

# THE SEED



2024



What Is a  
Climate-Resilient  
Landscape?

# A MESSAGE FROM THE EXECUTIVE DIRECTOR



Hello fellow gardeners, tree lovers and difference-makers!

Welcome to a new year and a new issue of *The Seed*. Last year's *Seed* theme, **Let's Rethink the Lawn**, spurred a multitude of wonderful conversations among readers throughout the state and beyond. We received requests to mail additional copies to discussion groups, workshops, college classes, garden clubs and more. All the positive feedback and interest buoyed us in our day-to-day work and inspired us to think intentionally about the theme for the 2024 edition of *The Seed*.

We've noticed that people are waking up. The public is becoming increasingly aware that we — the global “we” — are facing challenging times ahead as the result of climate change. Around the world people have experienced unprecedented and unrelenting heat waves. The issue of water scarcity has become a topic of increasing concern. Real conversations about climate refugees are taking place.

We here at the Nebraska Statewide Arboretum are experiencing this awakening on a smaller scale as we field more questions than ever about how to garden in continuous drought conditions, how to bring fireflies back to summer nights and what to do about yellowing trees.

As a staff and a group of environmentally minded people, we are acutely aware of the impact a resource like this magazine can have, as well as the risk inherent in failing to engage people in productive and hopeful ways. Thus, the theme for this issue — What Is a Climate-Resilient Landscape? — was conceived.

We intentionally phrased it as a question because we'll be the first to admit, we're not exactly sure what it means to foster a climate-resilient landscape. That's why this issue is a starting point for a year-long dialogue on this topic. Throughout 2024 we'll host conversations, exchange ideas and toss out wild thoughts about what climate-resilient landscapes can mean. We'll spend time talking about what we can do as individuals, while acknowledging the need to call for action on the national and global level.

We would love for you to join us! Visit NSA's new Climate-Resilient Landscape landing page ([plantnebraska.org/climate](https://plantnebraska.org/climate)), which will be updated throughout the year to feature publications, articles, podcast episodes, event announcements, recordings of virtual conversations and other climate resiliency resources. Bookmark this page and check it frequently so you don't miss anything.

You may remember in last year's letter that I committed to transforming my front yard into a pumpkin patch. I'm pleased to say it was a successful experiment (see the photo above), and I received many compliments from my neighbors! You can also read on page 5-6 about three Nebraskans who took what they read in last year's issue of *The Seed* to heart and implemented their own lawn alternatives as a result.

**So, what do you say? Join us on this exploration. Perhaps you'll even consider implementing a new idea or two in your own corner of the world. Together, we just might do something amazing.**

A handwritten signature in blue ink that reads "Hanna Pinneo".

**Hanna Pinneo**  
Executive Director  
Nebraska Statewide Arboretum



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# OUR MISSION

WE PLANT NEBRASKA FOR HEALTHY PEOPLE, VIBRANT COMMUNITIES AND A RESILIENT ENVIRONMENT.

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# SEEDLINGS

## BITS OF GARDENING WISDOM



White oak (*Quercus alba*)

### THE MIGHTY OAK

If you want to support the environment in one small (but tall) way, plant an oak.

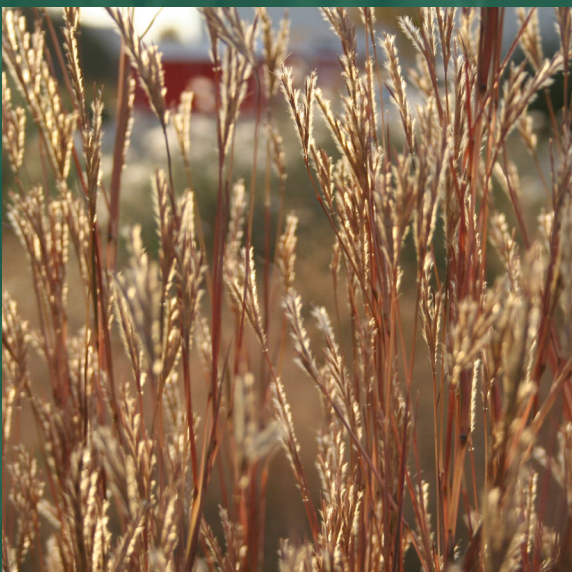
The mighty oak (*Quercus*) is a keystone species, which means the ecosystem is largely dependent on its existence. Oaks support more species — up to 2,300 — than any other tree genus, providing food and protection for birds, mammals and invertebrates.

In the U.S. alone, oaks support 897 caterpillar species. And why are caterpillars so important, you might ask? Because they fuel the food chain. One study by author and researcher Doug Tallamy determined that a single chickadee family fed their young 350-570 caterpillars each day.

Seven oak species are native to Nebraska: red (*Quercus rubra*), white (*Quercus alba*), black (*Quercus velutina*), blackjack (*Quercus marilandica*), bur (*Quercus macrocarpa*), chinkapin (*Quercus muehlenbergii*) and dwarf chinkapin (*Quercus prinoides*). Plant one this spring, knowing even a single oak tree can make a significant impact on the environmental health of your neighborhood.

