Propagations

TREE TIME

A Time for Trees, A Time for Arboreta

by Gerard Donnelly

Planting and watching trees grow takes time. A long time. The lifespan of a tree may be the equivalent of multiple human generations. This is the good and patient work of arboreta, which requires considerable time horizons to achieve many of their purposes. At The Morton Arboretum, in Lisle, Illinois, we call this "tree time." The time required to establish, test, and evaluate tree collections and develop beautiful, planted landscapes that inspire people's interest and appreciation is such that only long-term, multigenerational organizations like arboreta can undertake them.

Given these timescales, I like to say that it is good to be old if you are an arboretum. This year, The Morton Arboretum is celebrating its centennial year, having been established by Joy Morton in 1922. Morton had been encouraged and advised by Charles Sprague Sargent of the then-fifty-year-old Arnold Arboretum of Harvard University. The Arnold Arboretum is celebrating its sesquicentennial year, founded in 1872, the same year Morton's father, J. Sterling Morton, established Arbor Day in Nebraska. The Arbor Day Foundation, created fifty years ago, in 1972, upon the Morton-family legacy of planting trees, is advocating for tree planting on the occasion of its anniversary with a theme of "A Time for Trees."

The time for trees has arrived. There has never been a time when recognition of the value of trees and tree planting was greater than it is today. Trees are being planted globally at scale to sequester carbon and cool the planet. There is widespread appreciation for the ecosystem services that trees provide in urban areas by filtering air pollution, cooling hot cities, and mitigating stormwater pulses. Numerous scientific studies show how trees contribute to human health and well-being.

Yet time has not been good for trees over the past 50, 100, and 150 years. Burgeoning human activities have drastically reduced the size and health of the world's forests as well as the diversity of trees and myriad other organisms that depend on them. In addition, climate change is already impacting trees through altered weather patterns, violent storms and floods, drought, and ravaging forest fires. Trees—long-lived, stationary organisms—are highly susceptible to climate change because growing conditions are changing at rates that can stress and exceed tolerances and adaptability within their lifetime.

How serious is the threat? The recent *State of the World's Trees* report by Botanic Gardens Conservation International (BGCI) is alarming. Based on the organization's Global Trees Assessment involving contributions from arboreta across the globe, including The Morton Arboretum, the report documented that 30 percent of the 58,497 known tree species in the world are threatened with extinction.

With the majority of the world's population now living in cities, urban forests are recognized as key assets to ensure healthful, sustainable, and climate-resilient communities. However, urban centers are challenging settings for trees to grow in and survive, let alone flourish and contribute their full complement of benefits to people, communities, and the environment. Also, trees and their benefits are not equitably distributed across urban landscapes—they often reflect the disparities

Illustration by Jon Han

of resources and human demographics.

Climate change, tree extinction, tree planting, urban forestry, and environmental justice are significant challenges that all arboreta can play a key role in addressing. But the magnitude of these issues requires the power of coordinated collaboration to have a meaningful impact. No single arboretum can do it alone.

For this reason and others, ten years ago, The Morton Arboretum established ArbNet as a global network of arboreta. By working together, arboreta can be better equipped to champion the cause of trees. ArbNet has identified more than 2,100 arboreta in 133 countries, all of which have a common purpose of collecting and showcasing the diversity of trees and promoting their planting and conservation.

ArbNet offers an arboretum accreditation program that recognizes standards of professional practice at four different levels of institutional capacity, encouraging the achievement of higher levels of development over time. Lockerly Arboretum in Milledgeville, Georgia, provides a good example. Initially accredited at level two in 2017, Lockerly used ArbNet accreditation standards to set development goals, including the creation of a new horticultural internship program and expanding participation in scientific research. Upon meeting these goals, Lockerly achieved level-three accreditation in 2021. ArbNet helps member institutions exchange information, expertise, and models that others can use or adapt for their purposes.

Climate change threatens trees as well as the arboreta that maintain living collections of them. Arboreta need to conduct tree performance evaluations and risk assessments to prepare for predicted changes in growing conditions. We also need adaptation strategies that include relocating species, varieties, or specimens to arboreta with more suitable future growing conditions. ArbNet can play a key role in this. Rather than have such exchanges handled variably on a case-by-case basis, an organized system and standardized process are needed to optimize these adaptive plans. The Morton Arboretum envisions a coordinated climate adaptation strategy and program for trees among the arboreta and tree-focused gardens in North America.

