organizations, like Trees for Oakland, are able to sustain their work solely because of CalFire grants. At the recent OUFF meeting, CalFire representatives noted that their funding is set to be increased from $30 million to $60 million in the next fiscal year.

City ballot measures such as Measure KK in 2016, which provided $600 million "in bond funding for street improvements, public facilities, and affordable housing projects," and Measure Q in 2020, which has provided at least $27.5 million in the 2021-2022 fiscal year mostly for improving city parks, have given the tree services more financial ability to expand the amount of tree service employees (City of Oakland, 2022). Gordon Matassa of the Tree Services Division says that the second most prominent issue the division faces aside from funding is employee retention. Hiring can be a nearly year-long process due to a complex HR process. According to Matassa, in the last year and a half the division has hired four tree trimmers but now only two remain. So even when funding is available, hiring is an issue that further impedes the division's ability to build their capacity (G. Matassa, personal communication, July 27, 2022).

Situation Assessment Performed Periodically

Oakland had never performed a complete tree inventory assessment or had an official urban forestry plan. There was a street tree plan created in 1981 but it was never passed by the City Council.

At last, there is a major development in this area. A 50-year Urban Forestry Master Plan (UFMP) has been initiated. This is being funded by a $970,130 CalFire grant, with $298,571 for the UFMP specifically. The grant began in October 2020 and is set to end in March 2023. The Davey Resource Group, a leading environmental consultancy, was hired to help carry out research and write the UFMP. The City has outlined different development stages: a tree canopy assessment and tree inventory, community engagement through an online public survey, first and final drafts, and lastly a recommendation to the City Council for adoption. The canopy assessment and tree inventory were completed in 2020. Now the government and the public have accurate statistics, like those shared in this paper, to refer to and with which to plan. The public survey closed at the end of July 2022.

Goals That Are "S.M.A.R.T." And Agreed to By Stakeholders

As noted above, Oakland has never had a comprehensive UF plan. The City has thus always been operating its UF initiatives without measurable goals and instead in a reactive mode. The Tree Services Division responds to specific cases as they come up individually.

In the near future, the Urban Forestry Master Plan is expected to recommend how to strengthen Oakland's urban forest in ways that impact the many issues the city faces, like crime, heat islands, tree inequity, and air pollution.

There is still some concern about the degree to which the community will be involved in goal setting. Results from the community survey will not be summarized until after the first draft of the UFMP is complete. This creates the possibility that community input will not be fully incorporated since the plan will have already been formulated.

Regarding goals and programs suggested by state, national and international organizations, city representatives admitted that while these programs are interesting and could be useful, there is simply not enough capacity to pay much attention to them. They noted that when a complex city like Oakland has a plethora of issues competing for City assistance and stretched resources, involvement in broader, abstract programs is not a priority. Regional UF representatives from CalFire stated that they are unaware of collaboration with international bodies. They speculated that stronger involvement in them would most likely not change their day-to-day activities (T. Mar & J. Gowin, personal correspondence, July 19, 2022).

Strategies/Programs to Expand the Urban Forest Per the Goals

As noted, the City government has been severely constrained since budget cuts in 2008. Tree planting events were immediately stopped. There also have not been specific goals to orient any efforts that could be resourced. Since 2008, community organizations have led several initiatives, some funded via CalFire grants. It was noted at the OUFF meeting in July 2022 that some of these activities were poorly designed and a substantial portion of the newly planted trees did not survive. Issues included choice of trees and lack of resources for on-going watering. At the OUFF it was noted that there are many arborists and other experts available to design future Oakland programs for success.

Strategies/Programs to Sustain the Existing Urban Forest

Maintenance now generally consists of just taking out dead trees, oftentimes leaving the stumps which further hinders the ability to replant. Hundreds of requests come in monthly into Oakland's 3-1-1 call center and with few staff, Tree Services has a perpetual backlog of demands.

City officials seem to recognize that tree maintenance needs to be a priority when resources are available. Harami stated that the UFMP's inclusion of tree maintenance is a key factor he will look for when analyzing the plan for City Council approval (B. Harami, personal communication, July 15, 2022). At the OUFF speakers were vocal and in agreement about the need to protect the trees Oakland already has.

