Appendix A

Introduction to the Como Woodland Outdoor Classroom

POST 1

Installing the timber staircase.
Photo: City of Saint Paul

LEARN ABOUT NATURAL AND CULTURAL HISTORY AS YOU EXPLORE EIGHT MINNESOTA PLANT COMMUNITIES, ALL WITHIN A 17.5-ACRE SITE.

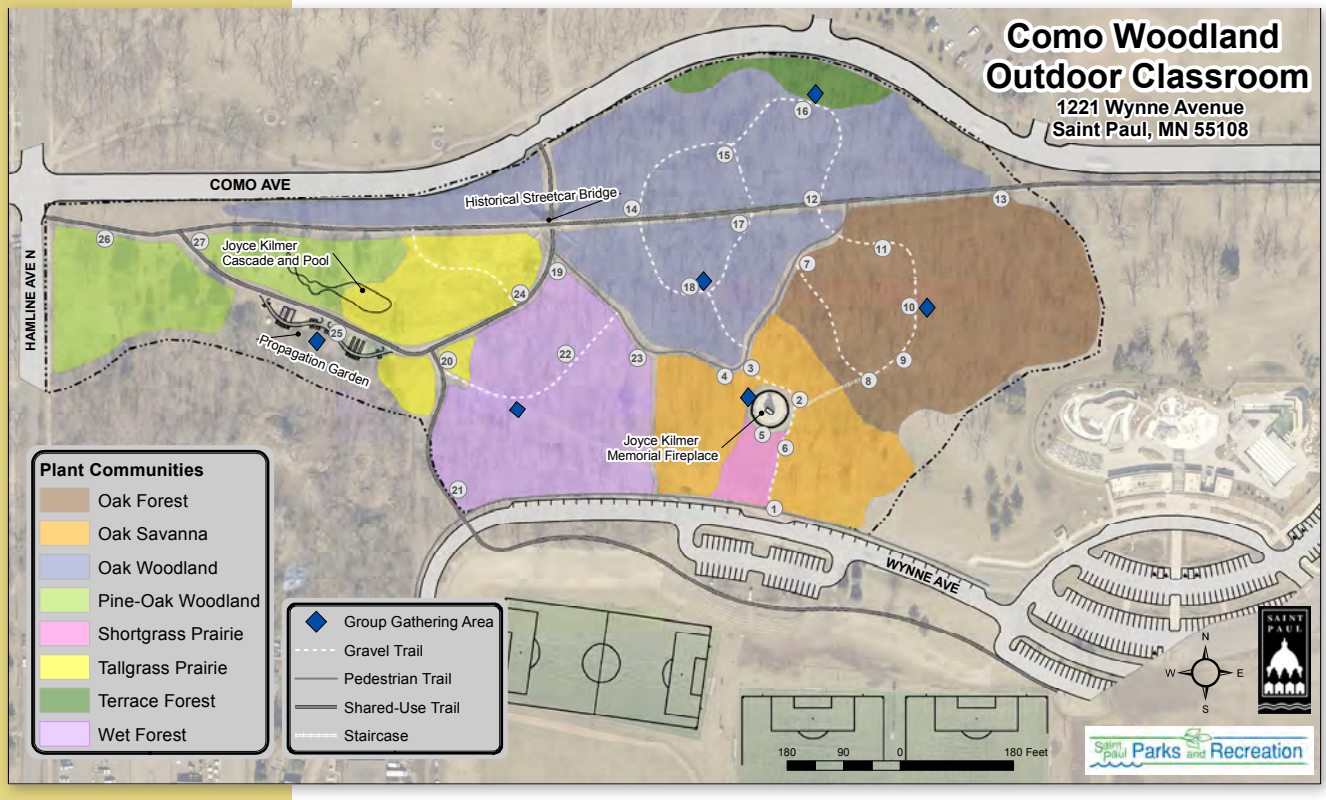
Welcome to the Como Woodland Outdoor Classroom! The Classroom was established in 2008 to provide a destination for students and others to study the natural world in an urban environment.

FEATURES OF THE CLASSROOM

Twenty-seven interpretive posts in the Classroom provide cultural and natural history for this 17.5-acre site within Como Regional Park. Other features in the Classroom include the Joyce Kilmer Memorial Fireplace, remnants of the Joyce Kilmer Cascade and Pool, a propagation garden, and accessible paved and gravel trails. Nearby features of Como Park include a zoo and conservatory, lake, swimming pool, and picnic grounds.

WHAT HAPPENED HERE BEFORE THE CLASSROOM WAS ESTABLISHED?

This land was home to Native Americans since the end of the last ice age — more than 10,000 years



Japanese garden near the Como Conservatory.
Photo: Jonathan Pellgen / CC BY-NC-ND

POST 1

ago. For generations, the Dakota and Ojibwe utilized natural resources from the area as they passed through. In an 1837 treaty, the land passed from the Dakota to the United States, and by the late 1840s, settlers and farmers had arrived. In 1873, it became a part of Saint Paul's Como Regional Park.

The Classroom and the adjacent areas have been used for a variety of purposes. For over 70 years, workhouse inmates toiled and passed their sentences in a building just east of here. Following the building's demolition, a public pool was built on that site. The southwest corner of the parcel has been home to a plant nursery and maintenance buildings. Playing fields were installed for recreational sports. Wooded areas became an arboretum, bird sanctuary, and now an outdoor classroom.

A VISION FOR EDUCATION AND RESTORATION

Community members, including students, were instrumental in the development of the Classroom in partnership with Saint Paul Parks and Recreation. The Como Woodland Advisory Committee community group created a vision for the space, advocated for establishment of natural areas and restoration of historical features, secured funding, and helped with hands-on habitat restoration. Thanks to generous funding from the Metropolitan Council's allotment from the Legacy Amendment's Parks and Trails Fund and the Environment and Natural Resources Trust Fund, restoration of the Joyce Kilmer Memorial Fireplace and initial installation of trails and native plant communities were completed by 2014.

During the development of the Classroom, land managers identified eight plant communities found in this region of Minnesota that could be replicated at the site. Ongoing efforts of Parks staff and community and student volunteers will be required for maintenance and the continued development of the Classroom's plant communities to provide a high-quality site for learning.

Youth learning about the water cycle at the Classroom.
Photo: City of Saint Paul

Volunteers helped restore the Joyce Kilmer Memorial Fireplace.
Photo: City of Saint Paul

Oak Savanna

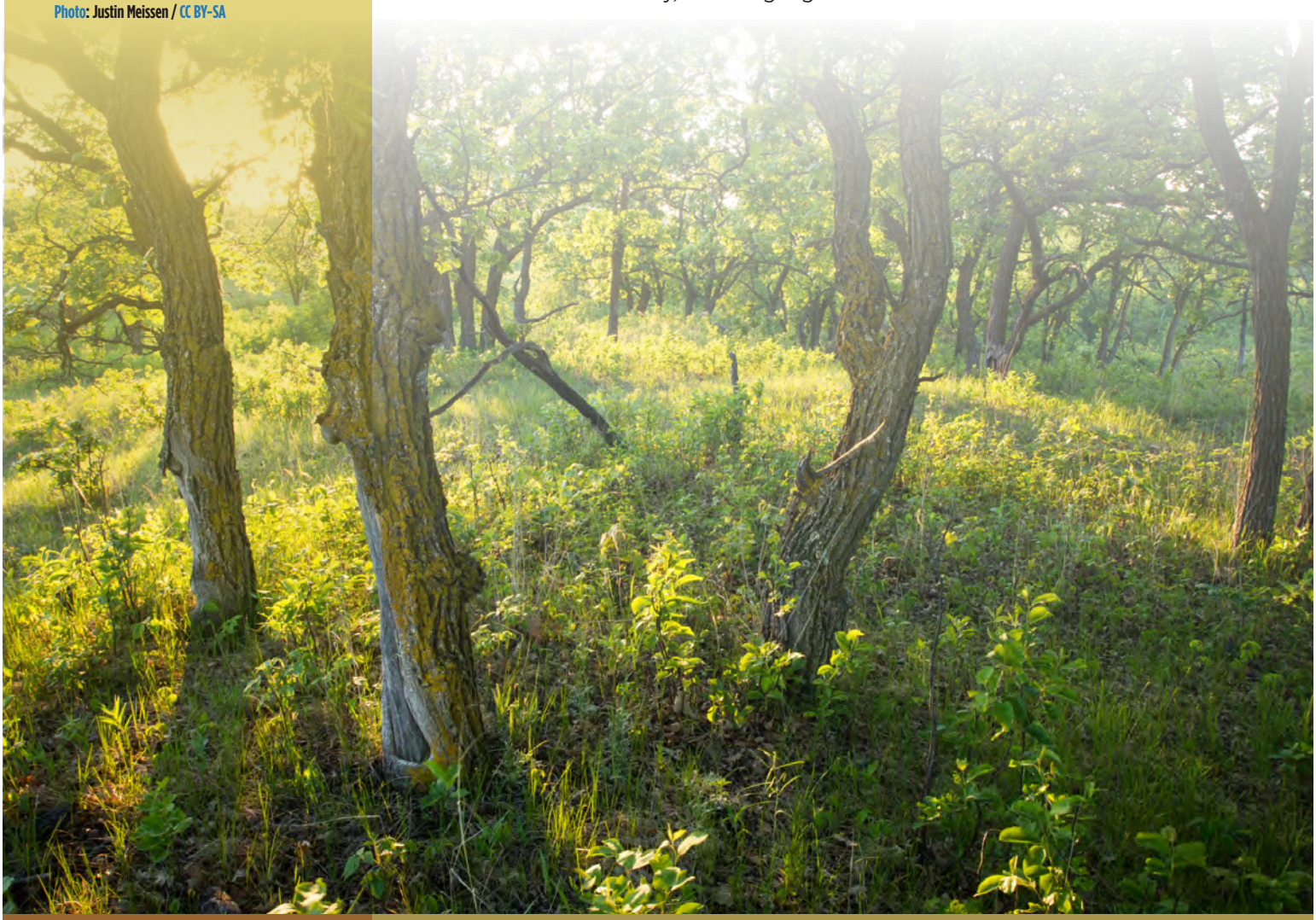
POST 2

TALL GRASSES AND SHRUBS DOMINATE THE GROUND LAYER OF THIS COMMUNITY UNDER A SCATTERING OF TREES.

WHAT MAKES AN OAK SAVANNA UNIQUE?

Oak savanna plant communities are characterized by bur oak trees with an understory of prairie grasses and **forbs** (wildflowers). Unlike in an oak woodland, the trees here are spaced out far enough for sun-loving prairie plants to still grow. Tall prairie grasses dominate the understory, including big bluestem, Indiangrass, and Canada wild rye. Forbs are an important component of the plant community, covering 5-50% of the ground. Common forbs such as heart-leaved alexanders, purple prairie clover, and goldenrods add a splash of color, as well as food for **pollinators**.

The frequency and intensity of fire, along with other factors, affect the ability of trees to become established



Note the similarities between the oak savanna pictured here and your surrounding landscape. How many similarities can you find?
Photo: Justin Meissen / CC BY-SA

Mature bur oaks have thick bark with deep ridges.
Photo: South Dakota Department of Agriculture

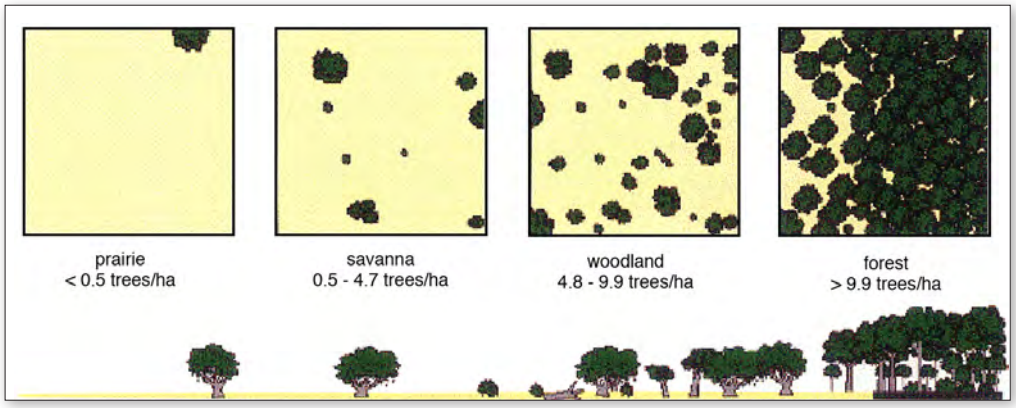
POST 2

in the landscape. Oak savannas exist naturally where fire occurs often enough to prevent trees from dominating the landscape, but are not so frequent or intense that trees cannot survive. Historically, this ecosystem only occurred where there was a barrier to slow down prairie fires such as water or topography, thus allowing scattered, small oaks to become established. More frequent fires would push this plant community to a tallgrass prairie ecosystem, nearly eliminating the tree **canopy** altogether. Fewer fires would transition the same site to a more heavily-treed oak woodland or shady oak forest.

At the time of settlement, oak savannas covered about 50 million acres in the Midwest. Most oak savannas have been converted into cropland, leaving only about 30,000 acres remaining, or only 0.06 percent of the original land area. Unfortunately, most of the remaining oak savanna is severely degraded due to **invasive species** and a lack of land management.

Fun fact:

Bur oaks have adaptations that allow them to thrive in fire-dependent plant communities such as oak savannas. How? Bur oaks have thick bark that insulates the cambium from the high temperatures produced by fires. The cambium is located just under the bark and is the growth layer of the tree. If the cambium is damaged, the tree is unable to add new cells and will die. Young trees are more susceptible to intense fires since they have not yet produced the thick bark of adult trees. Once bur oaks reach 12 to 15 years old, they are rarely damaged by fire and are quite resilient.



Fire frequency influences the tree density of a plant community. Prairie has more fire and few trees. Forests have little fire and many trees.
Credit: USGS

Joyce Kilmer Arboretum

POST 3

THE ARBORETUM CONTAINED PATHS, A RUSTIC ENTRANCE GATE, A LARGE STONE FIREPLACE, AND A LIMESTONE-LINED CASCADE AND POOL.

In 1935, park superintendent W. LaMont Kaufman identified the area around this post as suitable for the development of an arboretum given its fine trees, rolling hills and valleys, and natural lagoon. He designed a fireplace and a limestone-lined cascade and pool. Kaufman noted that this wooded area, "located in the heart of the city, should be of great scenic and educational value to all nature groups and lovers of wild life." He planned to plant and label all of the family groups of plants, trees, and shrubs native to this part of Minnesota.

HONORING A WAR HERO AND POET

In 1935, when construction in the arboretum was already underway, Kaufman approached the Joyce Kilmer Post of the American Legion, of which he was a charter member, to ask for funds for its development. The patriotic veterans' organization obliged.

