



Let's Diversify Community Forests

TREE CITY USA®
BULLETIN

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With news of invasive insects and diseases that are destroying community trees throughout the country, it is easy to view the situation as hopeless. However, one of the most powerful means of combating the havoc caused by these invasions is relatively simple and inexpensive — diversifying the kinds of trees we plant and manage.

When reflecting on his state's historic loss of elm trees, Dr. John Ball of South Dakota State University told *The Forestry Source*, a publication of the Society of American Foresters, "I realized we learned the wrong lesson. The lesson we learned was not to plant elms. What we should have learned was to diversify."

That important lesson means not simply switching to another species that is immune to a current plague,

A greater focus on diversification of a community's trees should be a goal of every tree board and urban forestry department.

but rather to truly diversify the trees being planted. To ensure maximum effectiveness and maximum protection of the benefits provided by the urban forest, the diversification needs to be carefully planned.

Urban forest diversity has been defined by Professor Emeritus Joe McBride of the University of California–Berkeley as "the complexity of tree species composition, the size distribution of trees, and the patterns of distribution within an urban forest." With the continuing spread of urbanization and in the face of climate change, the concept — and practice — of tree diversification is more important than ever.



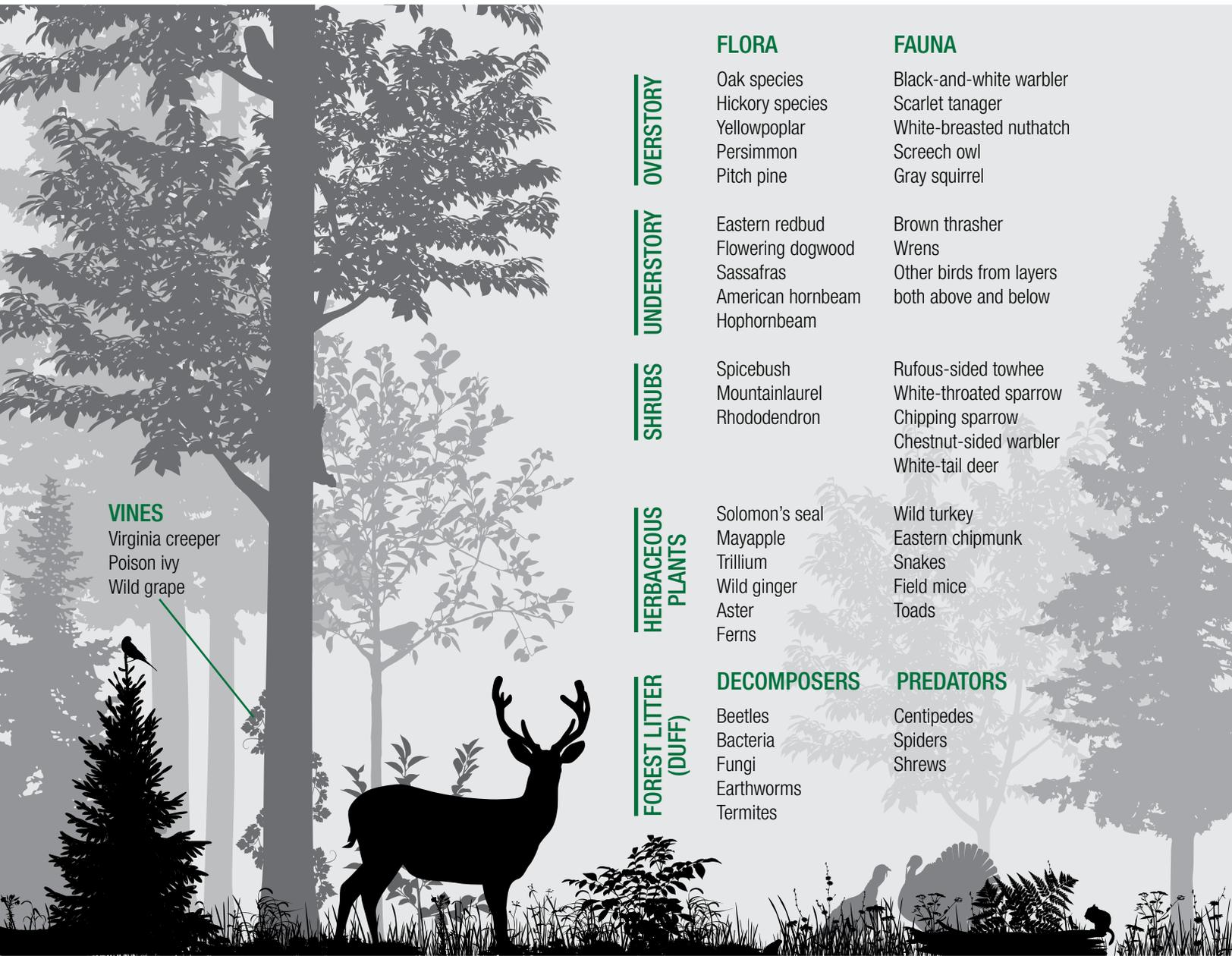
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Diversity in Nature