Community groups have stepped in to take care of tree maintenance since the City's near abandonment of its services after the 2008 budget cuts. The author was involved in weekly volunteer tree prunings through the unofficial Oakland Alliance of Tree Lovers (OATLee) over the past two years. The head volunteer would pick a neighborhood in Oakland and a small group of volunteers would come with their own tools to prune street trees. The author has also been a part of organizing summer tree maintenance workdays to weed, mulch, and water trees in multiple parks across the city. Some concerned residents in Oakland seem to understand that maintenance is more important than planting and are especially protective of the old native oak and redwood trees that are so integral to the Oakland landscape. Harami noted that he participated in a neighborhood protest when a large, healthy tree was about to be cut down. The community effort was successful, and the tree still stands today (B. Harami, personal communication, July 15, 2022).

Conclusions on Urban Forestry in Oakland

Similar to the global state of urban forestry, Oakland is at a turning point. While years of inadequate funding have left many needs that will take a long time to be fully addressed, the development of the UFMP is a giant step forward. Community groups, like OUFF, are also capitalizing on this moment to forge stronger relations with the City and collaborate for better volunteer turnout. It will be important that concerned citizens and the

City Council read through the contents of the UFMP, especially regarding the implementation of community input from the survey and the comprehensiveness of tree maintenance protocol. Once funds from the CalFire grant run out in March 2023, the extent to which the City will finance long term projects to achieve its new UF goals will be critical to watch.

Looking to The Future - What Could and Should Be Done

Drawing from conclusions made about the global state of urban forestry and the case of Oakland, this section presents a set of suggestions to achieve greater success. They are listed under each of the proposed success factors.

Engaged Government and Community Members Willing to Coordinate Efforts

Government Integration Across All Levels and Sectors
More effective and coordinated UF action will be achieved through stronger integration of national, state, and city government perspectives and across departments. Regular communications between these actors are key so that programs stay current to changing circumstances. Engaging in this kind of cross-level collaboration can provide big-picture perspectives, give more support to stretched-thin municipal tree divisions, and help UF programs better address specified urban issues. One way this can be achieved is through Forums, discussed next.

Forums
Forums are versatile and inclusive ways to increase dialogue among stakeholders. The flexible nature of forums makes them a viable option for places around the world and at all different scales, from international to neighborhood levels. Governments or community members alike have agency to organize these forums. It is exciting to see that there are already multiple such forums for UF, like the World, European, and California Forums. They can make stakeholders feel more connected and heard by one another, increasing collaboration, and ultimately strengthening the efficacy of UF initiatives.

More Public Awareness and Engagement - Example: Melbourne, Australia
If citizens become more knowledgeable about UF, they are likely to demand action from their government representatives and get engaged themselves. Simple education schemes like placing informative signs near project sites or creating a webpage that streamlines all community and governmental UF projects can help citizens develop more appreciation for the urban forest and motivate them to get involved in volunteer efforts.

Inventory databases are a great way to track UF data, update the data as needed, and engage the public. Melbourne, Australia created a unique database in 2013 that is noteworthy. Melbourne's modern online database is called the Urban Forest Visual. It displays 80,000 public trees. Each tree is given a symbol that shows its species genus and a color to display its maturity level. The database also maps out the City's timeline for new street planting on each street in central Melbourne.

The Urban Forest Visual should not only serve as a model for other cities to make the data of their urban forest easily accessible to the public, but it also makes giving community input exceptionally straightforward. Every single tree mapped on the database has its own email address so that citizens can share their love, concerns, or desires about any individual tree. According to *The New York Times*, city officials have received a staggering amount of love letters from Melbourne citizens (Wilson 2022). This display of strong community affection for the urban forest has had a domino effect on other UF initiatives in the city. They now have an ambitious goal to reach 40% tree canopy cover by 2040, up from the 22% current tree canopy.

This strategy is an affordable, simple, and effective way to make citizens feel like they have an active voice in their city's UF strategy. Instead of an arduous and expensive marketing campaign or a one-off community input event, creating a transparent tree database with emails for each tree is a continual outlet for citizens to directly share their thoughts and expect a personalized response back from the City. In turn, this gives a city a streamlined, clear way to get feedback. It also allows them to get an updated sense of how much citizens care about their urban forest, which can have positive implications on the ambitiousness of city initiatives and allocation of resources.