The Kilmer Post was named after poet Alfred Joyce Kilmer, who died while serving in France in 1918 during World War I. He wrote the well-known poem

W. LaMont Kaufman (left) and Fred Truax, Parks Commissioner (right) at Joyce Kilmer Fireplace, 1936. Their initials can be seen at the top of the fireplace. Photo: City of Saint Paul

W. LaMont Kaufman at fireplace entrance gate, circa 1936.
Photo: City of Saint Paul

POST 3

"Trees" in 1913, which begins, "I think that I shall never see/a poem lovely as a tree." Kaufman, who also fought and was injured in the war, was fond of quoting "Trees" in his work. He had the poem engraved on a wooden plaque that was hung from an oak tree near the fireplace.

Works Progress Administration crews completed construction of the fireplace and the limestone cascade and pool in 1936. The fireplace design incorporated an old three-arched drinking fountain from the nearby streetcar station and stones from a home on Summit Avenue. Many conifers were planted around the cascade and pool. The conifers planted during this effort are now a part of the Classroom that represents the pine-oak woodland plant community.

FALLING INTO DISREPAIR

Over the decades, the arboretum fell into disrepair. The area's remoteness attracted vagrants, vandals, and dirt-bikers. The arboretum became more secluded when streetcars stopped running through in 1953, and even further secluded when sections of Como and Beulah Lane were removed in 1985.

In the years that followed, the cascade stopped running and became completely overgrown. The fireplace, nicknamed the "Dutch Ovens" by locals, sat covered in graffiti and crumbling inside a low chain-link fence. The arboretum became overrun by buckthorn and other invasive plants.

In 2003, community volunteers began to clean up the park and explore the idea of an outdoor classroom. Today, thanks to these efforts, many Arboretum features were restored and the Como Woodland Outdoor Classroom welcomes visitors to learn about native plant communities.

Trees

BY JOYCE KILMER

I think that I shall never see
A poem lovely as a tree.

A tree whose hungry mouth is prest
Against the earth's sweet flowing breast;

A tree that looks at God all day,
And lifts her leafy arms to pray;

A tree that may in Summer wear
A nest of robins in her hair;

Upon whose bosom snow has lain;
Who intimately lives with rain.

Poems are made by fools like me,
But only God can make a tree.

Joyce Kilmer Cascade and Pool, 1936.
W. LaMont Kaufman, second from right.
Photo: City of Saint Paul

Fire as a Management Tool

POST 4

THE NOTORIOUSLY DESTRUCTIVE FORCE THAT CAN HELP NATURE THRIVE.

Five out of the eight plant communities in the Classroom depend on fire to function properly as ecosystems. From this location you can see the oak savanna and the shortgrass prairie, two of the fire-dependent communities. Many of the native plant species found in these plant communities have evolved with fire. Native perennial prairie plants have deep root systems and dormant buds that live below the soil surface. This allows them to recover following fires and rebound after drought, outcompeting less fire-tolerant species.

Saint Paul Natural Resources staff performing a prescribed fire.
Photo: City of Saint Paul

A HISTORY OF USING FIRE

Throughout history, humans have used fire to shape the landscape. In the past, fires were sparked by lightning or intentionally set by Native Americans. These fires had many benefits. The heat from the flames killed small, woody plants and kept prairies and woodlands open for hunting. Fire was also used to remove vegetation and prepare the land for farming. Native Americans used fire to maintain different ecosystems, fostering healthy habitats for the wildlife they hunted and the native plants they collected and used.

In the present day, **prescribed fires**, also called **controlled burns**, are an important management tool used by natural resources professionals. As with many urban parks, the presence of **invasive species** and other undesirable plants in natural areas of the Classroom is unavoidable. When used properly, fire's effect on undesirable plant populations is easily observed.

POST 4

HOW DOES FIRE HELP MANAGE UNDESIRABLE SPECIES?

Many undesirable species are "cold season" plants. This means that they are able to leaf out earlier in the spring while soil temperatures are still fairly low. Once the growing conditions are suitable for native plants, the weedy species are already thriving, out-competing the native plants for sunshine, water, and nutrients. Natural resources professionals use this knowledge to help time prescribed fires.

There is a short window of time during which many of the weeds and invasive species have emerged while native plants are still dormant below ground. Using prescribed fire as a management tool allows land managers to effectively knock back undesirable plants that have emerged from the ground after they have expended much of their energy reserves. Simultaneously, the newly exposed and ash-darkened earth absorbs the sun's energy — warming the soil, kick-starting and extending the growing season for warm season native plants.

Many plant communities depend on fire to stay healthy. Photo: City of Saint Paul

Shortgrass Prairie

POST 5

A DRY AND FIERY PLANT COMMUNITY THAT IS INHOSPITABLE TO TREES AND SHRUBS.

Shortgrass prairie, as the name suggests, is dominated by short- to mid-height grasses with flowering plants interspersed. The dominant grass species are little bluestem and prairie dropseed. Side-oats grama is also usually present. Shrubs struggle in this environment due to lack of moisture and the frequent presence of fire.

WHY ARE SHORTGRASS PRAIRIES TYPICALLY SO DRY?

Shortgrass prairies grow in well-drained sandy soils or on steep slopes where water runs off readily. This dry habitat often includes exposed patches of bare ground, which usually are not found in tallgrass prairie. Plants living in this ecosystem have special adaptations to survive. As with other prairie ecosystems, most of the **biomass** in a shortgrass prairie is underground in the roots. Long, fibrous roots allow the grasses to obtain moisture when it is available and keep the plant stable in the sandy soil. Small, narrow, or hairy leaves are adaptations of prairie plants that help prevent water loss.

Shortgrass prairie plants often have small, narrow, or hairy leaves allowing them to live in dry conditions. Can you find any plants around you that have this adaptation?
Photo: Tom Samuelson

POST 5

Species Spotlight:

EASTERN BLUEBIRD

Eastern bluebirds (*Sialia sialis*) are often seen nesting and foraging for insects in the Classroom. The male of this species is a vibrant blue color, with a rusty throat, breast, and sides. Females look similar but have duller plumage. Eastern bluebirds hunt for insects in open areas and nest in cavities, laying 3-5 pale blue eggs per clutch. During the 1930s to 1960s, bluebird populations decreased dramatically due to habitat loss and competition from other cavity-nesting birds, including non-native invasive birds such as European starlings and house sparrows. In response, people began to construct artificial bluebird houses to place in parks and homeowners' yards. These efforts, as well as the work of nestbox monitors, the Minnesota Department of Natural Resources, and the Bluebird Recovery Program of Minnesota have led to a rebound in bluebird population size.

Above, bluebird eggs in a nest.
Photo: Sharon Shinomiya

At left, volunteers have maintained bluebird nestboxes in Como Park, including the Classroom, for many years with great success. The shortgrass prairie offers an ideal insect hunting habitat for these ground-foraging birds. Photo republished with permission of The Pantagraph, Bloomington, Ill.

McMurray Field

POST 6

"WHERE IS THE MONEY? I HAVEN'T THE SLIGHTEST IDEA, BUT I HOPE IT DID SOME PEOPLE SOME GOOD."

- WILLIAM MCMURRAY

The 32-acre field to the south of the Classroom has been used for a variety of sports, including baseball, soccer, football, and hockey. For many years, it has also been the site of the Hmong Freedom Celebration, a multi-day sports festival drawing crowds in the tens of thousands from all over the world.

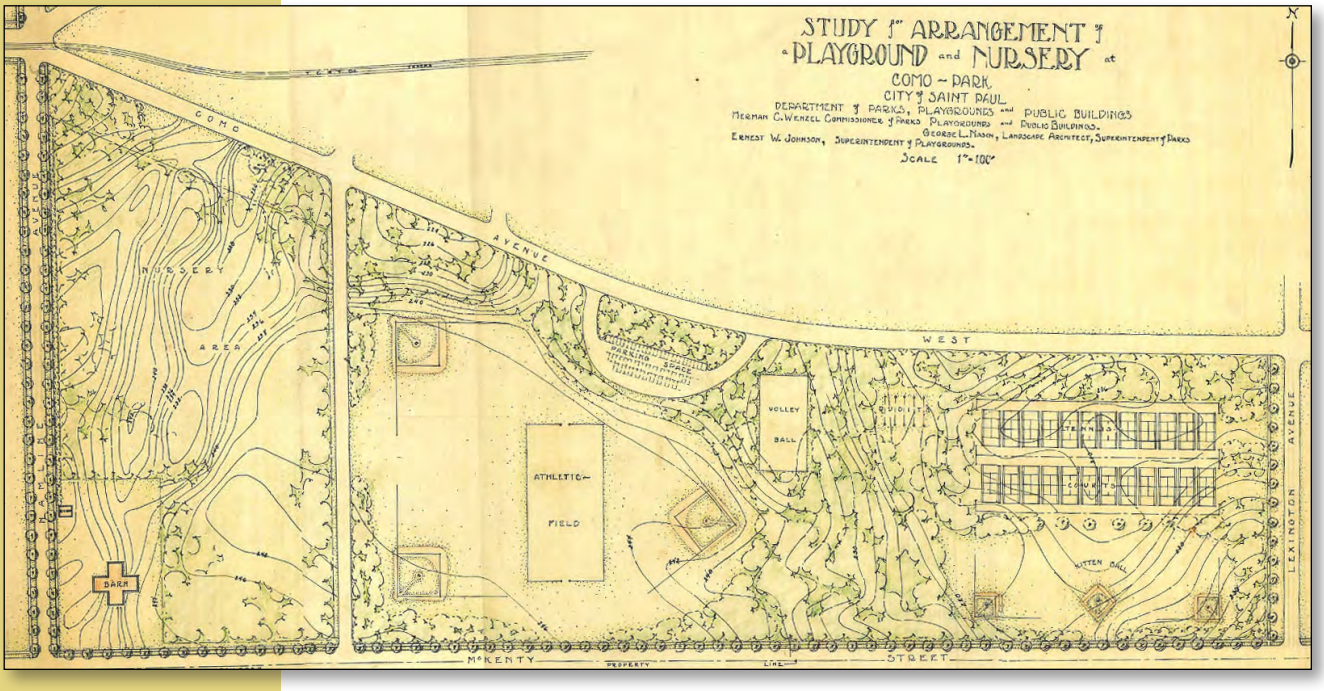
RECOGNIZING POTENTIAL

As early as 1890, the high plateau on the western end of present-day McMurray Field was identified as suitable for playgrounds due to its broad, level land. Plans were made but not implemented due in part to lack of funds and, before 1898, the presence of the workhouse farm.

FINALLY COMING TO FRUITION

In 1924, Como Avenue was cut through the southwest part of the park from Hamline to Lexington. It became the northern border of a two-level field, creating a separation from the workhouse. At the same time, plans were made to develop both levels as playing fields and this time, plans stuck. The field was partially graded in 1925. Further grading was done in 1929, the same year it was named for Saint Paul businessman, William McMurray.

Plan for two-level athletic field, circa 1924. Note the park nursery on the left. Image: City of Saint Paul



Playing flag football at Hmong Freedom Celebration. Photo: Lee Pao Xiong, Director of Center for Hmong Studies, Concordia University

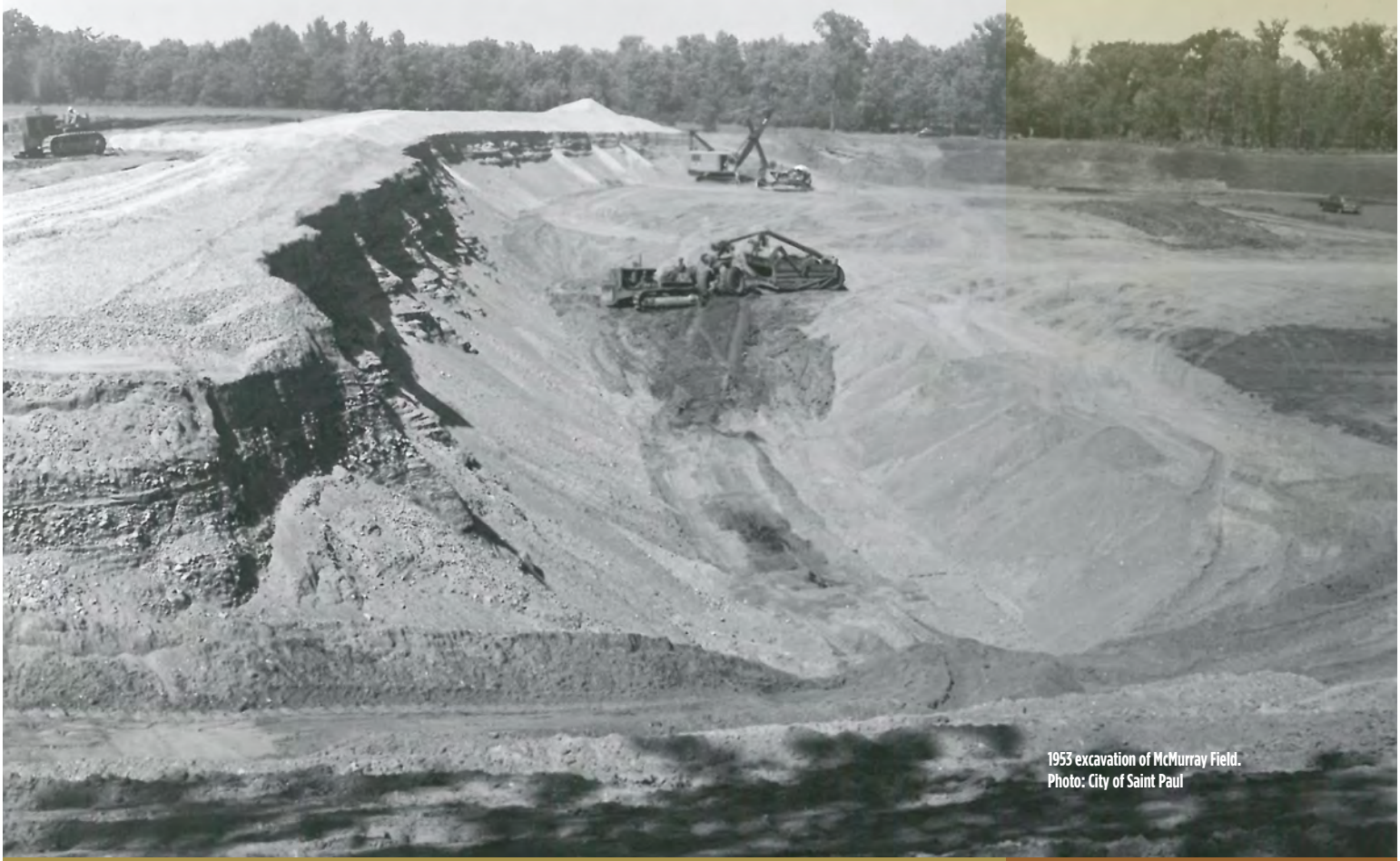
POST 6

Aerial views of the field from the 1940s show several kitten ball (an early version of softball) fields in the lower eastern end, tennis courts in the middle along the southern edge, and a few baseball fields on the western upper end. In 1953, the higher, western end of the field was excavated to create one level. The transition allowed the creation of two badly needed baseball fields.