There is something healthy and stable in a diverse natural setting. Plants and animals can find a niche that meets their particular requirements and provides a richness in the environment that leads to what we call sustainability.

Natural forestry diversity includes both diversity of species and forest structure. One example is the vertical layering of a forest, as illustrated here, and the life each layer supports. Some animal species have exacting requirements for particular trees, the jack pine/Kirtland's warbler association being a classic example; others may depend on the size or age of trees for meeting their needs. The life-sustaining niches of some animals are based on temperature or

light conditions or density and extent of the forest. Space is also a factor. For example, a forest adjacent to a meadow provides a range of wildlife habitat, and some animal species depend on being able to move from one to another. Certainly climate plays a role, too. When habitats are altered, whether by human action or natural events, balances are disrupted and there can be a shift to new and sometimes less desirable associations.



VINES

- Virginia creeper
- Poison ivy
- Wild grape

OVERSTORY

FLORA

- Oak species
- Hickory species
- Yellowpoplar
- Persimmon
- Pitch pine

FAUNA

- Black-and-white warbler
- Scarlet tanager
- White-breasted nuthatch
- Screech owl
- Gray squirrel

UNDERSTORY

- Eastern redbud
- Flowering dogwood
- Sassafras
- American hornbeam
- Hophornbeam

- Brown thrasher
- Wrens
- Other birds from layers both above and below

SHRUBS

- Spicebush
- Mountainlaurel
- Rhododendron

- Rufous-sided towhee
- White-throated sparrow
- Chipping sparrow
- Chestnut-sided warbler
- White-tail deer

HERBACEOUS PLANTS

- Solomon's seal
- Mayapple
- Trillium
- Wild ginger
- Aster
- Ferns

- Wild turkey
- Eastern chipmunk
- Snakes
- Field mice
- Toads

FOREST LITTER (DUFF)

DECOMPOSERS

- Beetles
- Bacteria
- Fungi
- Earthworms
- Termites

PREDATORS

- Centipedes
- Spiders
- Shrews

Lack of Diversity in the Urban Forest

The forest in almost any community is a human-made landscape. It is the result of a series of decisions that lead to its manipulation (management) or its neglect. The first step toward management for greater diversity is to understand how we got to where we are today and to recognize why a change is important.

