Recommendations for
University Tree-Care Programs

By Mikaela Schmitt-Harsh, Ph.D., and P. Eric Wiseman

CFaR | Center for Facilities Research

University and college campuses are major hubs of employment, education, and economic development. They are communities unto themselves and play an important role in people's livelihoods and well-being as they work, study, and recreate. An important aspect of that campus experience is the quality of the natural environment, and trees play a central role in defining the campus landscape. How trees are managed on campuses impacts many aspects of institutional operations, ranging from safety to sustainability to energy and infrastructure costs.

THE SURVEY

In 2017 and 2018, a web-based survey, conducted under the auspices of APPA's Center for Facilities Research (CFaR), was disseminated to colleges and universities in the United States and Canada, to collect information about the ways in which campus trees are managed. Individuals contacted to participate in the survey included campus arborists and facilities staff members who are active in campus tree management efforts.

There were 378 responses to the survey (response rate indeterminate given sampling approach), including institutions from 4-year public institutions, 4-year private not-for-profit institutions, and 2-year public institutions. Several universities with active Tree Campus USA certification responded to the survey (36 percent), although the majority of respondents do not currently take part in the program (64 percent).

SYNTHESIS OF FINDINGS AND RECOMMENDATIONS

A summary of survey results is available in the September/October 2019 edition of *Facilities Manager* magazine (the full report is available here: *https://www.appa.org/cfar-completed-projects*). Described here is a synthesis of findings situated within a set of recommendations for colleges and universities that aim to promote effective management and stewardship of campus trees. These recommendations are rooted in an extensive review of the urban forest sustainability literature (e.g., Clark et al., 1997; Kenney et al., 2011) and informed by institutional responses to this survey. These recommendations are neither exhaustive nor do they represent an endorsement of one action over another.

1. Sustained planting to maintain tree stocking and canopy cover
Natural attrition of trees, along with displacement by development, are major challenges to sustaining campus urban forests. The long-term provision of ecosystem services depends on a strong, sustained effort of annual tree planting to maintain adequate stocking and canopy cover. In

recognition of this, cities across North America (and beyond) are increasingly setting tree planting goals—a trend that is beginning to take shape on university campuses as well. In this study, 20 percent of responding institutions currently have a tree planting goal; another 16 percent are in the process of developing one. There is no *one* universal way to set a tree planting goal, and in this study, institutions identified a variety of approaches. Some provided a final tree planting count to be achieved by a given date (e.g., 100 trees by 2022); others a certain number of trees planted each year (e.g., 15 trees per year for 20 years); and others a goal based on replacement (e.g., one-for-one replacement).

Inventory data (see Recommendation #2) can be used to strategically plan current *and* future locations of tree planting efforts, as well as track locations of attrition. Ideally such plans would be crafted to go beyond planting in vacant spaces and routine tree planting efforts associated with capital projects (Stewart and Wiseman, 2018). Rather, more systematic planning of tree planting efforts, including *where* to plant, *what* to plant, and *how* the tree will be maintained to optimize its role in the ecosystem, should be considered.

2. Comprehensive tree inventory

Comprehensive tree inventories are critical to establishing baselines (*what do we have?*) from which future targets and goals can be determined (*what do we want?*). Such inventories can have a range of possible uses; among the most important is to aid landscape planning efforts. Inventories can also be used by students, faculty, and facilities staff to model the ecosystem services and economic value of the campus forest. In total, **tree inventories are an integral step toward understanding the existing resource base, and the opportunities and constraints for growth in the future.**

In this study, 67 percent of the responding institutions indicated they have some level of a tree inventory, with just over 50 percent of these computerized. The extent to which these inventories maintain information for *all* or just a *portion* of the campus landscape is unknown. To be most successful, a comprehensive tree inventory should include *all* campus trees—planted and emergent—that are greater than a designated size, for example, 1-in. diameter at breast height (DBH). Collection of attribute data that extends beyond tree species and location, such as dimensional measurements (height and diameter), health and structure ratings, and maintenance recommendations, will help with modeling (for example, using i-Tree tools) and planning efforts. Since inventories can be time-intensive and therefore costly, early efforts should be made to identify how the inventory data will be used. Pending adequate support and resources, trees should be reinventoried periodically to monitor changes in the composition and health of the campus tree population.

