APPENDIX IV. SPECIES SELECTION GUIDANCE

This appendix contains additional information about important considerations when choosing tree species and where to plant them to achieve different desired outcomes. The topics addressed respond to specific concerns and interests in East Palo Alto, and guidance is supported by reference to the scientific literature. This appendix supplements guidance in Chapter 6, Action 2 of the Urban Forest Master Plan.

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Diversity and resilience to climate change

While the urban forest can protect people from some of the negative impacts of urbanization and climate change by, for example, mitigating heat and reducing air pollution, growing an urban forest that is resilient to the impacts of climate change is key to preserving these benefits into the future.

Biodiversity is an important element of a resilient urban forest. Planting diverse trees with different adaptations decreases vulnerability of the overall forest to threats like extreme weather, new pest invasions, or changes in water availability. Currently, East Palo Alto's public urban forest has sufficient species diversity, with no single species making up more than 10%, no genus more than 20%, and no family more than 30%. These percentages are commonly used as a rule of thumb for urban forest diversity, as relying too heavily on a single species or set of closely related species can increase vulnerability to pests or other disruptions (Kendal et al., 2014). Further planting should seek to maintain this high level of diversity.

Age diversity is also important throughout the city and along single streets or blocks. If all trees are the same age, they will eventually die around the same time. A street with a mix of young and old trees will maintain a more constant tree canopy cover through time, as young trees grow and older trees leave only small gaps when they die.

Tree species selection is also a key component of the urban forest's resilience to future climate conditions. Native species are long adapted to a particular location and climate, and provide a range of benefits to native wildlife. Some native species are more well suited to urban conditions than others, but many are able to thrive in the city. When considering shifting conditions due to climate change, the ranges of many species are expected to shift or contract (Ackerly et al., 2015; Lanza & Stone, 2016). In cities, changes in temperature and water availability are already altered from natural conditions. When choosing new trees to add, considering the species' natural range can be beneficial: species that are already at the hotter, drier, or more southern edge of their range may be unable to cope with future conditions, while species in the middle of their range are likely to continue to survive in the future. Some concerns related to climate change adaptation in natural ecosystems are actually mitigated by urban conditions: urban trees are often planted, and thus rely less on natural dispersal and establishment processes, and can be supported by irrigation in times of severe drought.

Fruit provision

East Palo Alto residents are enthusiastic about fruit trees, and the City's general plan includes a goal to plant fruit trees when feasible on public property and to encourage fruit tree planting on private property. Opportunities for additional fruit trees could be found in public parks, schools, and residential areas, especially where fruit is publicly accessible but unlikely to create hazards on roads and sidewalks. Fruit trees may not be eligible for tree planting grants, and would need to be planted through different sources.

With the production of fruit comes a need for harvesting and maintenance that exceeds the requirements of many other tree species. Local programs could help East Palo Alto residents manage their fruit trees and use or distribute the collected fruit. For example, Village Harvest, a Bay Area nonprofit, coordinates fruit harvesting and leads free educational programs for tree care, planting, and preservation (https://www.villageharvest.org). They currently have a fruit drop-off site in East Palo Alto, where residents can drop off any excess fruit from their backyards and donate it to local food shelters. The City or residents could also develop new programs to support public fruit trees, as has been done in other cities.

Examples of public fruit tree programs

City Fruit

City Fruit is an education-based nonprofit in Seattle that helps people grow, harvest, and preserve urban fruit and fruit trees. Volunteers harvest food around Seattle, donating the fruit to food banks, meal programs, and local pop-up fruit stands, and sending unusable fruit to farms for animal feed. Fruit tree owners can reach out to City Fruit for help managing their trees, and they can also be added to a "harvest list" for the program to collect any excess fruit. This program helps both fruit tree owners and local communities by ensuring that fruit is harvested and delivered where it is most needed, with minimal waste.

For more information, visit https://www.cityfruit.org

Common Vision

Common Vision is an East Bay nonprofit that grows fruit tree orchards in low-income schools. Their "edible classrooms" project consists of incorporating art into an educational program and creating an "orchard curriculum." They include children in the planting process, as well as educating them on the importance of healthy food. Common Vision focuses on creating school gardens that are high yielding, low cost, and low maintenance.

For more information, visit https://www.commonvision.org

Water use

Reducing outdoor irrigation is an important target for water conservation efforts during drought. Urban trees, especially those that are young and still establishing and those that are not well suited to the local climate, can require extra irrigation to stay healthy, especially during periods of drought. While tree planting strategies should avoid particularly water-intensive trees that are not adapted to the local climate, keeping young trees alive until they can establish and helping large, valuable trees to live through extreme droughts are important ways to keep the urban forest healthy and able to provide important services to people.

Prioritizing low water use trees can significantly reduce the amount of water needed for irrigation. For example, it is estimated that if the Los Angeles urban forest was entirely composed of high water-using species it would need to use up to 62% of total municipal water consumption, while water-efficient species would only consume 9% (Pincetl et al., 2013). For drought-adapted trees, water requirements can be as low as 10-20 gallons twice per month when they are young, and none once established. Therefore, with appropriate species selection, water use by trees has a fairly small impact.