THE STORY BEHIND THE NAMESAKE

William McMurray was a successful tea merchant and park advisory board member. He was also an extremely generous man, ultimately to the detriment of himself and his company. In 1922, he donated 25 acres of land (bought with borrowed money) to Saint Paul, which became part of Battle Creek Regional Park. By 1944, he'd lost everything but lived quite happily. In an interview with the Pioneer Press, he said "Where is the money? I haven't the slightest idea, but I hope it did some people some good."

The Hmong Freedom Celebration's main draw is soccer but features traditional sports brought from Southeast Asia. Takraw, or kato, is a kick volleyball game involving a rattan ball. Tuj lub, or top spinning, involves knocking down a rapidly spinning, grapefruit-sized top by flinging another top from a distance.



1953 excavation of McMurray Field. Photo: City of Saint Paul

Planting for Species Diversity

POST 7

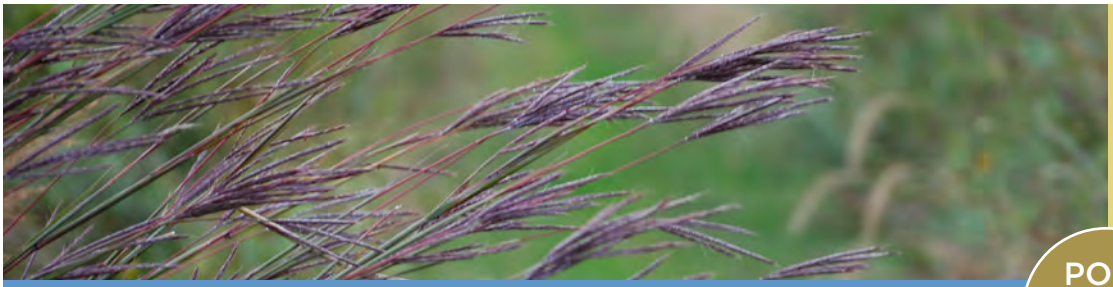
A VARIETY OF ORGANISMS CONTRIBUTE TO HEALTHY, STRONG ECOSYSTEMS.

Species diversity, the variety of living things, is an important measure in an ecosystem. For example, in a healthy forest, there is a variety of trees, shrubs, and wildflowers to support a range of wildlife. In a diverse ecosystem, a disturbance that wipes out a single species is unlikely to be catastrophic because other species can adapt and fill the vacant **niche** (role in the environment). Land managers use this knowledge in planning restoration work, and take care to include a wide array of diverse plant species. This in turn supports species diversity in the rest of the **food web**.

Conversely, a system with low species diversity is vulnerable to disturbance and may collapse. One example of a disturbance is the introduction of a non-native **invasive species**. In the past, Saint Paul and many other communities relied heavily on elms as boulevard trees. The vast majority of these trees died after Dutch elm disease (DED) was introduced from Europe in the 1960s. Ghostly white elm **snags** may be found in the Classroom; they were likely victims of this fungal disease. Saint Paul had to replant many of its boulevard trees, but again relied heavily on few species, especially green ash. Another non-native invasive species, the emerald ash borer (EAB), was first detected in 2009 and is expected to kill a majority of the ash trees across the city. To guard against a future threat to the urban tree **canopy**, Saint Paul's forestry unit is replanting with a wider variety of tree species.

Even ecosystems with high species diversity can be threatened by invasive species. Other threats to diversity include habitat loss, pollution, and climate change. Some plants and animals will be unable to adapt to climate change quickly enough, and will be lost.

A red fox caught on a Saint Paul Natural Resources trail camera in the Classroom. Photo: City of Saint Paul



Big bluestem.
Photo: Ellen Macdonald / CC BY-NC-ND

POST 7

FOOD CHAINS AND WEBS

Healthy ecosystems support many **food chains**, the connections between a food source and its consumer. The chain starts with **producers**, organisms that can create their own food, which are generally photosynthetic plants. **Consumers** make up the next few links in the food chain. They are generally animals and can be herbivores, carnivores, or omnivores. Food chains do not end with a top predator; the **decomposers** (bacteria and fungi) and **detritivores** (such as earthworms and snails) recycle nutrients to the soil, and in turn, to the producers.

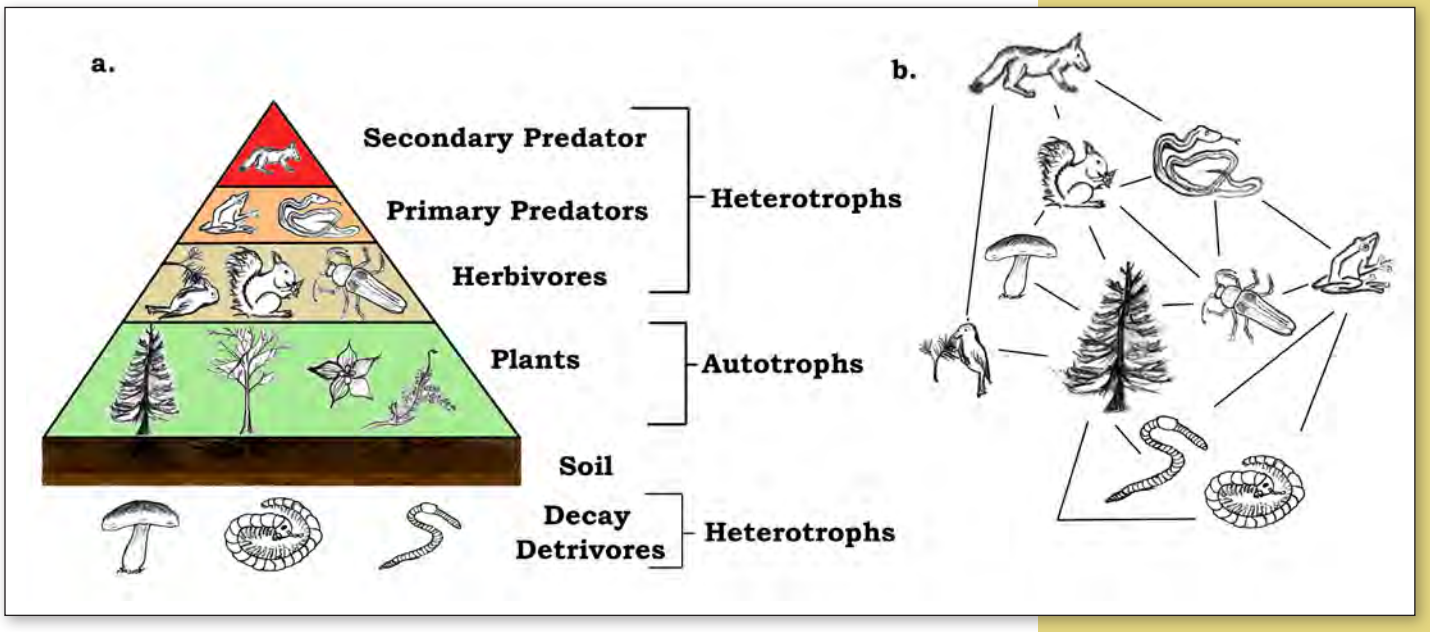
Let's follow one simple food chain in the Como Woodland Outdoor Classroom. In the tallgrass prairie, herbivorous rodents called voles eat the leaves of big bluestem. The vole is hunted and eaten by a carnivorous red fox and her kits. When the fox eventually dies, decomposers break down her body and return the nutrients to the soil. These nutrients are then used by big bluestem.

Food chains seem very straightforward, but interactions in an ecosystem are usually much more complex. Often these interactions are better described by a food web, which is a series of interacting food chains. In the previous example of big bluestem, the vole, and the fox, many more interactions are occurring. In the bigger picture, big bluestem leaves are eaten by caterpillars, grasshoppers, and katydids. Voles are also eaten by great horned owls, and foxes eat many more species than just voles.

Fun Fact:

In 2009, the United States Forest Service planted Dutch elm disease-resistant elms in the Classroom's oak forest.

Examples of a trophic pyramid (a) and ecological food web (b).
Image: Mark David Thompson / CC BY



Citizen Science

POST 8

ANYONE CAN CONTRIBUTE TO SCIENCE!

People have long recorded the timing of flower blooms, bird migrations, and other plant and animal life cycles. This has been valuable information for cultivating or gathering food. For example, some people who hunt for morel mushrooms begin looking in the spring when certain flowers bloom or oak leaves are a particular size. These cues are more reliable than using a calendar, because flower bloom and bud burst times shift from year to year.

The study of these life stage changes and when they occur each year is called **phenology**. Over millennia, many species have adapted so that their life cycles are synchronized with other species and with seasonal events such as spring flooding. This synchronization allows species to rely on one another for critical survival needs such as seed dispersal and pollination. With the climate changing more rapidly than in the past, some life cycles are becoming out of sync.

Climate scientists are interested in the long-running phenology records of farmers and other laypeople to understand more about the biological effects of climate change. In fact, scientists in many fields recognize the value of these **citizen scientists**. The efforts of citizen scientists have helped uncover the flight patterns of monarch butterflies and the population numbers of birds.

Students, land managers, and community members have participated in citizen science in the Classroom by recording phenological events, surveying breeding birds, and more. This information contributes to scientific research projects such as Project BudBurst, which is tracking when tree buds leaf out in spring. Citizen science is important for stewardship of the Classroom and is a way that anyone can help the environment.

Murray Middle School students use the classroom for citizen science projects. Photo: Tim Chase

POST 8

Species Spotlight:

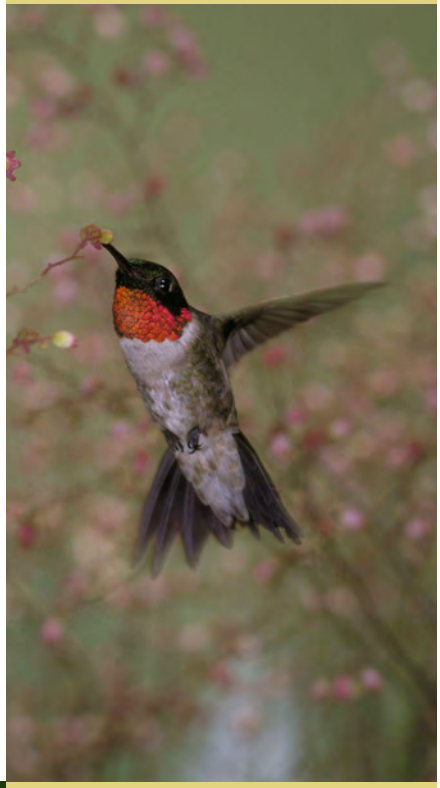
EASTERN RED COLUMBINE AND RUBY-THROATED HUMMINGBIRD

The distinctive red pendulant flower of columbine (*Aquilegia canadensis*) is a favorite woodland flower for many. It was popular enough to be considered for our national wildflower because its five **nectar**-filled spurs resemble bald eagle talons. Columbine's genus name contains the Latin word for "eagle."

It is amazing to think that a tiny hummingbird overwintering in Central America can remember the long journey back to Minnesota. It is equally amazing that its migration is timed with critical crops of nectar along its 3,000-mile journey.

What if blooming times of flowers shift?

Ruby-throated hummingbirds (*Archilochus colubris*), like many **neotropical migrants**, use cues like day length to time their migration. Flowers, however, base their blooming periods on weather and climate. Flowers will bloom several weeks earlier in warm springs and go to seed earlier as well. As the climate changes, so does the timing of seasonal events like bud bursts and insect hatches. While migratory birds use the same cues they've trusted for millennia, could the climate change enough to leave them without a consistent food supply on their migration journey? Fortunately for hummingbirds, red columbine has a relatively long blooming period, leaving the tiny bird some wiggle room in our changing climate.



Ruby-throated hummingbirds time their spring migration with the flowering periods of red columbine.
Photo: USFWS / CC0

Eastern red columbine's color, long tubular flower shape, and abundant dilute nectar make it a favorite flower of ruby-throated hummingbirds.
Photo: Brigitte Werner / CC0

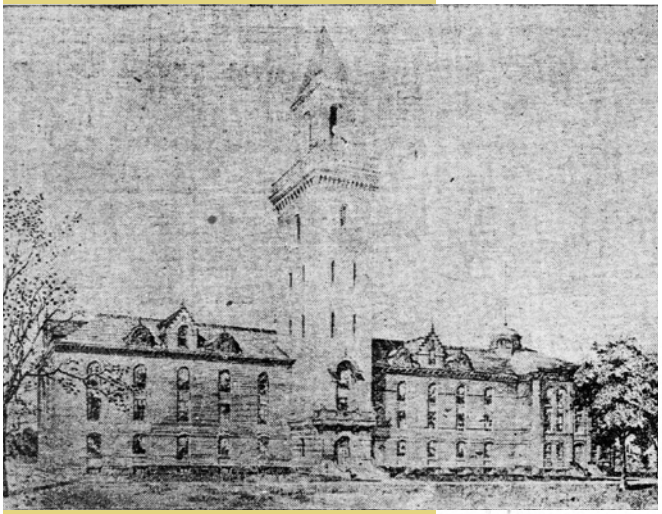
The Workhouse

POST 9

A WORKHOUSE BOARD MEMBER OBSERVED, PERHAPS WITH NO SMALL SATISFACTION, THAT THE WORKHOUSE TOWER "THROWS MEMBERS OF THE PARK BOARD INTO SPASMS EVERY TIME THEY LOOK AT IT."

THE ESTABLISHMENT OF THE WORKHOUSE

In 1881, when the development of Como Park was delayed by economic conditions and before a park board was in place to protect park interests, Saint Paul granted 40 acres of parkland to the workhouse board for the construction of a new workhouse on land east of the Classroom. Locating a workhouse on unused parkland on the rural outskirts of the city seemed a prudent idea at the time.



The red brick three-story building opened in 1883 with 30 cells. Its first occupant, David Hoar, a repeat offender described as "a good-natured unfortunate whose appetite has proved his ruin," was admitted on January 3, sentenced to ten days for drunkenness. Most workhouse inmates were first-time offenders convicted of drunkenness, vagrancy, larceny, or disorderly conduct. Workhouse inmates were put to work for sentences that ranged from five days to a year, with shorter sentences being much more common. The primary purpose of the workhouse was to punish convicts through confinement and work, not to offer rehabilitation. The idea of rehabilitation did not come into fashion until the late 1910s and early 1920s, when reforms such as treatment and halfway shelters were instituted.

The workhouse was a self-sustaining institution. Soon after it opened, inmates helped build an on-site residence for the workhouse superintendent and two additions to the already-too-small workhouse. Twenty acres of woodland were promptly cleared for a farm and garden.

