

Chapter Five—Management Implications

Boulder’s urban forest reflects the values, lifestyles, preferences, and aspirations of current and past residents. It is a dynamic legacy, currently dominated by older trees planted several generations ago, but with a future to be determined by young trees whose character will change greatly over the next decades (Figure 14). Drought during the past few years has left its mark in the form of increased tree mortality rates.

Although this study provides a “snapshot” in time of the resource, it also serves as an opportunity to speculate about the future. Given the status of Boulder’s street and park tree population, what future trends are likely and what management challenges will need to be met to achieve urban forest sustainability?

Achieving resource sustainability will produce long-term net benefits to the community while reducing the associated management costs. The structural features of a sustainable urban forest include adequate complexity (species and age diversity), well-adapted, healthy trees, appropriate tree size distribution and cost-efficient management. Focusing on these components—resource complexity, resource extent, and maintenance—will help refine broader municipal tree management goals.

Resource Complexity

Though Boulder has a rich mix of species with 105 species of street trees, a heavy emphasis is placed on green ash, which makes up 14% of the population. Green ash provides a high level of benefits at approximately \$75 per tree and this number will increase as the trees age and grow larger (currently nearly half of green ash trees are under 6 in in DBH). However, a disease or pest infestation, of the emerald ash borer, for example, could result in a severe loss to the city. For this reason, a more diverse mix of species should be planted: some proven performers, some species that are more narrowly adapted, and a small percentage of new introductions for evaluation. Proven performers in-

clude the American linden (*Tilia americana*), red oak (*Quercus rubra*), bur oak (*Quercus macrocarpa*), swamp white oak (*Quercus bicolor*), catalpa (*Catalpa speciosa*), hackberry (*Celtis occidentalis*), and horsechestnut (*Aesculus hippocastanum*). Species that merit planting and evaluation include Shumard (*Quercus shumardii*) and chinquapin (*Q. muehlenbergii*) oaks, hornbeam (*Carpinus betulus*), dawn redwood (*Metasequoia glyptostroboides*), and new cultivars of disease-resistant elms such as ‘Frontier’ and ‘Pioneer’ (*Ulmus* hybrids).

Figure 15 displays trees in the smallest DBH size classes, indicating trends in new and replacement trees. Green ash, Siberian elm, honeylocust, and crabapple are most common. Most of the species shown are large trees that have potential to be functionally productive. Only crabapple, Amur maple, cockspur hawthorn, and juniper are smaller trees. New introductions include white ash, red maple, and littleleaf linden. Hence, it appears that a diverse mix of large tree species is being planted, though green ash has been planted at twice the rate of the next most common tree. This species is not planted by the Urban Forestry Division, but they have been planted in newly developed areas. Siberian elms are also not planted by the Division; trees of this species in the smallest DBH class represent volunteers.

Boulder’s municipal forest has a diverse age structure that should provide a steady stream of future benefits from continuous canopy cover. Although some neighborhoods lack age diversity, such as Gunbarrel, where almost 80% of trees are in the youngest class, most of the trees will be large at maturity, and if properly cared for, will provide a high level of benefits in the future.

In summary, to improve Boulder’s urban forest resource complexity we recommend:

- Diversify new plantings by developing a list of species that includes species proven to perform well in most conditions, some species that are

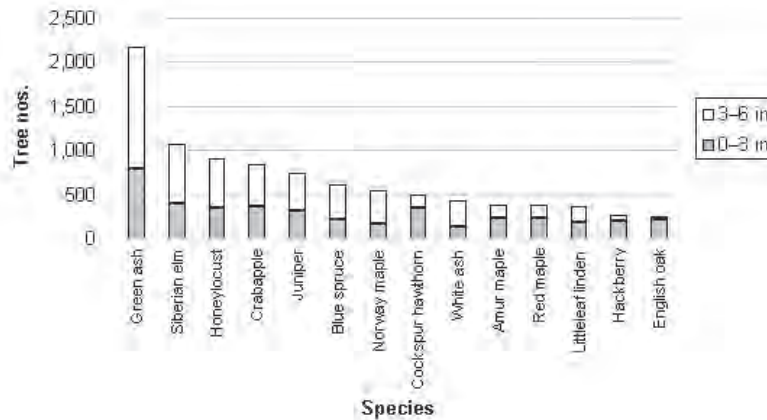


Figure 15—Municipal trees being planted in the highest numbers by the Urban Forestry Division and in areas of new development. Siberian elms are no longer being planted; those shown here are volunteers.

more narrowly adapted, and a small percentage of new introductions for evaluation.