“THERE CAN BE NO PURPOSE MORE ENSPIRITING THAN TO BEGIN THE AGE OF RESTORATION, REWEAVING THE WONDROUS DIVERSITY OF LIFE THAT STILL SURROUNDS US.

E.O. Wilson, American biologist



Little Bluestem (*Schizachyrium scoparium*)

### FAVORITE NATIVE SPOTLIGHT

When we think of climate change in Nebraska, we likely think of drought. One small step you can take in your own yard to help mitigate the effects of climate change is to choose native plants and trees that require little water to thrive.

Grasses aren't always considered the sexiest plant, but they are the quiet superstars of the sustainable landscape. The classic example is little bluestem (*Schizachyrium scoparium*), a prairie species that gets its common name from the bluish hue of the stem bases in early spring. Little bluestem really shines in the fall, however, when it glows a radiant mahogany with golden seed heads that shimmer in the late afternoon sun. This grass keeps its color throughout most of the winter, providing nice visual interest in an otherwise drab landscape.

Growing in dense, 8-24-inch-tall mounds, little bluestem thrives in dry, sandy soil and full sun and, when established, has excellent drought resistance. It's also a favorite with birds, which eat its seeds during the winter, is a larval host for several species of moths and butterflies and provides nesting material and structure for native bees.

In short, little bluestem is a powerhouse plant that should be part of every pollinator garden.



# THE BENEFITS OF BIODIVERSITY

## EACH OF US HAS A ROLE IN HELPING TO CREATE SUSTAINABLE LANDSCAPES IN OUR OWN SPACES



Black swallowtail on purple coneflower (*Echinacea purpurea*)



Cedar waxwing eating winter berries



Honeybee on bee balm (*Monarda bradburiana* 'Prairie Gypsy')

Given the choice between parking your car in a shaded, tree-lined lot or in a sunny lot devoid of shade, which would you choose? Or how about the choice between cycling along a bike trail that wends among plantings and trees compared to a trail that offers little protection from the wind and sun? You'd probably choose the shady parking lot and the protected bike trail, simply because they offer more enjoyable, comfortable and aesthetically pleasing experiences.

These are just two examples of the many and varied benefits that healthy ecosystems provide. The more biodiverse an ecosystem is, the healthier, more visually appealing and more resilient it is as well.

Diversity in trees and other plants protects the landscape from decimation by a single pest or disease, like emerald ash borer or pine wilt disease. Likewise, landscapes that are planted with native and well-adapted species are well-suited to deal with local pests, climate and soil conditions. Native plants like little bluestem, asters, sedges and hundreds of other species are adapted to the weather patterns of the Great Plains and able to tolerate drought, flooding, sizzling summers and frigid winters with less water, fertilizer and pesticides.

### NATURE PROVIDES A BOUNTY OF SERVICES

Sometimes we turn to well-adapted species to help remedy urban challenges created by construction and the use of concrete and road salt. We utilize what's called "green

infrastructure" — meaning we don't just plant for the sake of nature (in itself a worthy goal), but to solve human-made problems as well. For example, trees planted alongside "gray infrastructure" (anything made of concrete or other building materials) can help to mitigate urban heat.

Healthy and diverse ecosystems provide us with several kinds of ecosystem services, including supporting services, provisioning services, regulating services and cultural services.

**Supporting services** are those that are necessary for the health of all other ecosystem services. Examples include soil formation and retention, nutrient cycling, water cycling and the production of atmospheric oxygen.

**Provisioning services** are the products provided by ecosystems, including fresh water, food, fuel and genetic diversity.

**Regulating services** are the benefits provided by ecosystems processes that moderate natural phenomena. Examples of regulating services include water purification, pollution control, decomposition, erosion and flood control, carbon storage, pollination and climate regulation.

**Cultural services** are the non-material benefits provided by ecosystems, including spiritual enrichment, recreation, cognitive development and beauty. The example of the tree-lined bike trail in the opening paragraph is an example of the cultural services provided by a healthy ecosystem.

These various ecosystem services work

together to provide a multitude of benefits that impact human beings and the environment. For example, using a bioswale to manage stormwater helps to clean and return water to the ground, rather than as a waste product destined for the sewer. That same bioswale can also provide habitat for birds and other wildlife, improve the soil, cool the air and contribute beauty to an area.

### BIODIVERSITY FOSTERS A CONNECTION TO NATURE

Our towns are home to many wildlife species that benefit us and allow us to maintain a sense of connection to the natural environment. Biodiversity in our landscapes is necessary in order to provide food and shelter for the wide variety of birds, insects and other animals that live around us. Using green infrastructure to manage rainwater provides clean water for our wildlife neighbors as well as for ourselves. Maintaining a network of greenspaces in our towns provides wildlife with safe spaces to find shelter and raise their young away from our yards and homes.