3. Tree canopy cover assessment

A complementary assessment to field tree inventories is a tree canopy cover assessment, particularly for campuses that cover large geographic areas. **Canopy assessments can help decision-makers better understand the spatial arrangement of tree resources, and more accurately track changes to tree canopy over time.** In this study, 76 percent of responding institutions provided a canopy estimate for their campus, with values ranging from 1 percent to 95 percent. The wide variability in canopy cover across institutions can be attributed to several factors (e.g., local environmental conditions, size of campus, or historical legacy); from a purely methodological standpoint, the wide range may simply be the result of incomplete or absent canopy data. Just under 10 percent of those that provided a canopy estimate cited that it was an "accurate record." And since an accurate understanding of what the current resource base looks like is needed to inform the development of future targets, it makes sense that just 9 percent of responding institutions currently have a tree canopy goal.

With greater availability of remote sensing technology, including finer-resolution satellite imagery, canopy assessments can provide university staff with a more automated, rapid estimation of the campus tree population. Such assessments can be performed in collaboration or consultation with faculty and students interested in hands-on, application-oriented research. Freely available web-based canopy assessment tools, such as i-Tree Canopy and i-Tree Landscape, are good places to start in the examination of tree cover. Where possible, institutions

should examine not only their current or "actual" canopy cover, but also their maximum "potential" canopy cover (Kenney et al., 2011), which gives a better account of tree cover relative to available plantable space.

4. Strategic planting to enhance resilience and ecosystem

Plant more trees, but *which* trees should be planted? Maintaining a diverse mix of trees that are suitable to the growing environment *and* to the desired function at the site is critical to promoting a healthy, resilient urban forest (Kenney et al., 2011). Thus, future stocking of the campus forest should give consideration to planting a diverse mix of species that are proven performers on campus and that are resilient to pests, weather, and other known stressors in the area (Stewart and Wiseman, 2018). Though this will certainly vary by location and environmental context, efforts should be made to plant and maintain a diverse age distribution of trees (Kenney et al., 2011) and a reasonable mix of small-, medium- and large-maturing species. While native species are desirable elements of the plant palate, many urban sites have harsh growing conditions, and the planting of native species alongside a cautious selection of nonnative species may be needed to create a more resilient campus forest (Sjöman et al., 2016). Collectively, these recommendations aim to minimize maintenance costs and optimize the provisioning of ecosystem services.

Further, the services that trees provide to the economic and environmental bottom line of universities should be recognized as capital projects are planned. There are now many examples of student- and faculty/staff-led projects to inventory campus trees and quantify their ecological and economic value; however, such projects rarely inform tree care practices, including the selection and planting of trees. In this study, respondents identified a range of reasons to plant trees; however, "aesthetics" was by far and away the clearest indicator of tree planting efforts. As many universities are making commitments to campus sustainability efforts, **creating a culture of campus forest stewardship and sustainability that goes beyond beautification should be encouraged.** Rather, proactive recognition of the need to achieve carbon neutrality goals, improved stormwater management, and provision of pollinator habitats better recognizes the vital role trees play in the campus ecosystem.

5. Cradle-to-cradle tree management approach

Tree removals on campus are a regular part of tree maintenance and grounds management. In this study, the reasons for tree removal often varied—from tree death to insect/disease problems to conflict with a capital project. After removal, tree "waste"—the logs, brush, stumps, and chips—may be disposed of in many ways, with varying costs incurred with each method. Because the expansion and densification of college campuses may bring with it loss of tree cover, efforts should be made to close the proverbial loop and support a cradle-to-cradle system whereby "waste" products from felled trees are reutilized. Many responding institutions indicated they are creating mulch (78 percent) and firewood (41 percent) from campus trees, but the degree to which such practices are utilized relative to the total production of tree "waste" is unknown. A surprising 23 percent of respondents indicated they are processing trees into lumber for reuse either on- or off-campus, although again, the frequency of such practices was not ascertained.

The idea of wood reutilization and upcycling is drawing more and more attention from researchers, arborists, municipalities, woodworkers, campus facilities, and more. Some institutions currently have established repurposing programs, including on-campus sawmills, kilns, and other equipment (see for example, Michigan State University's Shadows Collection). Such programs can readily engage students in hands-on experiences and training concerning a wide range of issues, from urban

forestry to arboriculture to waste management to sustainability. Regardless of having resources and equipment available on campus, **an effective campus wood waste program would treat felled wood as a usable, and sometimes marketable, product.** Careful reuse and recycling can reduce disposal costs and reduce the environmental consequences of tree felling (e.g., lost carbon to the atmosphere).