Above, the workhouse with its central tower.
Image: St. Paul Globe, Library of Congress

At right, the workhouse in a later year.
Image: Ramsey County Historical Society

POST 9

STRIFE BETWEEN THE PARK BOARD AND THE WORKHOUSE

In 1887, funds finally became available for park development and a park board was established. Almost immediately the park board decried the placement of the workhouse in the park and called for its removal. Though park board president J. A. Wheelock praised the workhouse in 1895 as "exceptionally well managed" and an important factor in the work of park improvements from 1883-1894, he described workhouse inmates as "not the best kind of labor."

Despite repeated, vehement cries for the workhouse's removal, the city couldn't afford to move it elsewhere. While the workhouse was "temporarily" located in the park, the park board wanted to at least hide its "uncouth and forbidding aspect" behind trees.

In 1898, the park board asserted its authority and took possession of 24.5 acres of workhouse grounds consisting of most of the farm fields. When the workhouse board took the matter to court, the court decided that one city board could not sue another. The park board control of the land was maintained. They began to plant trees.

In 1903, the workhouse added a 150-foot tower to the front of the building. Park superintendent Frederick Nussbaumer declared that the workhouse board, "through an uncontrollable spirit for improvement and electrified by a magic touch of art, built a sentinel ... in the shape of a galvanized spire, proclaiming in silent protest, its unpleasant prominence in the surroundings." The workhouse board replied that the park board had trespassed and spoiled a productive farm, and the tower, while perhaps taller than necessary and architecturally out of proportion, was added for fire safety.

After this, the park board refused to use workhouse labor, calling the benefit of such labor an "old fiction which sought to justify" the workhouse's "illegal location" in the park. William Pitt Murray, a workhouse board member, defended the workhouse in a 1904 article and observed, perhaps with no small satisfaction, that the tower "throws members of the park board into spasms every time they look at it."

NEARING THE END

Economic conditions and world events conspired to keep the workhouse in the park and the rhetoric died down. By 1918, the workhouse was already old and obsolete. Its cells had no running water or toilets, it was too small and cost too much to operate, the building wasn't fireproof (even with the tower), the grounds were too small, and inmates had to walk to work through residential neighborhoods. The building was repeatedly condemned. Each time, makeshift repairs were made to keep it going. Finally in 1960, the "ancient, unloved, and unlovely" old workhouse was torn down after a new facility opened in Maplewood.

Inmates cultivated hay, oats, corn, potatoes, and other vegetables for sale and use in workhouse operations. A broom factory, and knitting, tailor, and shoe shops operated in various years. Female inmates worked in the laundry and made prison garments. Male inmates also labored in the park, clearing brush, grubbing stumps, building fences, thinning out the woods, and making roads. When inmates were not at work, they were confined to their dark cells.

Workhouse cell circa 1950. Note the slop bucket in the corner.
Photo: Minnesota Historical Society

Invasive Species Control

POST 10

INVASIVE SPECIES ARE ONE OF THE GREATEST THREATS TO NATIVE HABITATS, CAUSING MILLIONS OF DOLLARS IN DAMAGE (JUST IN MINNESOTA!) EACH YEAR.

Invasive species are plants, animals, and diseases that are not native to an ecosystem and cause economic, environmental, or human harm. Many invasive species grow and reproduce rapidly, outcompeting native species for resources like sunlight, water, and nesting sites.

The City's Natural Resources staff follows current scientific recommendations for efficient and effective invasive species control, using methods such as **prescribed fire**, cutting, and chemical treatment. Using the wrong strategy to control invasive species can backfire and be detrimental to the native plant community, so City staff thoughtfully coordinates any volunteer efforts. Volunteers lend important muscle in the battle by tackling labor-intensive jobs like hand-pulling plants and hauling brush.

Eradicating or completely eliminating many pervasive invasive species is astronomically expensive. Land managers have to weigh the ecological impacts of invasive species against the economic costs of removal efforts, and often define the final goal as reducing invasive species populations to a point that native species flourish.

Below and on the next page are overviews of two invasive species that are threats to the Classroom:

Invasive Species Spotlight: COMMON BUCKTHORN

Imported from Europe in the mid-1800s, the buckthorn shrub has had a devastating impact on Minnesota forests. Common buckthorn (*Rhamnus cathartica*) was heavily planted as hedgerows and wildlife habitat for over 100 years — even here in Como Park. Nurseries stopped selling buckthorn in the 1930s after its invasive characteristics became obvious. Buckthorn seeds are widely dispersed by birds that eat the berries. The unripe berries contain **emodin**, which acts as a laxative, causing the birds and mammals to excrete the seeds intact before digestion destroys the seed.

Fortunately, Saint Paul Natural Resources and a coalition of neighbors and school groups have made impressive gains in the battle with buckthorn in the Classroom since

Compare the constricting effect of buckthorn on the bur oak crown (left), to the wide branching pattern of a bur oak growing free of buckthorn competition (right). Photos: Josh Leonard

POST 10

2005. Even so, buckthorn can still be found growing in the Classroom today, and buckthorn removal will be an ongoing effort. Effective methods of buckthorn control include removing the whole plant including the roots, cutting and applying herbicide to the stump, or prescribed burning in the first year of growth.

Invasive Species Spotlight: EMERALD ASH BORER

The emerald ash borer (*Agrilus planipennis*), also known as EAB, is an insect that originated in Asia and likely arrived in the United States on wooden packing material shipped from Asia. It was first discovered in 2002 near Detroit, Michigan. In recent years, Michigan and other states have suffered widespread ash tree deaths numbering in the millions due to this insect. Adult beetles cause little harm to trees; it is the **larvae** that cause major destruction. EAB larvae live beneath the bark of ash trees and feed on the plant tissues that trees use to transport sugars (**phloem**), move water and nutrients (**xylem**), and create new plant tissues (**cambium**). The larvae effectively **girdle** the tree by creating vast feeding **galleries** in the phloem that cut off the tree's nutrient transportation.

The first confirmed EAB-infested ash tree in Minnesota was discovered in the South Saint Anthony Park neighborhood of Saint Paul in May 2009. Saint Paul Natural Resources is working collaboratively with local, state, and federal agencies on efforts to mitigate the effects of this destructive pest, and use a variety of strategies including the preemptive removal of ash trees on Saint Paul's boulevards. Other efforts to control EAB include using biological control – releasing natural predators to control pests. Scientists have released two species of non-stinging wasps that target EAB larva.

Stingless wasps are being used to fight emerald ash borer. Photo: David Cappaert, Michigan State University, Bugwood.org / CC BY-NC

Emerald ash borer galleries found under the bark of a green ash tree. Photo: City of Saint Paul

Oak Forest

POST 11

A DENSE CANOPY OF DECIDUOUS TREES SHADES THE PLANTS BELOW AND HELPS RETAIN MOISTURE.

The oak forest plant community is typically found on the upper slopes or crests of bluffs, and has a dense **canopy** of **deciduous** trees like red and white oak and basswood. Oak forests differ from oak woodlands in several ways. Oak forests are not fire-dependent systems, and historically experienced fire less frequently. Forests tend to have a more continuous tree canopy and more nutrients and moisture in the soil than woodlands.

The oak forest understory often includes young black cherry trees, which are easily identified by their bark. The bark is reddish-brown with short, gray horizontal lines called **lenticels**. These allow for air exchange between the tree and the atmosphere. Mature black cherry trees have dark, scaly bark that looks like burnt potato chips. The thick understory of the oak forest provides good cover for burrowing animals like red and gray foxes, chipmunks, and woodchucks to make their dens.

The thick understory of the oak forest provides good cover for burrowing animals like chipmunks and foxes. Photo: J. Jongsma / CC BY-SA

Look at your surroundings and see if you can identify young and old black cherry trees. Distinct lenticels can be seen on young cherry trees (left), and scaly bark characterizes more mature specimens (right). Photo at left: Peter Dzuik, Minnesota Wildflowers Photo at right: MONGO / CC0

Invasive species such as garlic mustard have a field day on disturbed ground.
Photo: Hans Braxmeier / CC0

POST 11

This oak forest plant community is situated on an area of disturbed soil due to the historic presence of the workhouse nearby. At the turn of the 20th century, the Parks department shielded the workhouse from view using fill and trees, including the non-native invasive black locust tree. Attempting to remove certain non-native invasive plant species such as black locust trees can actually encourage more vigorous growth. Land managers are monitoring black locust trees, and future plans may involve their removal.

HOW WILL CLIMATE CHANGE IMPACT INVASIVE AND NATIVE PLANTS?

Climate change is making Minnesota warmer and wetter, with more severe precipitation events. Prolonged droughts are predicted. The distribution of some plants and animals are shifting, and some plants, such as aspen, are dying. Leaving some invasive trees in the Classroom, such as black locust, will allow students to study how **invasive species** and other native species are responding to a changing climate.

Many animals live under the canopy of the oak forest including foxes, chipmunks, and woodchucks. See if you can spot their burrows!
Photo: © MNDNR

Seed Collection and Dispersal

POST 12

THEY CAN FLY, FLOAT, OR HITCHHIKE. SEEDS HAVE FANCY WAYS TO GO PLACES.

Most parents want their children to stay nearby, but plants want their seeds to travel. Seeds that land under a parent plant may be too shaded to grow or will have to compete with the parent plant for water and nutrients. Since plants lack locomotion, they may use wind, water, or animals to disperse their seeds far and wide.

Even with all these methods, native plants sometimes need a helping hand. Land managers enhance the plant communities in the Classroom by collecting seeds from areas of abundance and dispersing them in areas where native plant populations need a boost. When invasive species are removed from an area, they may easily rebound from existing seeds in the soil. Spreading native seeds can be an effective way to introduce competition and keep invasive species at bay.

EXPLOSIONS AND COURIERS

Jewelweed, or touch-me-not, is a fascinating plant found in the Classroom that uses a ballistic mechanism to launch its seeds. Its seedpods explode when touched, allowing seeds to travel far from the parent plant. This plant has orange flowers with five petals that are fused together to form a hood, and is found in moist woodland soils.

Other plants use animals to spread their seeds. One example is the **symbiotic** relationship between squirrels and oak trees. Most people know that squirrels bury acorns for

Jewelweed's unique exploding seedpods spread their seeds near and far.
Photo: Benny Mazul / CC BY

POST 12

winter and often forget where they bury them, resulting in the forgotten acorns growing into oak trees. But few people know that squirrels usually eat white oak acorns immediately, but store red oak acorns for later.

Why do squirrels eat white oak acorns in the fall and store red oak acorns for the spring? White oak acorns **germinate** soon after they fall from the tree – so squirrels better use them or lose them. White oak acorns are also lower in bitter **tannins**, which makes them tastier. Red oak acorns fall in the autumn but don't germinate until the following spring – they can be more effectively stored. Though they have more bitter tannins, they are concentrated at the bottom of the acorn, making the top is more palatable. When squirrels eat red oak acorns, they often eat the tops and discard the bottoms. This is beneficial for the oak tree, since the acorn's embryo is located in this bitter area of the acorn. After squirrels discard the bottom of the acorn, the acorn still has a chance to germinate. Research suggests that red oak acorns are more effectively dispersed by squirrels than white oak acorns.

History Highlight: Henry David Thoreau, author of natural history and environmental literature, wrote in his journals, "Touch-me-not vessels, as all know, go off like pistols on the slightest touch, and so suddenly and energetically that they always startle you, though you are expecting it. They shoot their seed like shot. They even explode in my hat as I am bringing them home."

Above top, red oak acorns.
Photo: Jane Shelby Richardson / CC BY

Above bottom, white oak acorns.
Photo: Janet Tarbox / CC BY-NC

Squirrels are common in parks and woodlands, but they have a surprisingly intricate relationship with the oak trees upon which they depend.
Photo: PublicDomainPictures / CC0

Como Park

POST 13

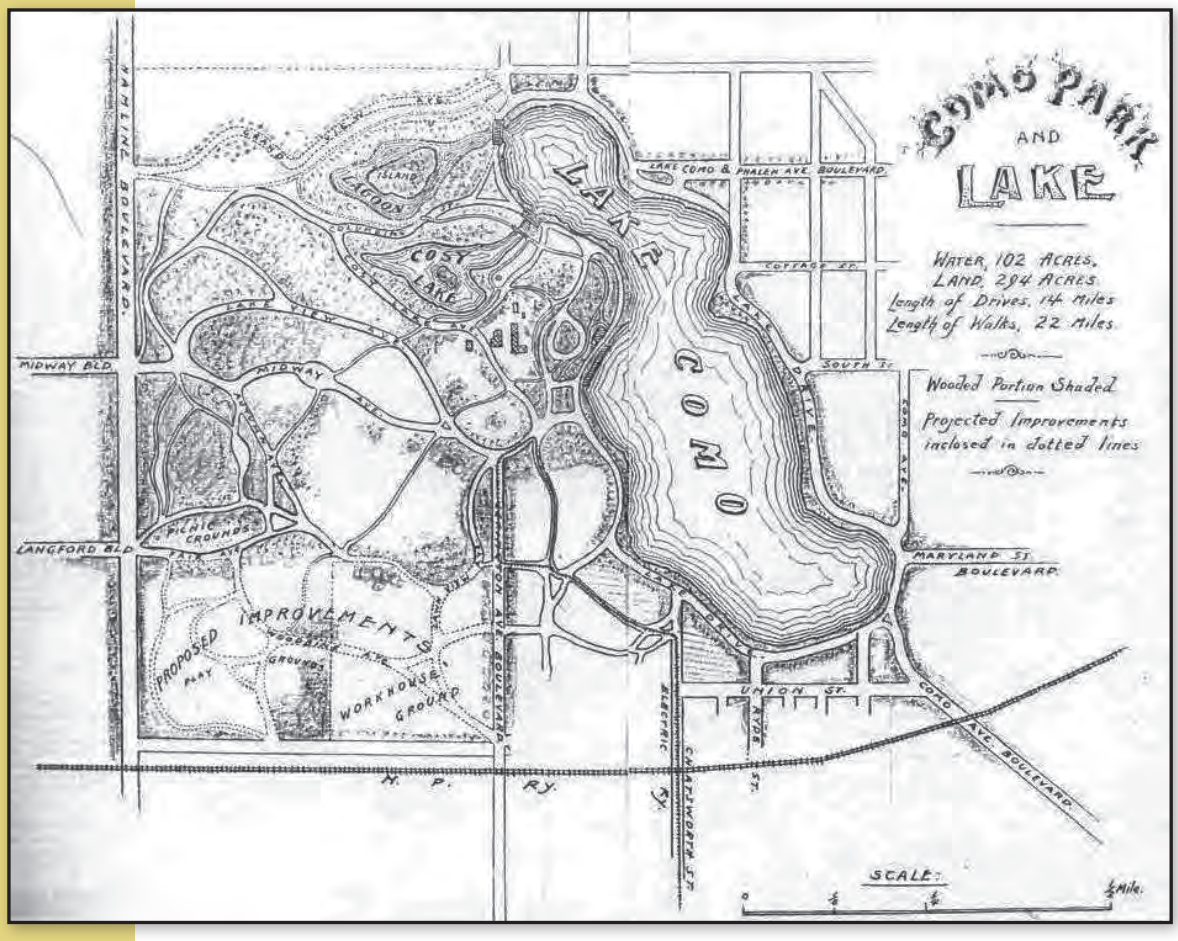
EARLY EFFORTS TO SET ASIDE PARKLAND AND LATER INVESTMENTS MADE COMO PARK WHAT IT IS TODAY.