Each of us has a role in helping to support biodiverse ecosystems in our neighborhoods and towns. By choosing to plant a diversity of native and well-adapted plants and trees in our own spaces, we create sustainable landscapes that are resilient, beneficial and beautiful.

*Sarah Buckley is a Sustainable Landscape Specialist for the Nebraska Statewide Arboretum.*

# SAVE THE RAIN

## CONSIDER ADDING A RAIN GARDEN TO CAPTURE VALUABLE WATER

A more climate-resilient landscape is one that acts like a sponge, willingly receiving water when it falls and holding onto it so it can be used later by landscape plants. This concept of a "sponge city" was pioneered in 2014 by Kongjian Yu, one of China's leading landscape architects, and is now gaining attention across the globe.

How can we learn from this concept and turn our existing landscapes into something more sponge-like? We can begin by ensuring that whatever rain lands on our property has time to slow, sink and store in the soil.

### STEP ONE: SLOW THE RAIN

When a hard rain falls onto an urban area, much of it runs off without being absorbed into the soil. Trees in the landscape, however, can help rainwater stay around longer by acting as rainfall traffic controllers, intercepting drops with their canopy and allowing rain to reach the ground gradually and with less velocity. This is evident when we shelter underneath a tree to keep dry during a brief rain shower. The tree's canopy deflects the raindrops before they've had a chance to soak us — a process aptly called canopy interception.

If we shelter beneath that tree a bit longer, we'll find that water begins to drip onto us from the branches — a process known as dripage. Water that moves from leaves to branches and down the trunk to the soil below is known as stemflow.

### STEP TWO: IMPROVE THE SOIL

Once we slow the rain, we next need to consider soil type, degree of soil compaction, soil organic matter and other surface vegetation, all of which contribute to how well precipitation will sink into the ground.

Some of these factors, like surface vegetation, are easily controlled, while others, like lessening soil compaction and increasing soil organic matter,



A retention basin on the campus of Hastings College



A bioswale at Community Ever Green House in Gering

require strategic intervention. Mitigate soil compaction by aeration and by not parking vehicles under trees or unnecessarily walking in established garden beds. Increase soil organic matter by mulching lawn clippings, adding compost and letting the leaves decompose naturally in your yard. Diligent improvement to your soil's health will in time increase its ability to better infiltrate and retain water.

### STEP THREE: MAKE A RAIN GARDEN

Rain that lands on an impermeable surface like a roof or concrete driveway presents another challenge.

While rain barrels have become a popular option in recent years, unless they are installed at a larger scale or are paired with a smaller garden, their impact is minimal. Instead, consider installing a strategically placed rain garden as a more effective solution to prevent quick-moving volumes of downspout water from leaving your landscape.

Rain gardens are modest depressions (up to 12" deep) in the landscape immediately outside of the discharge of a downspout. They can also be placed where water is funneled by concrete drainage and





A rain garden in Omaha's Benson neighborhood enables water funneled from the street to sink more slowly into the landscape.

exits into the landscape. These spaces capture accumulated rainwater, allowing it to slowly sink into the soil over a period of 48 hours or less. Because residential rain gardens are sized to accommodate no more than 1 inch of rain, an overflow is created to allow excess water to exit the rain garden, preferably into the landscape, where it will have a chance to infiltrate before running off.

You might be surprised by how much rainwater runs off your roof in a given year. For example, a roof that is 50 feet x 30 feet has the potential to collect 27,000 gallons of water over the course of an average precipitation year in southeast Nebraska. This total gives you an indication of how much water you could be losing annually from your landscape, as well as an idea of what size rain garden you might need to accommodate your rainfall runoff.

Now that you've captured more rain and have stored it in your soil, it's time to get excited about the second word in the term — garden — as more water for roots will produce colorful abundance and resilient beauty. The Nebraska Statewide Arboretum is a great resource for selecting deep-rooted native species that will thrive in different locations in and around a rain garden. Check out the resources section of NSA's website — [plantnebraska.org](http://plantnebraska.org) — for plant lists and gardening tips.

**Brad Kindler is a Sustainable Landscape Specialist for the Nebraska Statewide Arboretum.**

## RAIN-SAVING SOLUTIONS FOR THE COMMUNITY LANDSCAPE

While a rain garden is a great option for retaining more rainwater in a backyard, some situations call for larger-scale solutions.

### DETENTION BASIN

Detention basins are landscape-scale green infrastructure that are positioned adjacent to waterways, creeks and lakes and act as temporary storm water holders. They are utilized to prevent downstream flooding and erosion by interrupting large volumes of rainwater in the basin and, like a rain garden, allow it to percolate into the soil over time. Detention basins may also be used in areas adjacent to parking lots and in industrial and agricultural areas to capture pollutants that accompany a pulse of surface and street cleansing rainwater.