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ArbNet's interactive network also provides an opportunity to test tree science questions using a "common garden" approach at arboreta in different growing zones and environmental conditions. One example of this approach is a North Dakota State University study to evaluate adaptive variation among sets of genetically identical poplars (*Populus*) growing at eighteen arboretum and university sites across the United States (including the Lockerly Arboretum). Researchers are using whole-genome sequencing and climate modeling to predict how plants will respond to different climate conditions in the future and inform management approaches to build climate resiliency.

To halt the extinction of threatened tree species, arboreta must commit institutional resources and staff expertise. We must coordinate with one another on targeted tree conservation efforts, including through programs like the Global Conservation Consortia organized by BGCI. A

prominent example is the Global Conservation Consortium for Oak led by The Morton Arboretum in collaboration with BGCI and dozens of arboreta and other partners involved in oak conservation. No single arboretum or garden can or should conserve all the world's threatened oak species, so a coordinated, global effort is needed. As part of these efforts, The Morton Arboretum is establishing conservation groves on-site for two threatened species from the southeastern United States: Georgia oak (*Quercus georgiana*) and maple-leaved oak (*Quercus acerifolia*). Over tree time—in 50, 100, or 150 years from now—curators will use these collections to ensure that the species are safeguarded from extinction risks, and researchers will study what can be done to help them survive in nature.

Tree planting has risen to the forefront as a solution to blunt global climate change, given the ability of trees to sequester carbon from the atmosphere. Yet large-scale tree plantings for carbon sequestration often take the form of low-diversity tree plantations or forestry plantings that do nothing to protect tree biodiversity; they may even diminish it. Arboreta must lend their expertise in tree diversity, planting, and horticulture to improve approaches for carbon-focused tree planting and reforestation efforts. A new global biodiversity standard for large-scale tree plantings being introduced by BGCI will position arboreta and other botanical gardens as key resources to achieve these essential outcomes, ensuring effective carbon capture in addition to—not at the expense of—biodiversity conservation.

Arboreta also have an important role to play in supporting objectives to plant trees in urban environments to ameliorate heat, filter pollutants, mitigate stormwater flooding, and lower energy costs. Urban forests also add beauty and improve social cohesion, human health, and well-being. Arboreta know how to cultivate trees in designed and managed landscapes, but they must assert their involvement and influence with municipal planners, engineers, and landscape architects to enhance opportunities to develop healthy and sustainable urban tree canopies.

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When arboreta partner with community organizations and local government agencies, they can play a meaningful role in addressing the disparities in people's access to the environmental and health-related benefits of a thriving urban forest. Although this issue was not at the forefront of efforts by arboreta or botanical gardens fifty or one hundred years ago, arboreta should now actively seek funding (or commit their own resources) for equity-focused tree plantings that engage residents in participatory planning and provide training for tree planting and care. Arboreta can partner with tree nurseries and growers to provide not only the diversity of suitable trees needed for urban conditions but also at the sizes that can be managed in community and volunteer planting efforts.

Furthermore, and aligned with the goal to engage and serve a broader spectrum of the public, arboreta must actively foster and support career paths associated with the work of an arboretum to new and different groups of people. Only with a diversified pipeline of tree experts, curators, scientists, horticulturists, conservationists, and educators will arboreta fully serve the public good.

Arboreta, with their beautiful trees and landscapes, attract a substantial public audience and provide immersive experiences and learning moments about the value of trees and nature. These are opportunities to register tree time—the time it takes for a tree to reach its full potential over 50, 100, or even 150 years. These long timelines require commitments to tree planting for future generations, sustained efforts to protect them and their growing environment, and actions to address climate change and other tree threats.

The grand challenges of our time related to trees require arboreta and tree-focused botanical gardens to collaborate actively. Together, these institutions can achieve more meaningful and successful impacts, engaging their vast collective audience to encourage people to plant and advocate for trees and a more sustainable world. The year 2022 is certainly a time for trees—and for arboreta.