Como Lakeside Pavilion.
Photo: Steve Sundberg / CC BY-NC-ND

HOW WAS COMO PARK ESTABLISHED?

In the 1870s, the well-respected landscape architect Horace W. S. Cleveland urged growing cities to set aside land for public parks before land prices skyrocketed. Large parks were considered desirable assets for the health and enjoyment of urban dwellers. At the City of Saint Paul's request, Cleveland identified many natural features in Saint Paul worthy of preservation as parkland, including the land around Como Lake.

An 1872 bond issue of $100,000 allowed Saint Paul to purchase nearly 260 acres of land near Como Lake for a major public park. The City bought 40 acres of land from Frank E. Clark, 193.55 acres from William R. Marshall, and 26.4 acres from William B. Aldrich (who owned a hotel at the lake).



A park plan from a 1889–1890 park board annual report.
Photo: City of Saint Paul

Como Lake.
Photo: MJI Photos / CC BY-NC-ND

POST 13

After its purchase, an economic downturn caused the park to lay dormant for 14 years. Some called for its sale, but the City held onto the parcel. By 1887, funds were finally available. A park board was created, and Cleveland was hired to design Saint Paul's parks and parkways. Cleveland envisioned a landscape park that brought out the "innate grandeur and beauty" of the natural features within it. He designed curving roads to bring carriages past points of beauty. Over the next few years, implementation of his grand plans began.

The bulk of construction and layout of the park was completed during Frederick Nussbaumer's 30-year superintendency (1891–1922). Nussbaumer embraced the popular idea that parks should offer playgrounds for organized, active recreation as well as natural beauty. In addition to many ornamental features, such as floral display gardens, lily and lotus ponds, a Japanese garden, and a spectacular glass-domed conservatory, ball fields and tennis courts were added.

HARD TIMES FOR COMO PARK

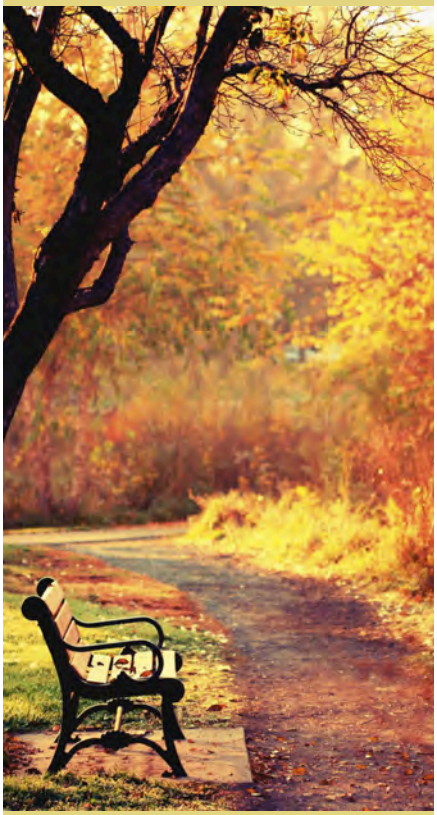
W. LaMont Kaufman served as park superintendent for 33 years (1932–1965). He held the park together through the Great Depression and World War II, and the periods of insufficient budgets afterwards. He used makeshift methods to keep the conservatory from falling into total disrepair, opposing those who deemed it an unnecessary "luxury." During the war, he and the zookeeper would take their own cars to collect food from stores and hotels for the zoo animals.

City officials recommended closing the zoo in 1955, but a citizen's volunteer committee fought to keep it open.

As the park system and demand for services grew, funds often did not keep pace. World events and economic downturns limited further development and high-maintenance features were removed or faded away. Vandalism became a problem. The long period of stagnation and decline began to slowly and steadily improve after the completion of a master plan for the zoo in the mid–1970s and a Como Park Master Plan in 1981.

COMO PARK TODAY

The period following the creation of the master plans has been one of improvement and renewal. Many roads have been removed to reduce traffic congestion and add green space. With more funds available through private donations, federal sources, and two state constitutional amendments, many of the neglected ornamental features have been restored or rebuilt. Considerable improvements have been made throughout the park, including shoreline restoration, major upgrades to zoo and conservatory exhibits, and significant new building projects.



Path along Como Lake.
Photo: Sharyn Morrow / CC BY-NC-ND

Early Settlement

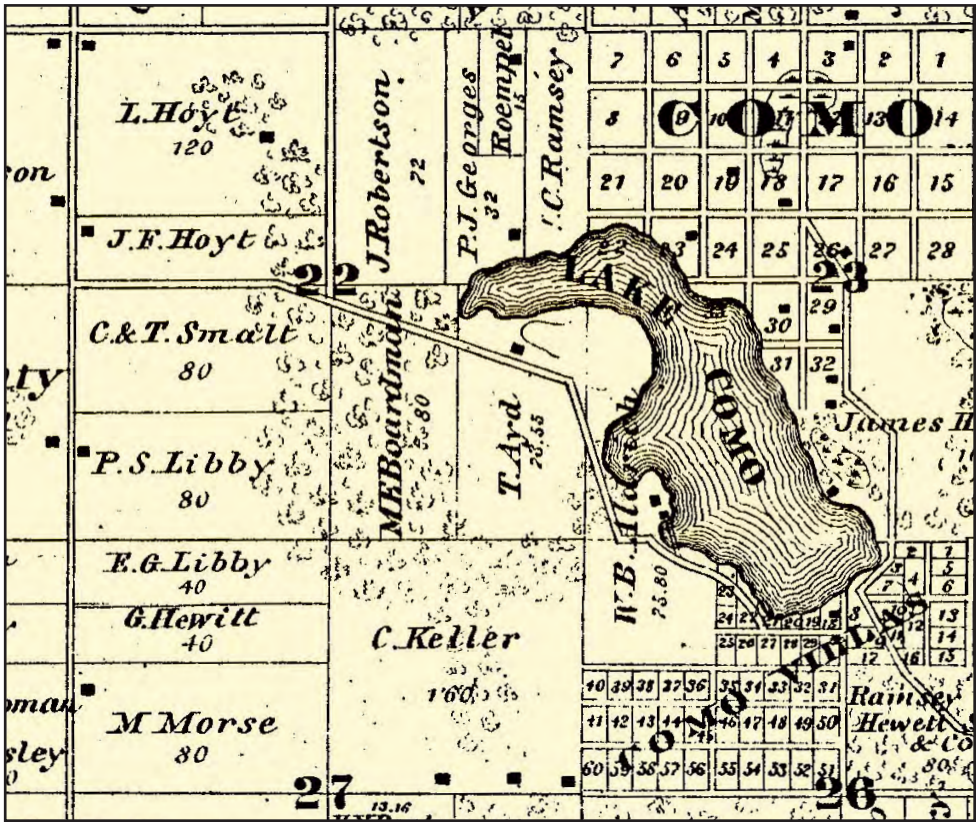
POST 14

WHEN THE TREATY OF 1837 STRIPPED THE DAKOTA OF THEIR LANDS EAST OF THE MISSISSIPPI, INCLUDING THE COMO LAKE AREA, FARMERS, LOGGERS, AND LAND SPECULATORS BEGAN TO POUR INTO THE AREA.

Early settlers and speculators began to claim land in the area around Como Lake in the late 1840s. It was common for land to be rapidly bought and sold at this time, and the land that is now the Classroom changed hands multiple times before Christopher Keller bought it in 1852. Keller and his wife, Anna, emigrated from Germany in 1845 with their six children. The family first settled in Wisconsin and later moved to Saint Paul.

FROM PRAIRIE TO FARMLAND

About a month before Christopher's death in January 1868, the land was split into four 40-acre sections, with ownership transferred to four of their children. The northwest 40 acres (where the Classroom is now located) went to their son John. According to 1870 population and agricultural censuses, John Keller and his wife Gertrude lived with their three



1867 Rose Township map showing Como Lake and Christopher Keller's 160 acres.
Image: L.G. Bennett, *Atlas of Ramsey County*, 1867

POST 14

children, a domestic servant, and six other children with the last name Keller. They had a total of 80 acres of land, 20 of which were woodland. They had a horse, five cows, eight oxen, five cattle, and ten swine; they raised barley, spring wheat, oats, potatoes, and corn; and made butter and hay.

FROM FARMLAND TO PARKLAND

While the Kellers and other families in the area were farming, Henry "Broad Acres" McKenty, a high-flying real estate dealer, came to Saint Paul. He arrived in 1851 and began to buy and sell land in the area, part of a speculative boom. He laid out several plats on the east side of Como Lake and in 1857 built a road from Saint Paul to his resort community. An economic downturn that same year ruined him, but the lake became home to at least three hotels after the Civil War.

Saint Paul's city limits were creeping ever closer by the 1870s. Farming in the area changed to reflect this reality as the area became more urban than rural. All four of the Keller children sold their land in 1871 and 1872. John and Gertrude Keller sold their 40 acres to Frank E. Clark, who sold it in 1873 to the City of Saint Paul to be included in the 260-acre Como Park.

Aldrich's Hotel on Como Lake, circa 1870.
Photo: Minnesota Historical Society

Conservation of Decaying Wood

POST 15

SNAGS AND LOGS ARE THE APARTMENT BUILDINGS OF THE FOREST! HOME, SWEET HOME.

WHY ARE DEAD TREES LEFT IN THE CLASSROOM?

One way land managers act as stewards of the land is by leaving dead trees, also known as **snags**, standing. Each snag supports a plethora of life. Underneath peeling bark, insect **galleries** can be found, which are channels carved out by beetle **larvae** as they feed on the inside of the tree.

Small emergence holes may also be seen where the adult beetles exited the tree after their larval stage. Most larval insects that feed under the bark of trees are not detrimental to the overall health of the tree. The larvae of the invasive emerald ash borer beetle (see post 10) are an exception since they kill live ash trees. Other holes seen in snags may be evidence of woodpeckers feeding on insects inside the dead tree.

If a human hit her head against a tree with the same force as a woodpecker, she would surely die. Woodpeckers avoid brain injuries through adaptations like sharp bills, strong neck muscles, and spongy skull bones. Photo: Bob Dunlap

Species Spotlight: HAIRY WOODPECKER

One black-and-white woodpecker that is often seen foraging in the Como Woodland Outdoor Classroom is the hairy woodpecker (*Leuconotopicus villosus*). Males of this species sport red feathers on the backs of their heads, but otherwise look similar to females. Hairy woodpeckers use their beaks to drill into wood and catch insects with their long tongues.

These woodpeckers also use their beaks to excavate their nests in snags. The nest opening is usually about 2 inches tall and 1-1/2 inches wide, and the internal cavity is eight to twelve inches deep. Similarly sized nesting holes are made by downy and red-bellied woodpeckers. If larger, oval-shaped holes are found, they were probably made by the pileated woodpecker, the largest woodpecker in Minnesota.

Decomposing fallen trees.
Photo: Joshua Mayer / CC BY-SA

POST 15

Eventually, snags fall down and become logs on the woodland floor. Logs are broken down by **decomposers** and become soil. This process plays an important role in the ecosystem, recycling nutrients such as carbon back into the soil and air.

The initial decomposer of woody plant matter is fungi. Fungi are not plants since they do not photosynthesize. **Hyphae** are the white, underground filaments that make up the main structure of a fungus. Mushrooms seen growing on the forest floor are actually the fruiting bodies of fungus. As hyphae gain a foothold into a log, this allows bacteria and beetle **larvae** to gain access and break down the log further. Fungi feed on woody material, which turn into the soft tissues of the fungi's mushrooms.

Species Spotlight:
BLUE-SPOTTED SALAMANDER

Logs offer shelter to a variety of animals, including blue-spotted salamanders (*Ambystoma laterale*). Blue-spotted salamanders are quite common in moist woodlands and forests and often reproduce in seasonal **ephemeral** wetlands. Though fairly common, blue-spotted salamanders are rarely seen since they spend much of their time under logs. These amphibians can be found within the Twin Cities metropolitan area, but are unlikely to be found in the Classroom due to fragmented habitat that prevents them from moving into the area.

Blue-spotted salamanders like moist soils and live under logs.
Photo: Greg Schechter / CC BY

Terrace Forest

POST 16

TERRACE FORESTS HAVE PLANTS ABLE TO SURVIVE THE OCCASIONALLY WATERLOGGED CONDITIONS OF FLOODPLAINS.

Terrace forest plant communities are typically found in southern Minnesota on level or rolling ground above small and large streams. Terrace forests have damp soils, though they only flood in very wet years.

WHAT MAKES TERRACE FORESTS UNIQUE?

Terrace forests share similarities with oak forests, including a fairly dense tree **canopy**. One key difference between the two plant communities is soil moisture. A combination of hydrology and shady canopy allow terrace forests to stay moist. In natural terrace forests, scraping into the surface of the soil may reveal numerous snail shells.

Land snails are detritivores that break down dead material and enrich the soil. Photo: Holger Langmaier / CC0

Terrace forests have damp soils and abundant shade from deciduous trees. Look for ostrich ferns, an indication of moist soil, along this hillside. Photo: © MNDNR

Virginia bluebells (*Mertensia virginica*) grow well in a terrace forest.
Photo: Arthur T. LaBar / CC BY-NC

POST 16

Terrace forests include species such as ostrich ferns, tall coneflowers, prickly ash, and basswood. Terrace forests also typically have woody vines such as wild grape and Virginia creeper. Dense patches of wood nettle may be present.

While fire doesn't disturb terrace forests frequently, floods sometimes do. Plant species that live in these communities must survive underwater for periods of time and avoid being washed away by floodwaters. Ostrich ferns are one example of a species with an **adaptation** to flooding — underground, they grow sideways runners called stolons that spread to grow new plants. This strategy allows them to form large colonies that cling to the soil and protect against erosion during floods.

Terrace forests once lined streams across southern Minnesota, but today there is only a patchwork of these forests left. When settlers arrived, these rich soils beside streams were often the first areas cultivated.