### RETENTION BASIN

A large-scale basin that is designed to hold water and remain filled for extended periods of time is called a retention basin. This type of green infrastructure improves water quality by allowing vegetation to filter and utilize nutrients over the course of a growing season. Retention basins also provide aquatic habitat and can support wetland species of amphibians and migratory birds, and, when integrated into urban environments, provide recreational opportunities like fishing, hiking and nature watching.

### BIOSWALE

A bioswale is a linear channel or depression that is used to channel, move and filter stormwater. The sides are planted with perennial species so that storm water is slowed while moving through the system, and the plants are able to assist in filtering pollutants that may have washed in. Bioswales can also be constructed on topographic contour, intercepting water runoff perpendicular to the slope. Once inside the swale, water spreads laterally, slowly sinking into the soil and helping to increase groundwater.



# LET'S RETHINK THE LAWN UPDATE

More and more homeowners are turning from monoculture lawns to alternatives that require less water and maintenance and offer greater environmental benefits. Here's a look at three real-life success stories from people who have gone beyond the traditional lawn in Lincoln.

## THYME FOR A CHANGE

After Abbey Bettinger had a retaining wall installed in her Lincoln front yard in 2020, she struggled to keep the remaining lawn alive and thriving. "I tried replanting the grass, but I wasn't good at the upkeep," she admitted. "I didn't want to mow it, and I didn't water it as much as I should, so I finally decided to see what else I could do that would be lower-maintenance and more environmentally friendly."

Abbey discussed turf grass alternatives with NSA Sustainable Landscape Specialist Sarah Buckley at an NSA plant sale, and she ultimately decided to give thyme a try. "I loved the purple blooms and the scent," she said. With her parents' help, she prepped the site in late winter and early spring, and then planted 600-plus thyme plugs over an April weekend.

Six months later, she is thrilled with her decision. "I haven't mowed it since it was planted, and I don't intend to," Abbey said in October. "I would definitely recommend thyme as



John Moss' corner lot in Lincoln features hundreds of native plants, including little bluestem (*Schizachyrium scoparium*), moonbeam coreopsis (*Coreopsis verticillata* 'Moonbeam') and giant purple hyssop (*Agastache scrophulariifolia*).



Lincoln resident John Moss (pictured in hat) replaced his entire corner-lot lawn with native and well-adapted plants.



Obedient plant (*Physostegia virginiana*) and false sunflower (*Heliopsis helianthoides*) are among the perennials in John Moss' landscape.



an option for anyone who is looking for an alternative to traditional grass. I'm really happy with it so far."

## THE GREAT LAWN EXPERIMENT

Like many landowners, Aldersgate Church has struggled to keep its lawns looking vibrant and lush during Lincoln's hotter, drier summers. After reading last year's "Let's Rethink the Lawn" issue of *The Seed*, Aldersgate Gardens affiliate site curator Steve Schafer decided to experiment with several eco-friendly lawn options that would require less mowing and water and serve as a better food source for pollinators.

Steve planted a dozen experimental plots around the 1.9-acre church grounds, including two types of buffalo grass, a white clover patch, two bee lawns (which combine native flowers and turf grass), two kinds of sedge plantings and several polyculture mixes for both sun and shade.

The experimental plots serve two purposes: to help educate the community about eco-friendly lawn alternatives (the gardens are open to the public) and to allow Aldersgate to test viable options for future lawn replacement projects.

Since 2016, when Aldersgate planted its first NSA Bloom Box, the church has transitioned nearly 75% of its traditional fescue lawn

into beautifully landscaped greenspaces featuring native perennials, grasses, trees and shrubs, a rain garden and a bioswale that captures runoff from the church's roof.

And Steve's not done yet; he's planning to transform another section of turf grass into an eco-friendly greenspace next spring. As for which of the 12 lawn substitutes he'll choose, the jury is still out. "I like them all, and each one serves a unique purpose," he said.

## FROM BORING TO FUN

Back in 2018, John Moss decided he was done with attempting to maintain the 5 x 66-foot strip of turf between his sidewalk and the street. "It was nothing but spurge and weeds, and I was tired of that," he recalled. "So I took a shovel and spade, excavated the top three inches off, rototilled it and then planted a mix of daylilies and natives there."

That was the beginning. Since then, piece by piece, John has replaced every bit of lawn on his corner lot with plantings. Along the way, he learned about new plants to try from NSA Horticulture Program Coordinator Bob Henrickson and by visiting NSA's weekly greenhouse sales during the spring and fall. Today John's

yard is a vibrant pollinator garden filled with hundreds of native and regionally adapted plants.

"So many people think there is nothing they can do in the face of climate change and environmental problems, but this is something I can change," John said. "I can plant. I can dig. This is an avenue for me to do something."

Each morning and evening John walks through his yard, observing, assessing progress and noting what needs to be done. "I see the calamint and the blue hyssop covered in bees," he said. "I see ruby throated hummingbirds zooming in and out. I see swallowtail caterpillars on the fennel. I see that it's working; I see tangible results, and that's exciting."

Neighbors regularly stop to ask John questions about his yard and to get advice from him about how to transform part of their lawns to native plantings.