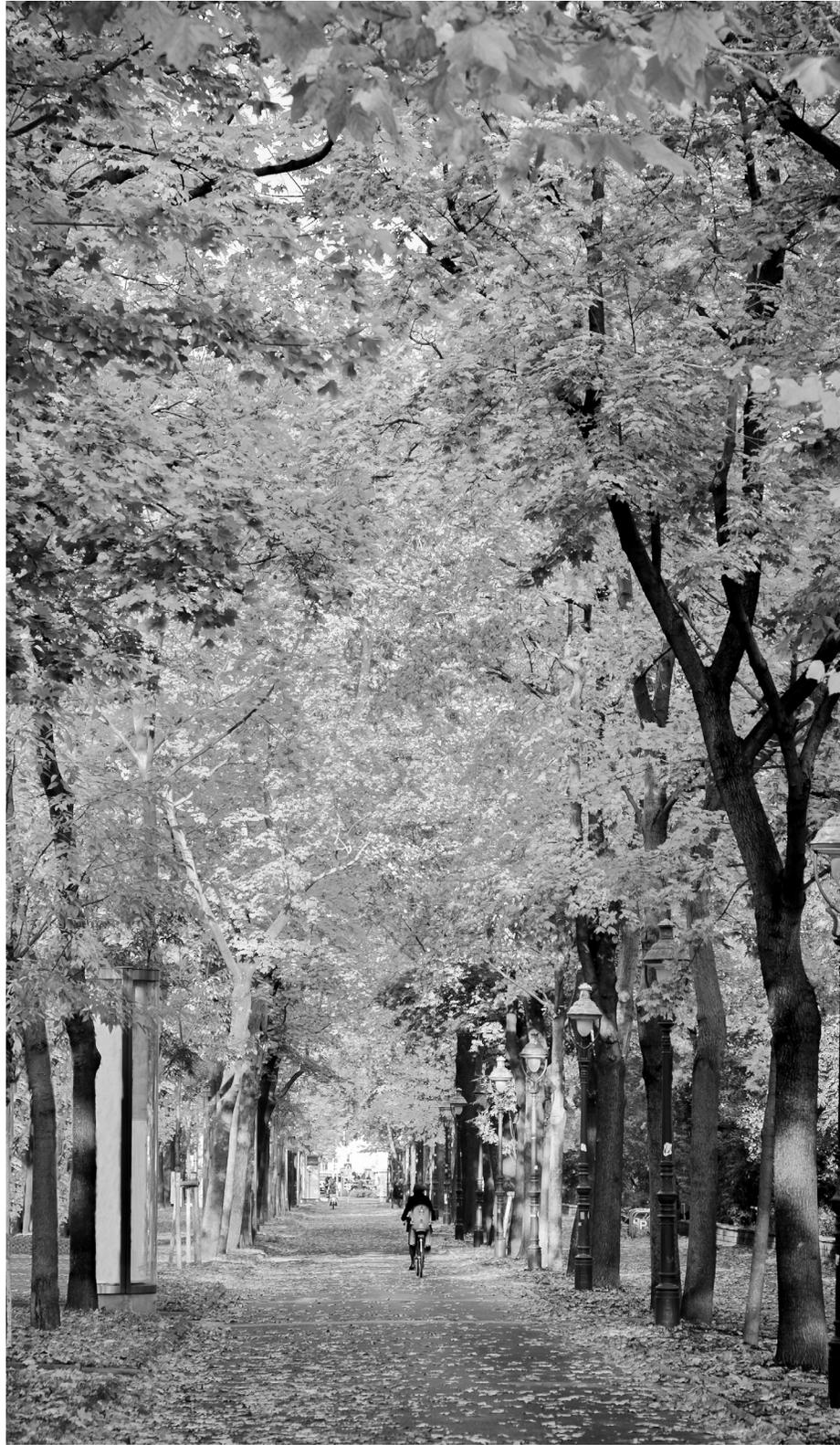
In many communities throughout the nation, a single genus, species, or collection of related cultivars dominate the canopy. For example, it may be 30 percent maples of various species and cultivars. Such was the case when beautiful American elms arched over the streets of our cities. When Dutch elm disease arrived in the United States early in the 1930s, it spread like an invisible wildfire. Because of a lack of diversity, entire streets and large portions of communities were left with nothing but stumps in their wake.

REASONS FOR LACK OF DIVERSITY

Dr. Joe McBride has identified several factors that contribute to the lack of tree diversity in communities:

- Local conditions, such as the harsh climate of the coldest hardiness zones, and a lack of species richness in the local biome.
- History. Past preferences for certain introduced trees, sometimes dating back to pioneer days.
- Expert advice, or lack of it, based on the experience and knowledge of local arborists or others responsible for tree planting and care.
- Spiritual/psychological factors such as childhood experiences with trees or religious symbolism.
- Availability of planting stock at nurseries.
- Previous insect or disease epidemics.
- Public popularity, including a desire for uniformity in streetscapes or other settings.

Tradition and the unifying effect of monoculture plantings are two of the reasons for a lack of tree diversity. While such plantings are often aesthetically appealing and can provide for management efficiency (for example, pruning cycles), they set the stage for disappointment and huge expense when those trees become a vulnerable victim to the unexpected.



The Need to Diversify

There are good reasons to diversify community forests. Achieving a goal of creating and maintaining a diverse urban forest will require departure from tradition and a new, concerted effort. However, the result will be healthier, more resilient urban forests.