The long, vertical fronds of the ostrich fern (*Matteuccia struthiopteris*) are thought to resemble ostrich feathers.
Photo: NPS / CC0

Tree Canopy Improvement

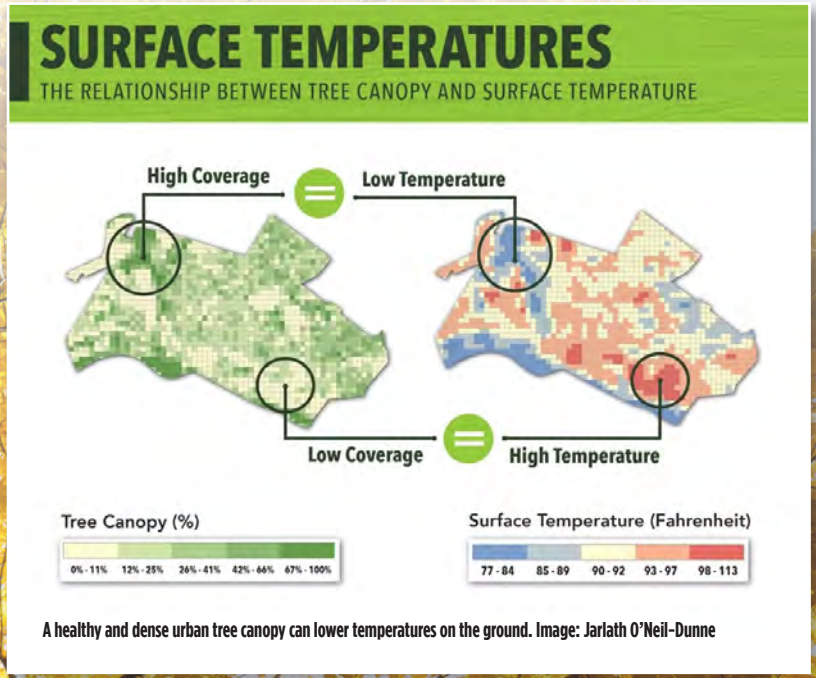
POST 17

THE BEST TIME TO PLANT A TREE IS 20 YEARS AGO.
THE SECOND BEST TIME IS NOW. — PROVERB

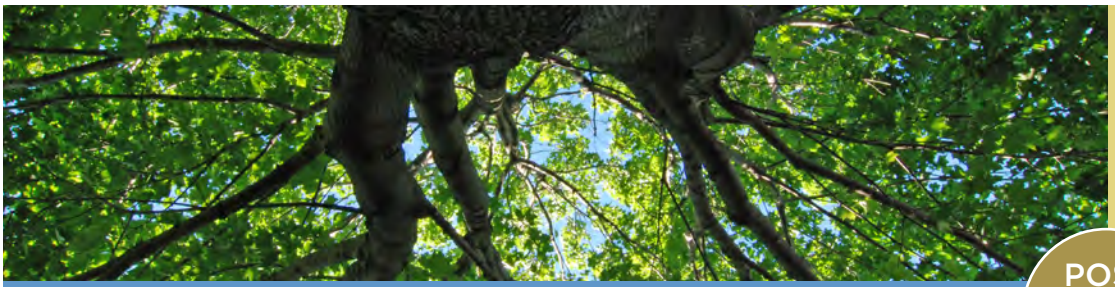
The urban forest provides habitat for wildlife and many benefits to the human community. The tree leaves and branches of the urban forest compose the tree **canopy**. Trees cool the air by casting shade and through **evapotranspiration**. Because buildings, roads, and other infrastructure have replaced vegetation in cities, the tree canopy is less dense than in non-urban forested areas. City rooftops and hard surfaces absorb the sun's energy and release it, creating an "island" of warmer temperatures. As a result, temperatures are higher in cities due to the **urban heat island effect**.

The urban heat island effect has negative effects on the people of Saint Paul. The extra heat increases air pollution, and it makes summer heat waves more intense.

Beyond making oxygen, trees can help people save money, stay healthy, and improve air and water quality. Photo: Michael Janke / CC BY-NC-ND



A healthy and dense urban tree canopy can lower temperatures on the ground. Image: Jarlath O'Neil-Dunne



Maple tree canopy.
Photo: Kent Landerholm / CC BY-NC

POST 17

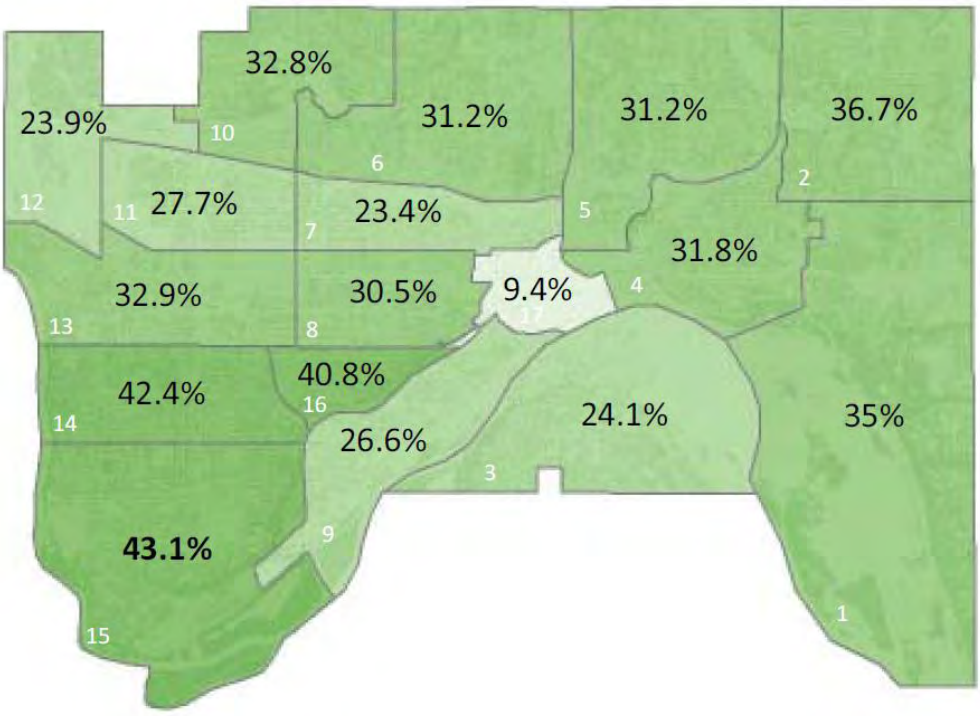
TREES HELP KEEP US HEALTHY

Two key air pollutants that can trigger asthma — ozone and particulate matter — are removed from the air by trees. The larger the tree, the more effective it is at removing air pollution. Another way trees improve human health is by reducing stress levels. Hospital patients who can see trees through their windows recover much faster than patients without these views.

TREES CAN PREVENT WATER POLLUTION

A tree's roots play a role in keeping water clean, too. When it rains, water runs off paved surfaces and carries pollutants through the storm drain system to the nearest body of water. Tree roots can soak up **stormwater**, reducing the amount of **runoff** and preventing pollution from entering lakes and rivers. Tree roots hold the soil and prevent **erosion** as well. Trees are not universally good for water quality, however. Tree leaves that fall on hard surfaces often pass through the storm drain system and enter rivers and lakes. They overload these water bodies with nutrients such as phosphorous, causing algae blooms and other imbalances. Raking leaves off hard surfaces like roads and sidewalks and composting them protects water quality.

Unfortunately, the tree canopy is often unevenly distributed in cities, including in Saint Paul. Research has shown that renters, people of color, and people with low incomes tend to have less canopy cover in their neighborhoods. This inequality has negative consequences on health, finances, environmental quality, and quality of life.



Percent tree canopy by district in Saint Paul, 2011.
Image: City of Saint Paul

Oak Woodland

POST 18

GIVE IT A LITTLE FIRE AND WATCH IT GO!

American hazelnut (*Corylus americana*) can survive moderate-severity fires by resprouting from rhizomes. Photo: USFS Superior National Forest / CC BY

The largest plant community in the Como Woodland Outdoor Classroom is the oak woodland. The tree **canopy** is dominated by bur oak and northern pin oak, and includes shrubs such as chokecherry and American hazelnut. It grows on sandy, dry soils and is dependent on fire to renew itself.

WHY DO THESE WOODLANDS LOOK SO DIFFERENT FROM PRAIRIES AND FORESTS IF THEY GROW ON SIMILAR SOILS?

Differences in vegetation can be explained in large part by the frequency of fire. Prairies burn regularly, and are therefore dominated by grasses and **forbs** with few trees. Prairie grasses have adapted to frequent fire, but trees usually cannot survive intense and frequent prairie fires. Forests rarely burn, and thus have a closed tree canopy. Fire in oak woodlands occurs about every 10 years during droughts or exceptionally dry spring or fall seasons. As a result, woodlands have less canopy cover than forests and drier conditions on the ground.

Rather than being a destructive element, fires in oak woodlands help the plant community regenerate. Plant species in oak woodlands are good at surviving fire and growing on newly burned sites; they can out-compete other plant species that lack these **adaptations**. Many oak woodland plants store energy underground and quickly resprout after a fire. For example, when trunks of bur oaks are killed by fire, the tree resprouts from

Oak woodland is a fire-dependent plant community. See if you can find fire-charred stumps, which are evidence of past fires. Photo: © MNDNR

POST 18

below ground using energy stored in its root system. Additionally, fire can help oak seedlings by periodically clearing away small trees and shrubs to allow more sunlight.

In oak woodlands, some fire-sensitive species such as basswood grow alongside oaks. Without fire, oaks are unable to compete with these species, and maple-basswood forests could **succeed** the oak-dominated landscape. Land managers now use **prescribed fires** to create favorable conditions for oak woodlands and other fire-dependent plant communities to thrive.

History Highlight: Fires started by lightning and by humans have shaped the landscape for the last 10,000 years. Native Americans used low-intensity fires extensively to encourage the growth of nut-bearing trees such as oaks, to improve hunting success, and to clear land for agriculture. Between the 1500s and the 1800s, the Native American population declined approximately 90 percent due to diseases introduced by Europeans and conflict. Migration, change in land ownership, and forced removal shifted Native Americans off their traditional lands. Agricultural fields and other managed lands were abandoned along with the fire practices that maintained them.

While early settlers initially used fire to clear land for crops, once fields were established, plowing prevented trees from creeping in and fire was no longer used. Settlers then actively tried to prevent natural fires from threatening crops, homes, and timber stands. Land that was not converted to cropland or logged soon became closed-canopy plant communities.

Land managers at the City of Saint Paul light prescribed fires to keep oak woodlands healthy. Images: City of Saint Paul

Como-Harriet Streetcar Line

POST 19

IN THE 1920s, TWIN CITY RAPID TRANSIT COMPANY HAD 523 MILES OF TRACK, NO PUBLIC SUBSIDY, AND 200 MILLION PASSENGERS A YEAR.

The Como-Harriet Streetcar Line had a great impact on Como Park with its physical presence in the park, its ability to bring many visitors to the park inexpensively, and the investments in the park made by the private operator of the line, Twin City Rapid Transit Company (TCRT).

Before electric streetcars reached Como Park, park visitors had no convenient, affordable method of public transportation to the park. Horsecar and cable car lines did not extend to the park. An expensive omnibus ran to the lake only three times a week in warm weather.

More efficient electric streetcars replaced horsecars and cable cars as early as 1890 in Saint Paul. When streetcars reached Como Park in 1893, the park became easily accessible to visitors. A ride to the park from downtown Saint Paul took half an hour and cost an affordable five cents. Visitors arrived via a single loop track at a small waiting station near Lexington Parkway and Horton Avenue.

WHAT IMPACT DID THE STREETCAR LINE HAVE ON COMO PARK AND THE CLASSROOM?

In 1898, the park board agreed to allow the streetcar line to be built through the park. Despite their strong misgivings about its negative aesthetic impact, the board determined that the benefits outweighed the disadvantages. The new Como-Harriet line connected the two cities and

Streetcar crossing Beulah Lane bridge in the Classroom.
Photo: City of Saint Paul

POST 19

greatly increased park attendance. More than one million people visited Como Park in 1898, with up to 40,000 in the park at one time.

TCRT agreed to build bridges over road intersections, gave money for the grading of Midway Parkway, and installed electric arc lights in the park. They built a new wooden waiting station and contributed money to expand seating at the lakeside pavilion and build a music float for the nightly concerts they sponsored.

TCRT also agreed to makes its tracks as aesthetically pleasing as possible, with no cuts or embankments, and with masking offered by trees. Bridges such as the Beulah Lane bridge were made into ornamental features of the park. They also built a new stone station. Evidence of these efforts still exists. The stone bridge abutments at Beulah Lane have been incorporated into a reconstructed bridge, part of a bicycle and pedestrian path that follows the route of the former streetcar line through the Classroom. The restored Lexington bridge, footbridge, and station are located northeast of the Classroom.

WHAT HAPPENED TO THE STREETCARS?

Streetcars reached their peak ridership in the 1920s. TCRT then had 523 miles of track, no public subsidy, and 200 million passengers a year. Most lines ran every ten minutes. The increase in automobiles, freeways, and suburbs in the following decades ultimately led to the demise of the streetcar. Buses, which could be operated with greater flexibility, took over the route in Saint Paul in 1953. The Como-Harriet line, the last line in operation, was completely abandoned in 1954 and its tracks were removed from the park four years later.

Eastbound streetcar about to cross Horton (now Como) Avenue, exiting from the Classroom area, 1948. Photo: John Stern, Minnesota Streetcar Museum

Pollinator Promotion

POST 20

POLLINATORS ARE RESPONSIBLE FOR ONE OUT OF EVERY THREE BITES OF OUR FOOD, NOT INCLUDING ANIMAL FOOD SOURCES.

During the growing season in the Classroom, **pollinators** find lots of **nectar** and **pollen** to eat and feed to their young. As they visit flower after flower, they perform an important job for the plant — they transfer pollen, which fertilizes the plant so that it can produce seeds. Pollinators also promote genetic diversity by transferring pollen between plants of the same species, which may help plant species better adapt to environmental pressures. Many people know that bees are important pollinators, but did you know that bats, beetles, butterflies, moths, and birds are all important pollinators as well?

HAVE YOU THANKED A POLLINATOR TODAY?

Pollinators indirectly feed humans and wildlife. Many of our food crops are dependent on pollinators to reproduce. Other food crop species may be able to self-pollinate or be pollinated by wind or water, but produce larger and more numerous fruits when visited by animal pollinators. For example, raspberries produce more and better fruit after insect pollination.

Pollinators are declining due to a variety of factors, including habitat destruction and pesticides. In order to help pollinators, Classroom land managers choose plant species that provide nectar and pollen throughout the growing season, avoid the use of pesticides that harm pollinators, and provide shelter and places for pollinators to raise their young.

Self-pollinated (left, middle) and insect-pollinated (right) raspberries. Photo: Jim Cane

POST 20

STEP RIGHT UP TO GET YOUR NECTAR AND POLLEN!