"Enthusiasm is contagious," said John. "I learn from Bob and other NSA staff, and then I get to share that knowledge with my neighbors."

"Lawns are boring," he added. "This is so much more fun."

**Michelle DeRusha is the Communications Coordinator for the Nebraska Statewide Arboretum.**



Lincoln resident Abbey Bettinger and her parents replaced her front lawn with easily maintained thyme.



Affiliate site curator Steve Schafer is experimenting with 12 different lawn alternatives at Aldersgate Gardens in Lincoln.

# WEATHER WOES FOR WOODY PLANTS

## DAMAGE CAUSED BY EXTREME WEATHER IS COMPOUNDED BY CANKERS

Weather extremes such as those we've been experiencing in recent years can directly impact the health of our trees. Often multiple conditions work in concert with each other and with pests to cause greater damage than any one problem alone. Severe fall freezes, drought and fungal cankers are frequently "partners in crime" in attacks on our Great Plains trees.

### SEVERE FALL FREEZE

For many plants, maximum cold hardiness is normally achieved in mid-winter (January). Unfortunately, extremely cold temperatures can occur much earlier than this, resulting in tree damage.

Moderate freezes with temperatures dipping into the 20s or teens (°F) are often of little concern. However, when temperatures drop to single digits or below in fall or early winter — October, November or December — tree health can be impacted.

Symptoms of fall freeze damage often do not develop until warm temperatures arrive. Frozen needles on conifers, for example, remain green while the weather is cold, but turn brown during an extended winter thaw or as spring warming begins. Buds killed by an untimely fall freeze fail to open in spring. Twigs or branches may be damaged or completely killed.

A closer look at these branch symptoms, however, often reveals an accomplice to the severe freeze: canker diseases. Cankers are characterized by discrete areas of killed tissue on twigs, branches or the trunk, and are typically caused by fungal pathogens. These pathogens infect the tree and take advantage of the freeze-damaged tissues.

Canker fungi often grow and spread easily during winter because the dormant tree tissues are unable to respond to the attack. By spring, the cankers may have expanded enough to effectively girdle the branches. Symptoms include scattered

branches that have failed to leaf out, or if leaf emergence occurs, the foliage ultimately wilts and dies.

### DROUGHT

Cankers are often found in association with drought as well. Drought-damaged tissues are more susceptible to fungal infection and spread. In addition, as drought-stressed trees attempt to limit water loss by shutting down leaf function and dropping leaves, the reduced photosynthetic activity means less energy is available for the production of defensive chemicals that keep canker pathogens and other pests at bay.

Supplemental watering during extended dry periods in summer is important to maximize tree health, but trees can also benefit from fall and winter watering if soils are dry. Roots have little tolerance to extreme cold, and the drier the soil, the more likely soil temperatures will fluctuate, especially if there is no mulch or snow cover. Drought cracks in the soil allow the cold to penetrate even deeper and kill more roots.

*Laurie Stepanek is a Forest Health Specialist for the Nebraska Forest Service.*

### MANAGEMENT TIPS

Here are some tips to help your trees withstand extreme weather.

- Select drought-tolerant trees with a hardiness zone rating suited to your location.
- Avoid fertilizing with nitrogen or pruning trees in late summer. Nitrogen applications and pruning stimulate new growth, which will not have time to properly acclimate before winter.
- Mulch with organic materials such as woodchips or pine needles to conserve moisture and provide some insulation from winter cold.
- Water trees thoroughly during extended hot, dry periods one to two times a week. Water 1 inch deep per week in clay soils; 2 inches in sandy soils. Water during the winter if exposed soils are dry and unfrozen.



Drought and severe freezes can contribute to canker, which causes leaf dieback.



# WEATHERING THE NEXT BIG STORM PLANTING, PRUNING AND TREE CARE TIPS TO IMPROVE YOUR TREES' RESILIENCE

Trees are among the most important elements in a landscape, and they have the potential for a big return on investment (ROI). Properly planted and well-cared-for trees provide myriad benefits, often spread over many decades, including shade and wind protection, energy conservation, wildlife habitat, increased property value, stormwater capture and even food. These benefits have real economic value and can reach into the thousands of dollars over the lifetime of a tree.

On the other hand, it's also important to remember that trees have costs associated with them as well, including purchase and planting costs, the time committed to ongoing care, costs associated with major structural pruning and possibly the cost of their eventual removal when they die.

So how can we get the biggest ROI from our trees while at the same time avoid or reduce big-ticket costs related to storm cleanup or premature removal? And how do we do this in the face of a changing climate, where more heat, drought and intense storms are likely heading our way? Here are some suggestions:

## 1. Start by picking the right tree for the right place.

If we don't get this right, then not much else matters. We're fortunate that there are many species and cultivars well-adapted to our region, climate and,

to some extent, our weather. Visit the resources page on NSA's website — [plantnebraska.org](http://plantnebraska.org) — for a list of native and well-adapted trees.