Resources That Are Adequate to Achieve Goals

Protected Budgets and Consistent Financing
Urban forestry requires long term planning for real results. Most funding for UF comes from municipal budgets that change based on yearly budget cycles and are stretched thin with others competing and pressing city needs. Low city funding is compounded by unstable or short term outside funding, like government grants or one-time donations to UF organizations, which make it difficult for long term projects to be sustained. One way to increase and stabilize funding may be to link UF to other city goals that are always funded, like public health or crime.

Leveraging Help from Young People
In the author's experience, young people are ready to engage in many kinds of meaningful work to help fight against climate change. UF initiatives would be smart to target youth as a resource for enthusiasm and labor to help achieve goals. Active social media campaigns are helpful, as well as collaborating with already-involved youth to frame projects as "youth-led". Additionally, educating youth could help spark interests in the subject that could ultimately lead to more people entering the field professionally.

Situation Assessment Performed Periodically

Track Change Over Time
The tree canopy assessments are relatively recent endeavors that have not been going on for long enough to track changes over time, aside from several exceptions from cities who embarked on their assessments many years ago. For example, Toronto, Canada updated their UTC assessment in 2021 to reveal that their canopy has increased by 1.8% from 2008-2018 (City of Toronto, 2018). An in-depth analysis was also recently performed for New York City that revealed that the city's canopy increased from 20% in 2010 to 22% in 2017 (The Nature Conservancy, 2021). It is expected that more cities will track their status over time to help identify programs that are working and areas that need more attention.

Goals That Are "*S.M.A.R.T.*" And Agreed to by Stakeholders

Use of International Standards, Such as The 3-30-300 Rule
The implementation of international standards can create shared goals that help unite cities, foster collaboration, make new ideas more applicable, and quell confusion. The Nature Based Solutions Institute has proposed the 3-30-300 rule (Nature Based Solutions Institute), which stipulates that every person should be able to see three trees from their home/workspace, there should be 30 percent tree canopy coverage in every neighborhood, and the maximum distance a person should have to go for a public green space is 300 meters. This rule has been promoted by the United Nations, established research groups, and city councils around the world.

Strategies/Programs to Expand the Urban Forest Per the Goals

Expanded Research to Inform Strategies

As discussed above, resources for UF are scarce and need to be used efficiently. Scientific evidence and well-designed social experiments can guide UF leaders on investments and programs. While the literature on UF has grown in recent years, more is needed on topics ranging from species selection, measuring the economic value of ecosystem services, and how urban forests can help to better integrate specific social groups, like youth or immigrants, into urban life (Food and Agriculture Organization of the United Nations, 2016).

Increase Planting on Private Property

A majority of trees in a city are on private property over which municipal governments have no jurisdiction. It is therefore important that citizens feel compelled to plant trees on their private property to increase overall canopy coverage. A common practice is free tree giveaway programs, where the tree is brought to the citizen and information is provided for best care practices. Other ways to get more trees planted is for volunteer groups, like the youth-led organization Tree-Plenish, to set up systems in which residents can purchase trees and volunteers will come plant them for free (Tree-Plenish). If opportunities are brought to residents at little cost to them, more will be open to the idea.

Considering Equity in Planting Initiatives

Tree equity should be at the center of planning initiatives to plant more trees. A lot of cities have unequal tree distribution that disproportionately impacts low-income communities of color. Upon looking for new places to plant, organizers should prioritize neighborhoods that have less tree coverage and reach out to local residents when doing so. Tools like American Forests' Tree Equity Score are helpful for achieving this.

Strategies/Programs to Sustain the Existing Urban Forest

Tracking Number of Trees Cared for and Health

The public should be made aware of actions being taken to care for existing trees. There should be updated data released about what governments or organizations have done to maintain the urban forest, which could include the number of trees pruned, removed, or watered. It would also be useful to have public data about tree health and growth over time, as done in Toronto, New York, and Melbourne. This would help inform the public about the effectiveness of long-term tree maintenance, as well as assist UF volunteers in identifying where their efforts are needed most (R. Shaw. Personal Interview. July 20, 2022).

Conclusion

Urban forestry is a multifaceted discipline that is gaining prominence as urbanization and climate change are accelerating. It is exciting to see the wealth of expertise and interest being harnessed in the creation of so many different UF programs at international, national, state, and municipal levels. Growing trees takes time and effort, and this will require consistent resources and implementation of thoughtful solutions at all levels. Every city dweller deserves to reap the benefits of a healthy urban forest. This is the moment to work together to grow a fuller canopy for the present and future generations.

Acknowledgments

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