- Increase age diversity in neighborhoods with low diversity by planting empty sites and by replanting in sites where trees have been removed.

Resource Extent

Canopy cover, or more precisely the amount and distribution of leaf surface area, is the driving force behind the urban forest’s ability to produce benefits for the community. As canopy cover increases, so do the benefits afforded by leaf area. Maximizing the return on this investment is contingent upon maximizing and maintaining the quality and extent of Boulder’s canopy cover.

Increasing street tree canopy cover is a goal outlined in the Boulder Valley Comprehensive Plan. Currently the stocking rate for street trees is only 20% and street and public trees cover only 3% of the city. Canopy cover will increase as young trees mature, but there is room along Boulder’s streets for many more trees. We recommend that the city undertake a windshield survey to determine the number of planting sites that are actually available for different sizes of trees. To provide the greatest level of benefits in the future, sites for large trees should be planted first wherever possible, followed

by those for medium and then small trees. Focusing planting efforts in zones where stocking levels are lowest will improve the distribution of benefits across neighborhoods.

The city should continue to insure that adequate space is provided for trees planted in new developments. Increased tree planting in parking lots to provide shade is another strategy to that could be applied to new and existing development. In summary, to improve the extent of Boulder’s urban forest we recommend that the City:

- Conduct a windshield survey to count and categorize planting sites, then develop and implement a Street Tree Planting Master Plan to increase street tree stocking with a diverse mix of well-adapted species.
- Develop a list of tree species that cannot be planted because their maintenance costs exceed benefits. Review this list, as well as the list of trees that can be planted, with the Planning department, landscape architects, and developers. Update both lists on a regular basis.
- Continue to insure adequate space for trees in new developments and encourage soil management. Encourage the use of structural soils when appropriate.

- Review and revise parking lot shade guidelines and enforcement to increase canopy cover.

Maintenance

Boulder’s maintenance challenge in the coming years will be to care properly for the large number of trees in the smallest size classes. Currently, newly planted trees are only trained once, after five years, and then pruning is done on an 8- or 10-year rotation (for park and street trees, respectively) after the tree reaches a DBH of 9 in. Small street trees are pruned even less frequently—only about 300 of 12,000 trees each year. Ideally, young trees should be pruned for structure and form at least every four years after planting.

Developing a strong young-tree care program is imperative to insure that the trees survive the establishment period and make the transition into well-structured, healthy mature trees that require minimal pruning. An effective program will provide regular watering and tree basin inspection during the first several years. Staking should be adjusted and removed once it is no longer needed. Young trees should be pruned for structure and form as needed. Investing in the young-tree-care program will improve survival rates and reduce future costs for routine care as trees mature. Also, well-trained trees are less likely to be damaged during storms than trees that have not developed a strong structure.

Cottonwood, silver maple, and willow have a large proportion of their populations in the larger size classes. These mature trees are responsible for a relatively large proportion of the current benefits due to their size. However, these species develop invasive roots and brittle wood with age. Therefore, continued regular inspection and pruning of these trees is essential to sustaining safe conditions and the current high level of benefits in the short term.

As Boulder implements Smart Growth policies there will be increased pressure to remove large, old trees for infill development, and other trees will be adversely impacted by construction prac-

tices. Ordinances to preserve and protect large trees should be scrutinized and strengthened if needed. The community’s heritage trees represent a substantial investment and produce benefits far greater than their maintenance costs.

Reducing sidewalk and sewer line repair expenditures is a cost-savings strategy for Boulder, which spends about \$161,000 (\$4.90 per tree) annually on infrastructure repairs. Most conflicts between tree roots and sidewalks occur where trees are located in cutouts and narrow planting strips less than 4-ft wide. Expanding cutouts, meandering sidewalks around trees, and avoiding shallow-rooting species are strategies that may be cost-effective when functional benefits associated with increased longevity are considered (Costello and Jones 2003).

In summary, we recommend that the City:

- Develop a strong young-tree care program that includes regular watering, staking adjustment, and inspection and pruning on at least a four-year cycle.
- Sustain the current level of inspection and pruning for older trees, as they produce substantial benefits but require intensive care to manage the shallow roots and brittle wood with some species.
- Review the adequacy of current ordinances to preserve and protect large trees from development impacts, and strengthen the ordinances as needed to retain benefits that these heritage tree can produce.
- Identify and implement cost-effective strategies to reduce conflicts between tree roots and hardscape that will prolong the useful lifespan of mature trees.



Figure 16—Trees shade the pedestrian area of the Pearl Street Mall, providing Boulder’s residents with cleaner air, reduced atmospheric CO₂, cooler summer temperatures, and a more beautiful, economically viable environment.