**2. Buy good nursery stock.** The quality of nursery stock is critically important to the long-term success of a tree. It's especially important to make sure the tree has a high-quality root system, keeping in mind that the roots are just as important as the top.

## 3. Think about the placement of your trees and especially consider planting trees closer together.

Remember that trees evolved growing tightly together in forests and in association with other plants that helped create tree-friendly soils. Trees planted in tightly spaced groups are more resistant to strong winds and storm damage.

**4. Plant properly!** It's critically important to plant a tree at the right depth and to deal with circling or pot-bound roots at planting time. Add a 2-3" layer of mulch and prepare to water as necessary for the first year or two. Visit the resources page on NSA's website — [plantnebraska.org](http://plantnebraska.org) — and scroll down to the "Instructions for How to Plant a Tree" PDF in the trees section for a detailed diagram.

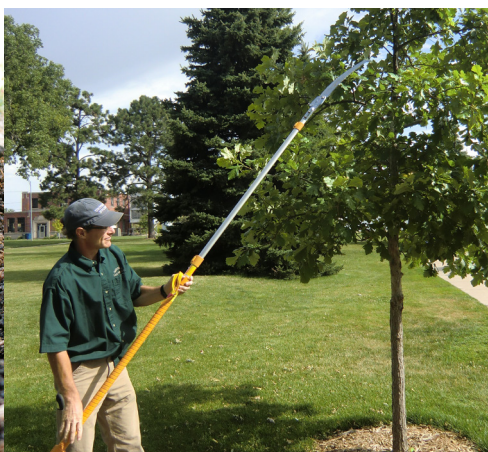
**5. Protect trees from damaging lawncare practices.** Injury from lawncare practices — including mowers or trimmers hitting trunks,

herbicide drift damage, compacted soils, and water-logged soils from automatic irrigation systems — is one of the biggest causes of tree death and decline in planted landscapes. Trees weakened by injury are less able to withstand extreme weather.

**6. Don't keep trees constantly moist.** Trees in irrigated landscapes that are kept consistently moist will be less drought tolerant if the water is ever shut off in a drought emergency. It's generally better to establish trees using irrigation as a supplement to drought rather than as the daily norm.

**7. Prune properly.** Help trees attain good branching structure (if they need it). Some of the worst storm damage in trees relates to poor structure, where branches are ripped out of the tree at weak branch attachments. Certain species, including maples, hackberry and elms, are especially prone to poor structure and will almost certainly benefit from fairly aggressive pruning when young to develop better structure. Conversely, over-pruning or poor pruning can also lead to tree decline and/or more storm damage. This topic is not easy to convey in a simple paragraph, so don't hesitate to consult with a professional arborist to get good advice and assistance.

*Justin Everton is the Green Infrastructure Coordinator for the Nebraska Statewide Arboretum.*



Planting trees at the proper depth along with pruning and staking can help to prevent storm-related tree damage.

# GOOD SOIL

## ONE OF THE MOST IMPORTANT ELEMENTS OF A HEALTHY ECOSYSTEM IS RIGHT UNDER OUR FEET

Although soil is perhaps the most important factor in growing healthy plants, it may be the least appreciated or understood. Good soil is a highly functioning, dynamic ecosystem with a diverse, intricate mix of minerals, organic matter and a range of flora, fauna and fungi. The healthier the soil, the greater its capacity to recover, adapt and remain productive for us and our plants in the face of increasing climate change.

### SOIL PROVIDES ESSENTIAL SERVICES

The complex soil food web is versatile and adaptable and includes microorganisms (bacteria, protozoa and fungi), earthworms, beetles, pillbugs, ants, and many, many more, all of which work in harmony to provide the following essential services that help to grow thriving, attractive and productive plants.

#### **Organic matter processing.**

Each soil organism helps to break down organic matter on top of or in the soil, improving its physical and chemical properties. Processing organic residues into accessible nutrients, called nutrient cycling, is crucial; without it, life as we know it would not be possible.

#### **Symbiotic relationships.**

Specialized bacteria and fungi form mutually beneficial relationships with plants. For example, Rhizobia bacteria enable legumes to collect nitrogen from the air. Mycorrhizae fungi attach to roots to create extensive systems of filaments that increase the plant's ability to absorb water and nutrients, boosting its tolerance of environmental stress.

#### **Water and air infiltration**

**and storage.** The movement of creatures through the soil creates channels for air and water to flow.

**Pest control.** Biodiverse soil helps to keep a wide range of pest organisms in check. Pesticides reduce the number of beneficial organisms, not just the intended target pest.

**Soil stabilization.** The process of breaking down organic matter creates highly stable humus, which then binds soil particles together into aggregates or clumps. This improves soil structure, making the soil more resistant to erosion. Humus also buffers the soil pH, helping to maintain an ideal range for plant growth.

**Carbon storage.** Humus is highly stable and can sequester carbon for decades.

### TAKE STEPS TO IMPROVE YOUR SOIL

If you don't have good soil already, you can take steps to improve it. Even if diversity of organisms is currently limited, they are likely already present or nearby and ready to move in. Their populations will increase rapidly with favorable conditions.