In severe drought conditions, use of irrigation may need to be restricted. Tree caretakers should ensure that trees remain healthy if irrigation is reduced to surrounding lawns or other plantings, either by providing supplementary watering to trees or by replacing high water use trees with drought-tolerant species. Priority for irrigation should be given to larger, older trees, as they provide much of the ecosystem services and functional value. Maintaining existing large, established trees protects past investments, while letting these trees become stressed and unhealthy due to lack of irrigation can result in losses of urban forest benefits that are difficult and costly to replace (Vogt et al., 2015).

Air pollution reduction

Mitigating air pollution is frequently given as an important goal of tree planting, but planting trees to improve air quality requires careful consideration of species choice and tree planting location. In dense urban conditions with tall buildings, street trees can at times trap tailpipe emissions from cars, worsening air quality for pedestrians (Janhäll, 2015). However, the urban form of East Palo Alto should not lead to this problem. Additionally, some species of trees emit BVOCs, a precursor chemical to ozone formation. Pollen allergies can also be a consideration, as some people are very sensitive to the pollen of specific tree species such as redwoods. These potential negative impacts on air quality can be addressed by careful species selection, as BVOC and allergenic pollen production vary widely among species (Eisenman et al., 2019). The best way to avoid these

issues is to plant diverse species in the urban forest, so that no one problematic species is overly common.

Planting along streets and active transportation corridors can indirectly reduce air pollution by encouraging active transportation and lowering tailpipe emissions from cars. Trees along roads can also directly capture particulate matter from the air on their leaves, removing pollution from the air. The best trees for capturing air pollution are tall evergreens with dense, fine-textured canopies (Yang et al., 2015). Trees that have smaller leaves with rougher textures can also capture more pollutants on their surfaces (Yang et al., 2015).

Heat mitigation and shading

Providing shade to cool pedestrians and buildings is an important service provided by the urban forest. Some tree species are better at providing shade than others, including species with larger leaves, denser canopies, or higher transpiration rates (Gillner et al., 2015; McPherson et al., 2018). The placement of trees also impacts their cooling abilities. Trees in locations that are sunny rather than shaded by buildings will have greater cooling effects, and trees planted on the south or west side of buildings will do more to cool the buildings and reduce the need for air conditioning (Sanusi et al., 2016; Norton et al., 2015).

Human health impacts

Trees have positive health impacts through heat mitigation and air pollution capture, as described above, while potential negative health impacts of allergenic pollen can be controlled through species choice and diversity. Trees can also have positive impacts by promoting physical activity and improving people's mental health. Trees located along streets where children can walk to school, near public transportation stops, and in and around parks can all help encourage both recreational walking and active transportation by creating shaded, attractive places for pedestrians (Nehme et al 2016). Numerous studies have found restorative effects of urban trees for people, showing improvements to mood, decreased stress and depression levels, and other positive mental health outcomes (Wolf et al. 2020). Locating trees in high-traffic areas where many people will be impacted by their presence, such as schools, parks, and high-density residential areas, is a good strategy to increase the benefits of trees for public health.

Native landscapes and wildlife

Many residents enjoy seeing and hearing birds in their neighborhoods, and tree planting can be designed to support a greater variety of birds as well as other types of wildlife. Animals often respond differently to native and non-native vegetation, with native wildlife typically more successful in areas landscaped with native plants (Narango et al. 2018, Threlfall et al. 2017). Trees that provide fruit, nuts, or nectar may be especially valuable to wildlife.

Planting trees that were historically found in East Palo Alto, such as coast live oak, valley oak, white alder, and native willows, can also be a way of connecting with local natural history. Oaks are particularly influential species in this region, where oak savanna and oak groves were once common. Oak canopy and limbs offer cover and nesting cavities for birds, while downed branches and leaf litter act as cover for small mammals, birds, reptiles, and amphibians. The presence of native oaks in East Palo Alto is a distinctive feature of the city, and these oaks should be protected and expanded to benefit biodiversity and build local character. Parks and schools in former oak grove areas are ideal locations to bring back oak trees, while former willow locations could support the re-establishment of native willow groves.

While tree planting throughout the city can help create wildlife corridors and provide resources to animals, it should be avoided in and directly adjacent to tidal marsh areas along the Bay. These special and unique habitats support endangered species like the salt marsh harvest mouse, and offer an opportunity to experience a remaining patch of the historical ecosystem. Tidal marsh does not naturally include trees, so tree planting is not recommended in these areas. The addition of trees could even have detrimental effects in the tidal marsh, as it could allow raptors new places to perch and catch the endangered salt marsh harvest mouse and other wildlife.

Salt tolerance

Salt in the soil or groundwater is an important consideration that limits the possible palette of successful tree species, as salt in large quantities can be toxic to plants. Many cities in the South Bay and Peninsula are beginning to use recycled water for irrigation. Recycled water, or highly treated wastewater, is beneficial for increasing available water for irrigation, but often contains a higher salt content. Planting trees that are salt tolerant can help create landscaping that will thrive when irrigated with recycled water. Salt may also be an important consideration near the Bay, if groundwater intrusion from the Bay is expected to increase salinity of groundwater used by trees.

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