Plants have evolved alongside pollinators and have developed many different strategies to attract pollinators to their flowers. Characteristics used to attract pollinators are called pollination syndromes. Plants can use flower shape, fragrance, nectar, and color to entice pollinators to visit them. One particularly interesting pollinator syndrome is the use of ultraviolet patterns to attract bees. The visible light spectrum for bees and some other insects is not the same as for humans. Humans are able to see violet to red, while these creatures cannot. Instead, they can see ultraviolet, which humans cannot. Many flowers, such as the black-eyed Susan shown below, have an ultraviolet bull's-eye pattern that signals to pollinators that this flower is a good place to land for a snack.

Once a plant has successfully attracted a pollinator, it must provide some type of reward so that the pollinator will be encouraged to visit other plants of the same species. Rewards usually come in the form of nectar (a sugary liquid exuded from the plant, a high-energy food source) or pollen (another food source rich in protein, vitamins, and minerals). As the pollinator gets its reward, it typically picks up grains of pollen, which it then carries to the next flower, thus completing the pollination process. Bees are fuzzy and are especially good at transferring pollen.

Close-up of bee head covered in pollen.
Photo: Sam Droege, USGS / CC0

A black-eyed Susan photographed in visible light (left), ultraviolet light in color (center), and ultraviolet light in monochrome (right)
Photo: Prof. Andrew Davidhazy, andpph.com

Native American Use

POST 21

THE COMO LAKE AREA OFFERED MANY EDIBLE AND MEDICINAL PLANTS, FISH, AND A LOCATION TO SET UP CAMP DURING SEASONAL TRAVELS.

Minnesota is the homeland of the Dakota, whose creation story centers on Bdote, the confluence of the Minnesota and Mississippi Rivers. The Dakota followed a seasonal way of life. In the summer, they lived in bark lodges in larger, permanent villages along the Minnesota and Mississippi Rivers, where they grew gardens with corn, beans, and squash. The Dakota village of Kaposia was initially located where downtown Saint Paul is now. Later, the village shifted across the Mississippi near present-day South Saint Paul. For generations, the Kaposia residents and other local Dakota collected wild plants for food, medicine, and dyes, and fished in rivers and lakes. Wild rice was harvested from shallow lakes further north in August. In winter, they traveled in smaller family groups into the woods to hunt deer, and in spring, they made maple sugar and hunted muskrats.

1853 illustration of a Dakota camp. Image: Harper's New Monthly Magazine, Minnesota Historical Society

TRAVELING AND CAMPING NEAR COMO LAKE

Como Lake was located along the corridor that both the Ojibwe and Dakota used to travel between the rivers, Dakota villages, and Fort Snelling to the south and wild rice lakes, hunting grounds, and Ojibwe villages to the north. Como Lake was a relatively small, shallow lake that covered a larger area than it does today. A much smaller sister lake, Cozy Lake, lay in the crook of Como's northwestern arm, separated by a narrow strip of land. The area around the lakes consisted of rolling hills with scattered oaks. Because the lakes were shallow, fish would have been small and better suited for eating right away, not drying. The area around Como Lake offered many plants that would have been used for food and medicine. An 1888 list of plants in the area by Como Park's gardener, Frederick Nussbaumer, includes a wide variety of berries, nuts, **forbs**, roots, and tubers. The area would likely have served for temporary camping purposes.

POST 21

A legend recounted by T. M. Newson in 1879 was set on the shore of Como Lake (then called Medewaka according to Newson) and involved the abduction of a young Ojibwe woman, Heleopa, by a group of Dakota. The woman's brother, Nimpewapa, and a group of friends pursued the captors and retrieved an unconscious Heleopa, but her brother was mortally wounded in the fight. According to Newson, Nimpewapa was buried on a hill near the lake and Heleopa visited his grave, marked by stones and flowers, for 50 years.

A NETWORK OF TRAILS

The written record mentions two trails crossing through the wider Como Lake area. One of the trails cited passed through the farm of Heman and Jane Gibbs, who settled in 1849 on 160 acres three miles west of Como Lake. Members of Cloud Man's village followed this trail each fall and camped on the farm to visit Jane and rest. Before her marriage, Jane had spent five years living at Lake Harriet near Cloud Man's village at Lake Calhoun and had learned the language and become close friends with the Dakota.

Another trail followed present-day Lexington Parkway past the Northern Pacific Railroad Shops (now known as Bandana Square) and veered northwesterly between Como Park and the Minnesota State Fairgrounds through land owned by Benjamin Hoyt. The Hoyt land was located less than a mile northwest of Como Lake. The Dakota from Kaposia in South Saint Paul frequently followed this trail. A 1901 Saint Paul Globe article details conflicts that arose in 1850 between the Dakota who used the trail and the Hoyts.

EXILED FROM MINNESOTA

The Dakota way of life began to change as the fur trade developed during the mid-1600s. Hunting and traveling patterns shifted as the Dakota and other local tribes began to hunt more animals and vie for control of hunting grounds. First the French, then the British, and finally Americans moved into the area to establish trading posts, missions, forts, and settlements.

Between 1805 and 1858, twelve treaties were made between the Dakota and United States government. The treaties dislocated the Dakota from their lands and confined them to a small reservation along the Minnesota River. The Treaty of 1837 applied to the lands east of the Mississippi, including the Como Lake area, and soon after farmers, loggers, and land speculators began to pour into the area. After the U.S.–Dakota War in 1862, most of the Dakota were exiled from Minnesota.

Dakota people crossing the border from South Dakota to mark the 150th anniversary of their exile from Minnesota. Photo: David Joles. Republished with permission of Star Tribune, Minneapolis, MN, © 2012.

Stormwater Management

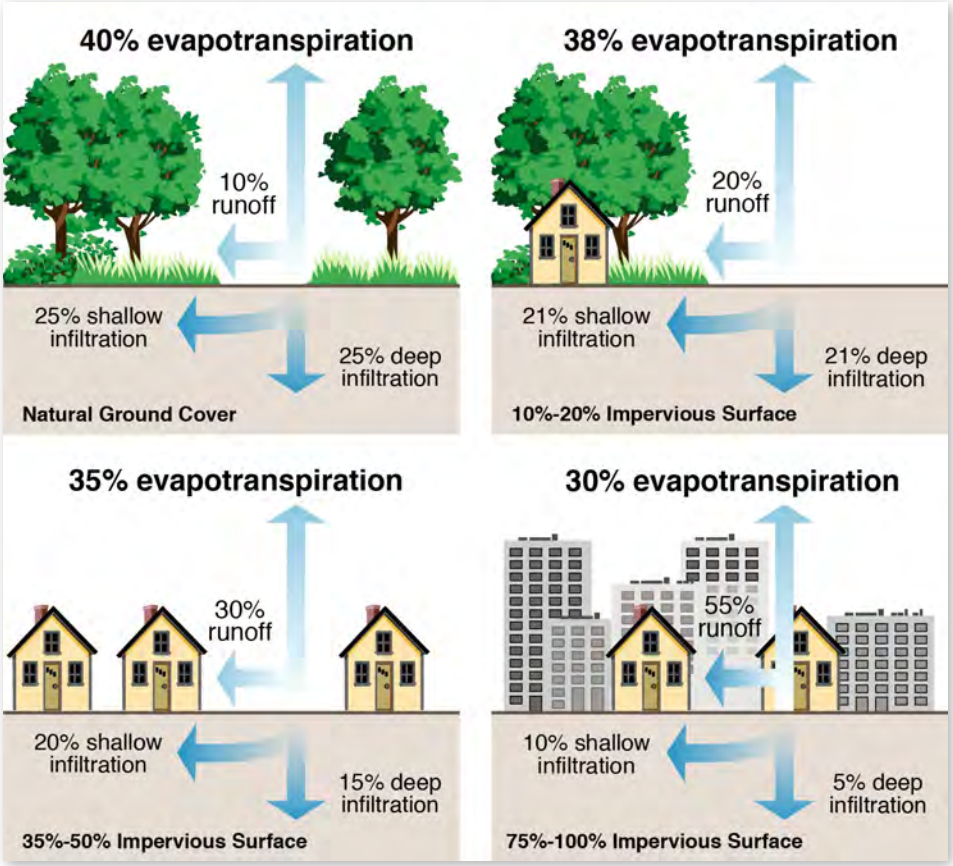
POST 22

BE THE SOLUTION TO RUNOFF POLLUTION.

DOES WATER THAT FLOWS INTO STORM DRAINS GET CLEANED?

An average of over 32 inches of precipitation falls in Saint Paul each year. Where does that water go? Some soaks into the ground (**infiltration**), some is taken up by plant roots and emitted from leaves (**evapotranspiration**), and some flows over land to a nearby water body (**runoff**). The **stormwater** that runs off roads, compacted ground, and parking lots typically goes into storm drains and flows into underground pipes. Storm drains in the Como area carry the water to Como Lake and ultimately the Mississippi River. Since stormwater picks up pollutants like oil, salt, chemicals, and pet waste, people are often surprised to hear stormwater is not treated before it enters the Mississippi!

Before cities grew, most of the rainwater soaked into the ground and was taken up by trees and other plants. Little water flowed over land to lakes and rivers. Today, a large portion of Saint Paul is covered in **impervious** surfaces like asphalt that don't allow water to



Impervious cover in a watershed results in increased surface runoff. As little as 10 percent impervious cover in a watershed can result in stream degradation.

In *Stream Corridor Restoration: Principles, Processes, and Practices* (1998).
Image: Federal Interagency Stream Restoration Working Group

Leaves in the street.
Photo: Dan Wiedbrauk / CC BY

POST 22

soak into the ground. Areas covered by turfgrass (such as lawns or athletic fields) are sometimes called "green concrete" because roots are shallow and the ground is often compacted. Under these conditions, the amount of stormwater runoff increases.

One of the biggest threats to water quality is leaves and grass clippings, because they deliver excess nutrients to lakes and encourage the overgrowth of algae. Leaves that fall on impervious surfaces get a fast track to the water. Excess nutrients can make lakes and rivers unhealthy for fish and other wildlife and unfit for swimming.

In the Como Woodland Outdoor Classroom, land managers employ strategies to prevent pollution and improve water quality. Much of the stormwater from impervious surfaces adjacent to the Classroom is diverted into the low-lying wet forest plant community where it can infiltrate more naturally. Plantings like native grasses and **forbs** have long roots that open up pathways for water to infiltrate into the ground.

GARDENS THAT FILTER WATER AND FEED THE BIRDS

Rain gardens are engineered depressions that hold stormwater and allow it to soak into the ground. They are often planted with native species. Pollutants are filtered out through the soil rather than becoming runoff and entering into lakes and rivers. There are numerous rain gardens within Como Park; the nearest one is in front of Como Regional Pool's main entrance. Rain gardens are increasingly installed in homeowners' yards and in landscaping of commercial properties to collect stormwater, add aesthetic interest, and provide habitat for wildlife. Look for a rain garden in your neighborhood!

Rain gardens provide a valuable service to the residents of Saint Paul by cleaning polluted stormwater that would otherwise go into the lakes and rivers.
Photo: City of Saint Paul

Wet Forest

POST 23

MOIST SOILS AND A DENSE TREE CANOPY MAKE WET FORESTS A HAVEN FOR SPRING EPHEMERAL WILDFLOWERS.

This area of the Como Woodland Outdoor Classroom is the wet forest plant community, modeled after low-lying hardwood forests along streams in southern Minnesota. This plant community is very similar to the terrace forest plant community, with moist soils and a dense tree **canopy**, but wet forests experience less flooding than terrace forests. The wet forest system was historically characterized by elms – American, red, and rock elms. Elm populations were drastically reduced by Dutch elm disease, a fungal disease introduced in 1961. Elm **snags** can often be found in forests and serve as a reminder of Dutch elm disease. Other important tree species in this plant community include sugar maple and basswood.

The wet forest is generally buffered from events such as fires, floods, and droughts. Light surface fires occurred about every 160 years, but these sites were protected from fire by moist soils and topography. This moist but well-drained soil is a happy medium for plants and shields them from the stresses of waterlogged roots and droughts except on rare occasions.

Wet forest.
Photo: © MNDNR

POST 23

HOW DO PLANTS FIND LIGHT IN A DARK FOREST?

Sunlight is limited in this type of forest, so plants must be adapted to living with low-light conditions. Each layer of the forest captures the light that penetrates through the plants above. Very little light makes it to the ground past the well-developed canopy, **subcanopy**, and **shrub layers** of the wet forest.

One group of plants has a unique strategy to capture sunlight in this shady plant community. Spring **ephemerals** are wildflowers that quickly develop before trees leaf out in early spring, taking advantage of the sunlight on the forest floor. Ephemerals grow stems and leaves, produce flowers and seeds, and then die back, all before the forest becomes too shaded. These plants remain alive underground, but are dormant until the following spring.

WHAT GOOD ARE ROTTING LEAVES?

Without frequent fires or floods, decomposing leaves and other organic material make up the spongy **duff layer** on top of the soil. Plants take advantage of this nutrient-rich layer by establishing extensive root systems here rather than deep in the ground. Unfortunately, the duff layer is threatened by animals commonly regarded as beneficial: earthworms. All earthworms in Minnesota are non-native species from Asia and Europe. These invasive earthworms destroy the duff layer, causing a decline in the native tree seedlings and forest understory plants and decreasing the availability of nutrients in the system. Earthworms are spread mainly by humans dumping bait or moving soil, so the best way to contain them is to prevent these activities in undisturbed areas.