**Increase organic matter.** Incorporate compost and/or plant residues into the soil, which will help to improve soil structure and water-holding capacity (see the sidebar for composting tips).

**Mulch with organic materials.** As mulch breaks down, it filters into the soil, moderates moisture and temperature and reduces compaction from foot traffic and heavy rain.

**Water properly.** Soil organisms thrive in damp, but not soggy, conditions. Over-irrigating can be harmful to many beneficial organisms.

**Limit pesticides.** Pesticide applications often have negative impacts on beneficial organisms and the natural balance; it's best to let nature take its course.

**Limit tillage.** Excessive tilling can devastate beneficial fungal networks and soil structure.

**Avoid compaction.** Compaction, whether from vehicles, mowers, people or the family pooch, limits root growth, increases runoff and reduces the soil's ability to provide air and water. It's especially important to stay off the soil when wet.

#### **Add native plants, which have deep, extensive root systems.**

New roots grow each year, helping to break up tough soil. Old roots die off, providing organic matter as well as additional channels for air and water infiltration.

Soil really is a miracle of nature, a complex web of self-sustaining interaction. By putting in the time and effort to nurture and sustain it, you'll be rewarded with beautiful, productive, resilient landscapes, as well as the satisfaction of knowing you are contributing to a healthier environment.

*Kendall Weyers is the Sustainable Communities Coordinator for the Nebraska Statewide Arboretum.*



A healthy ecosystem starts with good soil (photo credit: Marcus Spiske).





## COMPOSTING 101

If you have an abundance of leaves, garden residue or kitchen waste, consider composting. Here are some tips:

**Use what you have.** Any plant material can go into compost. Aim for a 1:1 ratio of high carbon "browns" (dry leaves, wood chips, straw) and high nitrogen "greens" (kitchen and garden scraps, grass clippings, coffee grounds), all slightly damp. Warm weather speeds up the process while cold weather slows or stops it.

**Share with your neighbor.** If you're short on browns or greens or have too much, share with or borrow from your neighbor. Your local coffee shop might even donate their grounds. Also, store leaves to mix with your kitchen scraps all year round.

**Compost where you can.** Purchase a tidy, pre-made bin or make your own DIY structure from pallets, blocks or whatever is available. Even a pile in the corner of your yard works.

**Let the critters help out.** The army of workers your compost attracts depends on the components and conditions of your mix. High volume, fresh mixes with plenty of nitrogen and appropriate moisture will get hot from bacterial activity. Smaller, older and high carbon mixes will be cooler with larger critters, like pillbugs, doing most of the work.

**Give it a sniff.** Properly maintained compost does not create unpleasant aromas. A sopping wet pile of grass clippings can stink (anaerobic bacteria), while a damp, balanced mix of "browns" and "greens" will not.

**Work hard or not.** Composting works whether you are ambitious or not. While precise mixing and frequent turning speeds up the process, compost will happen, albeit more slowly, if you don't do much to it.





# ADVANCEMENTS IN URBAN FORESTRY

## TREES ARE AN IMPORTANT COMPONENT OF CLIMATE MITIGATION IN CITIES

Here in Nebraska, the home of Arbor Day, we come by our urban forests honestly. Rather than cutting down forests to make room for neighborhoods and businesses, we plant trees as our communities grow.

Trees offer innumerable benefits to cities and to the people and creatures that inhabit them. They improve air quality, lower average temperatures, encourage us to spend more time and money in business districts, increase property values and reduce our stress levels. They also provide habitat and food for birds, pollinating insects and other wildlife.

In short, as the world's population continues to urbanize, we will become increasingly dependent on green infrastructure to improve city life. Recognizing this fact and acting on it is the only way to ensure that society will be able to maximize the benefits that trees offer.

### FUNDING FOR URBAN FORESTRY

To say that 2023 was a monumental year for urban forestry would be an understatement. The Biden administration made history with a \$1.5 billion investment in urban forestry, which will foster community engagement, enable the planting of millions of urban trees and expand maintenance and monitoring of those trees to ensure their success. One hundred percent of these funds will benefit disadvantaged communities most impacted by climate change, pollution and environmental hazards, ensuring a more equitable distribution of the benefits offered by trees.

The Nebraska Statewide Arboretum will receive \$10 million of these funds and will serve as a "pass through" administrator by creating competitive sub-award programs under our current granting structure over the next five years (visit [plantnebraska.org/ucf-grants](http://plantnebraska.org/ucf-grants) for more information).

This year also brought the 2nd World Forum on Urban Forests to Washington,

D.C., a five-day conference organized by the Food and Agriculture Organization of the United Nations in partnership with USDA Forest Service and the Arbor Day Foundation. More than 1,000 urban forest advocates from 60 countries convened to hear case studies, learn about the latest research and technological advancements and grow their networks of support.