Without tree diversity, a community not only runs the risk of losing a large portion of its trees when unexpected disaster strikes, it deprives itself of optimizing ecosystem services. In addition, homogenization often lacks the aesthetic appeal of a diverse setting and does little to imitate nature and provide for the needs of birdlife, pollinators, and other wildlife.

REASONS TO DIVERSIFY



An entire row of young ash trees have fallen victim to the emerald ash borer. Cultivars and varieties within a genus are often susceptible to the same pests.

To the extent we can imitate nature and provide diverse habitats, we will enrich our surroundings with a greater variety of wildlife.



"In natural ecosystems there is a relationship between stability and diversity. Maintaining more diverse urban forests promotes greater stability."

DR. JOE MCBRIDE
Professor Emeritus, UC-Berkeley



Some species are more vulnerable to abiotic factors such as storm or salt damage. Planting a variety of species can reduce the risk that all will be severely damaged by harsh weather or other conditions.

Diverse vegetation adds interest to urban settings and provides a greater range of ecosystem services.



RICHNESS VS. DIVERSITY

Richness within the urban forest is not the same as diversity. Most street tree inventories record an amazing number of species, and yard trees add even more richness. This is due to the introduction of non-native species. The resulting variety, or richness, often exceeds that of what is found in a nearby natural forest. However, the problem is that the count usually reveals that a much smaller number of tree species and genera actually dominate. In a study of eastern North American cities, it was found that maples made up 20 percent of the street tree population in 11 of the 12 cities studied. In a study of 108 cities worldwide, on average 20 percent of the trees in urban forests were of the same species, 26 percent were in the same genus, and 32 percent were in the same family.

THE 'RULES' FOR DIVERSITY

There is no absolute when it comes to prescribing numbers for the ideal mix of trees in a community. However, in 1990, the late Dr. Frank Santamour of the U.S. National Arboretum proposed a rule of thumb. He did not claim to be the first to have this idea, but when he presented it at a conference of the Metropolitan Tree Improvement Alliance, his formula stuck. It became widely known as the 10-20-30 rule:

10-20-30

Dr. Santamour proposed that no more than 10 percent of any one species, 20 percent of any one genus, or 30 percent of any family should make up the urban forest. This, he argued, would reduce the risk of severe losses due to the ravages of newly arriving pests or outbreaks of known pests.

More recently, South Dakota State University's Dr. John Ball has suggested tightening up this general rule. His proposed guideline is:

NO MORE THAN 5 PERCENT OF ANY ONE GENUS.

Dr. Ball points out that, "If there's anything we've learned from Dutch elm disease and emerald ash borer, it is that the threat is not at the species level, but at the genus." For example, all species and even most cultivars within the ash genus *Fraxinus* are targets of the emerald ash borer. He told a writer from the *Society of American Foresters*, "My reasoning is not that Dutch elm disease or emerald ash borer would not affect your community, but

it means you've limited your exposure, and it's a more manageable problem than if you have 20–30 percent ashes or elms (of whatever species or cultivar)."

ADDING EVEN MORE DIVERSITY

A truly diverse urban forest will also have trees of a variety of ages and sizes. It may take many years to achieve this aspect of diversity, but a planned, continuous planting program is the answer. Another consideration of diversity is the shape, bloom times, leaf color, and other features that can add variety to the landscape.

Permaculture, the subject of Tree City USA Bulletin No. 59, can be another means of increasing diversity. Its principles of working with nature, including in small spaces, make it a way for residents to also contribute to the diversification of the urban forest.

LACK OF DIVERSITY ADDS TO COSTS

In a report to the city of Lincoln, Nebraska, Professor Eric North of the University of Nebraska-Lincoln pointed out, "There are direct costs (maintenance, removals, and replacements) associated with poor diversity." He went on to illustrate that only three genera (maple, oak, and ash) currently make up 43 percent of the city's public trees, 16 percent being maples of various species and cultivars. If a serious pest that affects maples were to arrive, the cost of removal and replanting would be approximately \$15.8 million. If the percentage of maples were only 10 percent, the cost would be \$9.7 million, a savings of some \$6 million.



From Theory to Action

Implementing an urban forestry policy or a plan to achieve greater diversity is not easy. However, some communities are making an attempt. Here are some actions that can help.