6. Opportunities for staff training and attainment of specialized credentials

The planting, care, and removal of trees on campus requires staff with necessary training and qualifications, and adequate resources available to support their efforts. Defining an "optimal" number of employees who are involved in campus tree care is tricky, as it varies among institutions, making staffing an inappropriate benchmark. Perhaps a better criterion would seek to address training, skill, and experience of facilities staff. The science and practice of arboriculture has advanced considerably in recent years, and there are now a number of standards, best management practices (BMPs), and credentials that could be employed to advance tree care practices on campus. Where possible, employing a Certified Arborist on campus whose sole responsibility is to oversee the comprehensive and systematic management of the campus forest is recommended. While many aspects of tree care likely fall within the capabilities of grounds staff, certain aspects of risk, pest, and construction management may require advanced training and skill sets. Therefore, increasing opportunities for staff training and attainment of specialized credentials is advised.

Budgetary allocations should be made to the grounds division

that align with the asset value of campus trees. Interestingly, respondents of this survey study were split in their attitudes toward their budgetary allocations. Roughly half of all respondents indicated they were satisfied with their current budget; one-third were dissatisfied, and the remaining were indifferent. Roughly half of responding institutions indicated their budget was adequate to meet identified needs of current and future projects, while the remaining half indicated their budget was not adequate.

There are many competing interests for campus grounds maintenance efforts that can limit or constrain available resources for tree care and protection. Without adequate resources, sufficient maintenance and systematic care of campus trees cannot be performed, which can lead to a triage-oriented, reactive approach to tree management (Stewart and Wiseman, 2018). This approach contributes to inefficiencies in operations and diminished quality of the tree resource, resulting in greater liabilities and fewer ecosystem services. Thus, efforts to align budgetary allocations to the value of campus trees—economic and environmental—should be made. Tree inventory data and the modeling of ecosystem services (see Recommendations #2 and #4) will enable institutions to better capture the value of campus trees.

7. A comprehensive systematic tree care plan

To sustain the character and contributions of campus trees requires a proactive, comprehensive, and planned *systematic* (as opposed to reactionary) approach. A good first step toward developing a comprehensive tree management plan could be modeled after the Arbor Day Foundation's Tree Campus USA "Campus Tree Care Plan" standard. This standard posits that a Tree Care Plan should be goal oriented, education oriented, and provide clear guidance for planting, maintaining, and removing trees.

A tree management plan should also lay out strategies to

monitor and plan for diseases and pests, as early detection may enable resources to be more readily accessible for deployment in the event of an outbreak. A good tree care plan also identifies policies and procedures for managing campus trees. Without clear directives and oversight, campus trees are vulnerable to harm from any number of activities ranging from construction projects to student events. Damage to root systems and the soil they occupy is a primary source of stress for campus trees, particularly the most valuable veteran trees.

To achieve the most success, immediate and plans for tree care should also be incorporated into campus master plans. Commitment and support from leadership toward tree and forest stewardship will promote greater recognition of the important role trees play on campus, and the ways in which students, faculty, staff, and community members can interact with and benefit from the campus forest. ⑨

LITERATURE CITED

Clark, J. R., Matheny, N. P., Cross, G., & Wake, V. (1997). A model of urban forest sustainability. *Journal of Arboriculture* 23(1): 17-30.

Kenney, W. A., van Wassenaer, P. J. E., & Satel, A. L. (2011). Criteria and indicators for strategic urban forest planning and management. *Arbo-riculture and Urban Forestry* 37(3): 108-117.

Sjöman, H., Morgenroth, J., Sjöman, J. D., Sæbø, A., & Kowarik, I. (2016). Diversification of the urban forest: Can we afford to exclude exotic tree species? *Urban Forestry & Urban Greening* 18: 237-241.

Stewart, P. W., & Wiseman, P. E. (2018). *Inventory and Analysis of Landscape Trees and Urban Forests on the Main Campus of Virginia Tech in Blacksburg, Virginia.* Faculty Works, Department of Forest Resources and Environmental Conservation, Virginia Tech. Retrieved from *https://vtechworks.lib.vt.edu/handle/10919/86179.*

Mikaela Schmitt-Harsh is an assistant professor in the Departments of Biology and Interdisciplinary Liberal Studies at James Madison University in Harrisonburg, VA. Her research examines the social-ecological dynamics of human-dominated forest ecosystems, such as urban forests and agroforests. She can be reached at *schmi2ml@jmu.edu*. Eric Wiseman is an associate professor of urban and community forestry in the Department of Forest Resources and Environmental Conservation at Virginia Tech in Blacksburg, VA. His research and extension efforts focus on tree care practices, urban forest ecophysiology, and green infrastructure assessment and management. He can be reached at *pwiseman@vt.edu*; this is his first article for *Facilities Manager.*