### STRIVING FOR 3-30-300

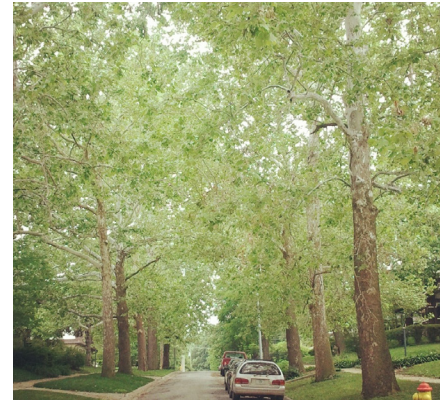
One of the World Forum's key organizers and presenters, Cecil Konjinendijk with the Nature Based Solutions Institute, continues his leadership in urban forestry with his 3-30-300 challenge. This goal encourages communities to strive for three trees for every home, 30% overall tree canopy in each community and for every citizen to live within 300 meters (three to four blocks) of a public park or green space.

This goal provides an evidence-based blueprint for success, ensuring that urban forests are pervasive, evenly distributed and resilient components of cities in the fight to mitigate climate change and improve city life.

Communities in Nebraska are already working toward the 3-30-300 goal. For example, West Point curates an ongoing community tree inventory. Lincoln offers "2 for Trees," a program that allows water customers to add \$2 to their bill to help support tree planting in the city. Bellevue's Green Team is doing tremendous work to reduce the impact of climate change.

These are just three examples of many, but the truth is, supporting community forestry is a long-term effort that will rely on the passion and action of future generations. You or someone you know might be the budding environmental advocate the world needs.

**Graham Herbst is the Eastern Nebraska Community Forester for the Nebraska Forest Service and the Nebraska Statewide Arboretum.**



Sycamores (*Platanus occidentalis*) line a street in Omaha's Bemis Park neighborhood.



Native plants contribute to the green infrastructure in Alliance.



The greenspace at Union Plaza in Lincoln features native plants and trees.





The Nebraska Statewide Arboretum is experimenting with dozens of tree species at locations around the state.

# TRIALING TREES FOR THE FUTURE

Trees are on the move. As greenhouse gas emissions continue to push temperatures higher, research conducted by the U.S. Forest Service indicates that plant hardiness zones are slowly shifting northward. This means that in just a few decades, some species that previously thrived in drier, hotter climates like Oklahoma or Texas might find a home in Nebraska and other Midwest states.

NSA Green Infrastructure Coordinator Justin Evertson and NSA Horticulture Program Coordinator Bob Henrickson are ahead of the curve when it comes to planning for and planting trees that will have the resilience to survive in Nebraska's increasingly challenging environment. Since 2014 they've been trialing dozens of tree species across the state and collecting data on which species have what it takes to thrive in extreme drought, cold and heat.

## RESEARCHING RESILIENCE

Tree trials at Prairie Pines Nature Preserve in Lincoln were originally initiated to research trees that could replace species commonly used in shelterbelts and conservation plantings — like Scotch pine, Austrian pine and ash — that had begun to die off from disease and insect infestation. Between 2014 and 2018, 50 species were planted in six plots, with new species added each year.

As the trees have demonstrated resilience and climate adaptability over the years, Evertson and Henrickson are thinking several of the species trialed, particularly those in the oak and hickory families, would also do well planted as street trees and in yards.

"There is a genetic toughness there that makes these species well-suited for climate adaptability," said Evertson. The trees in the trials were watered and mulched the first year they were planted, but once established, they were not fussed over.

"And yet," added Evertson, "they have thrived through some extremely wet years and some amazingly dry years, through the coldest temperatures we've ever had in February, and through the hottest, driest conditions we've seen in years."

## PLAYING THE LONG GAME

NSA is also partnering with the Nebraska Forest Service to conduct additional tree trials. Between 2014 and 2016, 635 trees (27 different species) were planted in 17 trial sites through a program called Environmentally Adapted Trees, funded by the U.S. Forest Service. Last year an additional 335 trees and shrubs from 12 species were planted at 18 trial sites through the Urban Tree Improvement Program, which is a cooperative effort with other Great Plains states to expand the palette of climate-adapted trees.

NSA provided all the trees for the trials, most of which were grown from seeds collected by Henrickson.

Of course, just because a tree can survive in a new environment doesn't mean it should be grown there. The callery pear is a good example. Once planted prolifically in eastern Nebraska, it's now considered invasive. It's also important to consider whether a species will support the

environment ecologically by benefitting pollinators and other wildlife.

"We are learning what works here, and then ideally we can partner with nurseries to get some of the more successful options into the pipeline and available for distribution," said Evertson. "It's really about the long game. This is slow work that's taking place over many years."

**Michelle DeRusha is the communications coordinator for the Nebraska Statewide Arboretum.**



Texas red oak (*Quercus buckleyi*) is one of the oak species being trialed at Prairie Pines in Lincoln.



Jack oak (*Quercus x jackiana*) is a hybrid between white oak and swamp white oak.



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