WORK WITHIN THE UNIFIED LANDSCAPE FRAMEWORK

Some professionals who promote diversity suggest, “Look around your planting site. Plant something other than what you can see nearby.” In some circumstances, such as a park or lawn, this may be a good idea. However, there is often a good reason to plant the same trees in one area. Landscape architects use this to provide a unifying effect in a neighborhood or around a building. Some uniformity can be compatible with the diversification concept if:

- The species are appropriate to the site and take into consideration pest problems and climate change.
- Different genera are used across various neighborhoods, streets, or sites throughout the municipality.

USE LISTS CORRECTLY

An extensive list of trees that have been proved to thrive in the area can give tree planters ideas beyond those trees with which they are familiar. Any such list should span genera and should not include overabundant trees. However, an approach that limits planting only to approved species, even if the approved list is rather extensive, may, in fact, limit urban forest diversity. A better approach may be to use a list of prohibited trees (including invasives and trees with known health or maintenance issues) together with an extensive suggested species list to guide tree planting. An ordinance section referring to suggested and/or prohibited lists should be part of the permitting process for planting in developments and rights-of-way.

CONSIDER THE NON-NATIVE DEBATE

Discussions about planting species that are native to the area vs. non-native introductions sometimes rise to the level of a passionate argument! However, the natives-only approach would, in many communities, severely limit the richness and diversity of the canopy. Invasive species are another story entirely. Clearly, invasives should be avoided or prohibited but, importantly, not all non-natives are invasive.

In Portland, Oregon, city code and its accompanying planting standards address all three categories and provide residents with a list in each case:

- **GREENWAYS, SCENIC CORRIDORS, AND ENVIRONMENTAL OVERLAY ZONES (SUCH AS NATURAL AREAS):** Native species only.
- **STREET TREES:** Non-natives are included and approved trees are listed by width of planting site and presence or non-presence of power lines.
- **INVASIVE SPECIES:** Prohibited.

CLIMATE CHANGE

Cities such as Chicago and Philadelphia are being proactive as the realities of a warming climate become more apparent. For example, Philadelphia is experimenting with trees transplanted from more southern regions. Chicago has produced an *Adaptation Workbook* that prescribes management practices such as improving watering methods as well as adding new species and building resilience through enhanced age, species, and genetic diversity when planting.

WORK WITH LOCAL NURSERIES

Improving tree diversity obviously depends on a wide range of trees being available to plant. Nursery operators should be alerted to the desire for a greater number of species and genera that are, of course, suitable for local planting conditions.

Cooperation with the nursery industry is essential to expand diversity of trees planted in any community.



QUANTIFYING DIVERSITY

Tree diversity in your community can be quantified in a number of ways:

- Determining the percentage of each species or — better yet — each genus based on the results of a street tree inventory.
- Use of iTree Eco. This software application can use existing inventories or new information from randomly selected plots to quantify urban forest diversity, structure, and ecosystem benefits. An optional component even allows you to predict potential impacts from storms or pest infestations.
- Diversity Indices. Simpson's Diversity Index and Shannon's Diversity Index are tools used in ecological studies to quantify information about plant life in specific areas. They take into account the number of species present, as well as the relative abundance of each species. Through use of mathematical formulas, the results are expressed in a number that can be used for comparison between cities, marshes, woodlands, or other areas. See page 8 for links to these methods and their applications.

A little data and some common sense can be a guide to determining diversity in the urban forest. More sophisticated tools are available to provide a more precise picture and set the stage for tracking progress toward greater diversity.



A Learning Activity for Youth

Teachers and youth leaders have an opportunity to introduce young people to the concept of tree diversity. This can easily be incorporated into more traditional biology lessons, tree identification sessions, or general discussions about ecology. Suggested concepts to include are:

1. Without tree diversity, one disease or insect could destroy all the trees in an area.
2. Trees come in different shapes, sizes, colors, and other features that add diversity.
3. Some trees need certain locations, temperatures, and soils to survive.
4. Greater diversity of trees means greater diversity of wildlife.
5. Tree diversity provides beauty and interesting variety.



FOR MORE INFORMATION ...

Quick links are provided to the sources used for much of the information in Bulletin No. 94. Visit the Available Resources page at arborday.org/bulletins.

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