Bloodroot (*Sanguinaria canadensis*), a spring ephemeral that captures energy from the sun in early spring.
Photo: Dr. Thomas G. Barnes, USFWS / CC0

Compare the photos of a forest without worms (left) to a forest with worms (right). Which forest do you think is healthier?
Photos: Great Lakes Worm Watch, UMD

Tallgrass Prairie

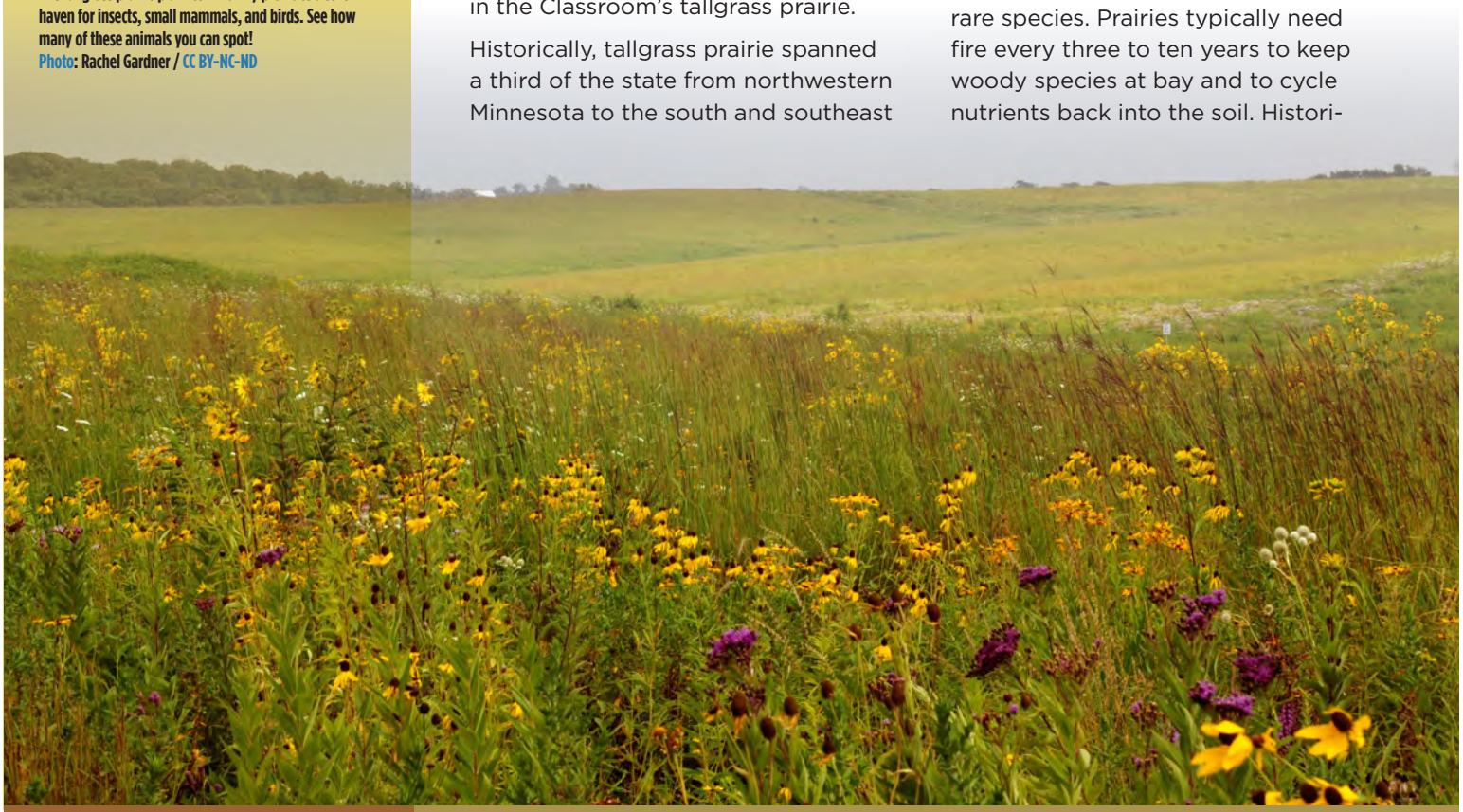
POST 24

HISTORICALLY, PRAIRIE COVERED ONE-THIRD OF MINNESOTA.

The tallgrass prairie plant community is characterized by a complete absence of trees, due to frequent fires. The **shrub layer** is extremely limited with only sparse patches of low-stature shrubs such as leadplant, prairie rose, wolfberry, and a few other fire-resilient species. Iconic tallgrass species such as big bluestem and Indiangrass dominate, while mid-height prairie grasses like little bluestem, side-oats grama and prairie dropseed also make up a significant portion of the habitat. **Forb** cover varies and soil moisture plays a major role in determining which species will thrive. Grey-headed coneflower, purple prairie clover, and stiff goldenrod are among the dominant forb species found in the Classroom's tallgrass prairie.

Historically, tallgrass prairie spanned a third of the state from northwestern Minnesota to the south and southeast of the state. Herds of bison roamed the prairie, grazing on grasses, promoting **biodiversity** of prairie species, and providing a critical food source for Native Americans. Along with fire, bison played an important role in shaping and regenerating prairie ecosystems. Today, less than one percent of Minnesota's prairie remains — only about 150,000 acres of the original 18 million. Loss of tallgrass prairie was caused by three major factors: tilling the soil for farming, loss or suppression of fire, and overgrazing by cattle.

Prairies provide food and shelter for a wide variety of wildlife and are home to nearly half of Minnesota's rare species. Prairies typically need fire every three to ten years to keep woody species at bay and to cycle nutrients back into the soil. Histori-



The tallgrass prairie plant community provides a safe haven for insects, small mammals, and birds. See how many of these animals you can spot!
Photo: Rachel Gardner / CC BY-NC-ND

POST 24

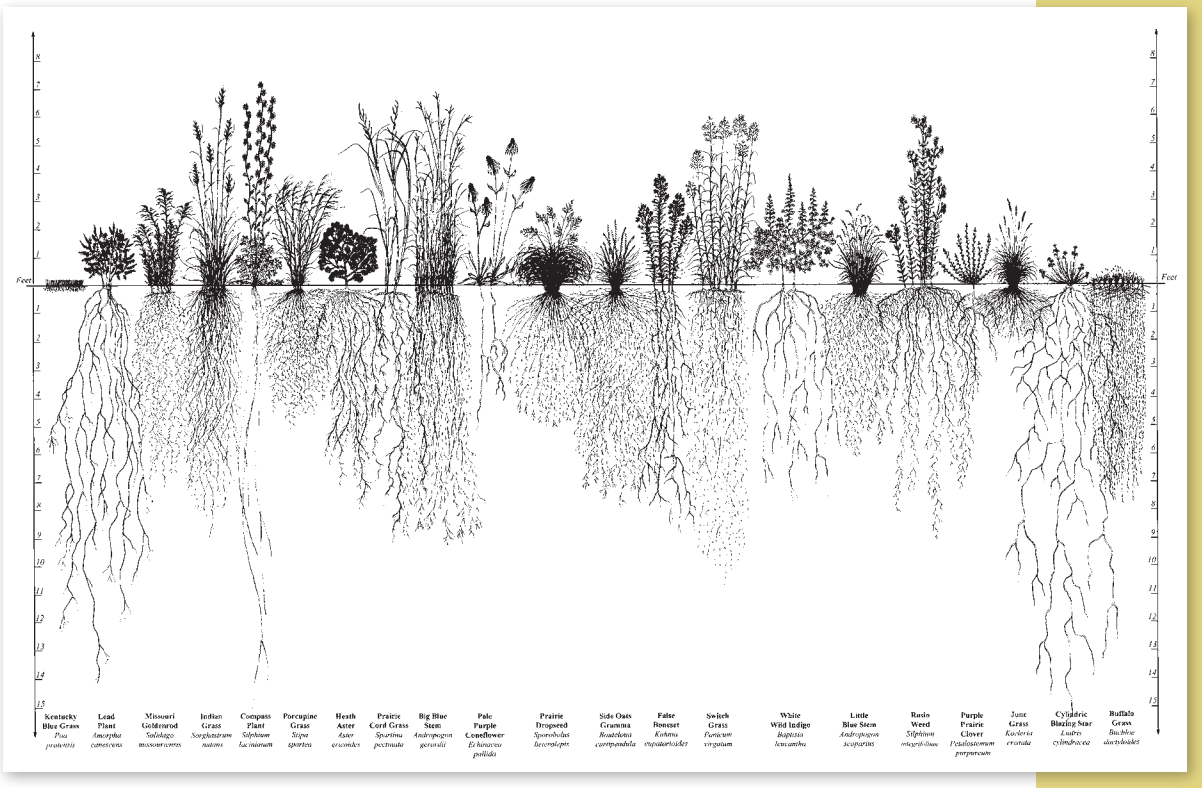
cally, these fires would naturally occur by lightning strike, or be ignited by Native Americans. Saint Paul Parks and Recreation staff manages tallgrass prairies with prescribed burns every three to five years.

PRAIRIE PLANTS: MORE THAN MEETS THE EYE

While the aboveground portions of prairie plants provide habitat and food sources for wildlife, what happens belowground is also astounding. Most prairie plants have more biomass below ground than they do above. In fact, approximately two-thirds of plant tissue in prairies exists below ground. These massive root systems provide many benefits to both the plants and the soil they reside in. The intertwining roots are exceptional at holding soil in place and preventing erosion. Each root tendril also serves as a pathway for water and air to penetrate deep into the earth and help recharge ground water.

The root systems of prairie plants are constantly experiencing decay and regrowth. In three to four years of life, a single plant will have a nearly complete turnover of its roots. Decaying roots provide nutrients, contributing to the fertility of prairie soil. As part of the photosynthetic process, prairie plants remove carbon dioxide from the air and store the carbon in their roots.

Bison were once common on tallgrass prairie, but now only exist in managed herds due to over-hunting and loss of prairie habitat.
Photo: USDA / CC0



Prairie root systems compared to turfgrass (far left).
Image: Conservation Research Institute and Heidi Natura

Propagation Garden

POST 25

MIGHTY OAKS FROM LITTLE ACORNS GROW. — PROVERB

WHAT IS PROPAGATION?

Propagation is the process of reproducing plants from seeds, divided roots, cuttings, or other plant parts. In the summer of 2014, the City installed a propagation garden in the Classroom including raised garden beds, stone seating, and space for gravel beds. The propagation garden provides a source for local **ecotype** plant material for future restoration activites within the Classroom and a site for educational activities for students and volunteers. Each year, the propagation garden features a variety of native species. Some of the native species that you might see in the propagation garden include prairie blazing star, purple prairie clover, prairie dropseed, and butterfly milkweed.

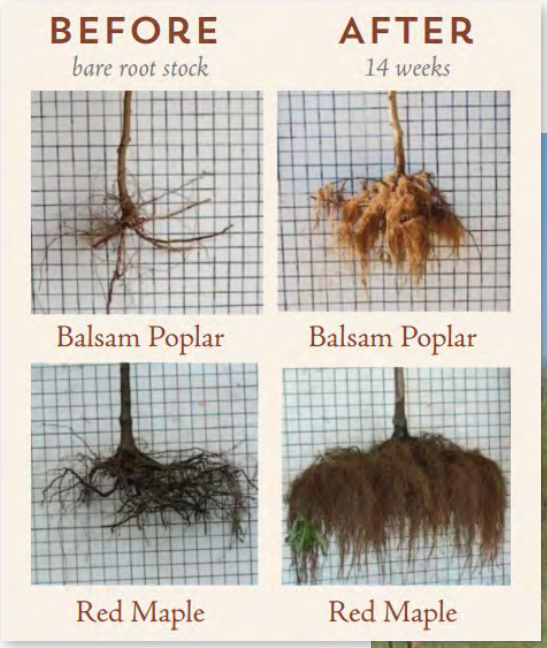
GROWING IN GRAVEL

A relatively new strategy for propagating woody plant material is the use of **gravel beds**. A gravel bed is an irrigated raised garden bed filled with about 18" of pea stone or another coarse stone instead of soil.

Dormant **bare root** nursery stock is planted in the gravel and grown until it is time to be transplanted. The porous structure of the pea

Youth transplanting young sedges and forbs into the propagation garden.
Photo: City of Saint Paul

stone retains water and allows oxygen to penetrate deep into the lower portions of the bed, allowing fibrous roots to develop. Fine, fibrous roots are typically broken or damaged when a plant is removed from soil, but conversely, gravel falls away from the roots and causes very little damage. This fibrous system grows vigorously while the plant is in the gravel, enabling it to easily absorb vital nutrients when planted. The result is increased transplant success.



Compare the roots of a balsam poplar and red maple before and after growing in a gravel bed. Transplantation after growing in a gravel bed is less stressful for plants.
Image: University of Minnesota Forest Resources

Gravel beds allow trees and shrubs to grow fantastically fibrous roots.
Photo: University of Minnesota Forest Resources

Nursery and Bird Sanctuary

POST 26

IN ITS EARLY DAYS, THE NURSERY SUPPLIED PLANTS FOR ALL CITY PARKS, PARKWAYS, AND STREET BOULEVARDS. AFTER ITS ABANDONMENT, LOCAL AUDUBON SOCIETY MEMBERS ADOPTED THE SITE FOR BIRD CONSERVATION.

In the early 1900s, invasive buckthorn was included in the stock at Como Park nursery.
Photo: Eli Sagor / CC BY-NC

THE NURSERY IS ESTABLISHED

In 1888, a park nursery was created at the southwest corner of the park. Trees and shrubs from an old (non-park) nursery and from city lots to be sold were transplanted into the new nursery at Como Park. Native plants from adjoining woods were transplanted directly to barren borders along new park drives.

A year after it was started, the nursery contained 2,179 trees, shrubs, and vines. After the expansion of the park's irrigation system, the nursery grew to over eight acres in 1903. Its stock rose to a peak for this era: 40,053, including 11,684 elms ranging in size from seedlings to 2.5 inches in diameter. Unfortunately, the nursery's stock also included 2,172 *Rhamnus cathartica* — invasive buckthorn. By 1946, the nursery reached its greatest size of 10-12 acres.

Between 1920 and 1945, the City owned and operated three nurseries: a municipal forest, used for street plantings; a nursery at Hidden Falls; and the nursery at Como Park — the largest of the three. The Como Park nursery was completely renovated in 1925 after a five-year lull in its use. It operated until 1946, when a lack of labor during World War II led to its abandonment. A large portion of the nursery remains in the wooded section of the park between the maintenance buildings and the Classroom. Can you find north-south rows of hackberry, ash, and elm from the historical nursery?

Como Park nursery.
Photo: City of Saint Paul

Birds fed on berries, nuts and seeds in the bird sanctuary.
Photo: Marsanne Petty / CC BY

POST 26

FROM NURSERY TO BIRD SANCTUARY

The former nursery became a bird sanctuary in 1952, when the Saint Paul Audubon Society approached a Parks commissioner about potential sanctuary sites. The effort was led by Pearl M. Jewell, a local school principal and Audubon member. The area had both open and wooded spaces with plenty of habitat, seeds, berries, and nuts to attract birds. The Joyce Kilmer Cascade and Pool provided a nearby source of water for birds. Members erected birdhouses and feeders, made trails through the area, spread flower seeds, and held clean-up events.

THE END OF THE BIRD SANCTUARY

Unfortunately, the secluded site was a magnet for vandals, who repeatedly damaged or destroyed the feeders and birdhouses, once even setting fire to a grassy area. By 1960, after eight years of excitement and disappointment, Audubon members had had enough. They stopped replacing the feeders and birdhouses and put their efforts elsewhere.

Pioneer Press article circa 1952. Lower center photo shows W. LaMont Kaufman and Pearl Jewell at the Joyce Kilmer Cascade.
Photo: Pioneer Press, Minnesota Historical Society

Pine-Oak Woodland

POST 27

A PLANT COMMUNITY BUILT ON SAND AND RENEWED BY FIRE.

WHAT MAKES A PINE-OAK WOODLAND UNIQUE?

The pine-oak woodland is an uncommon plant community found on sandy valley floors near streams and rivers of southeast Minnesota. The soil is well-drained due to eroding sandstone cliffs found in this community and streams depositing sandy soil as they flow towards the Mississippi River. The **canopy** is usually dominated by pines and oaks, with the occasional basswood and cedar. Tree species in Como Woodland Outdoor Classroom's pine-oak woodland include white pine, jack pine, red oak, and basswood.

The presence of **conifers** like pines and cedars sets this plant community apart from others represented in the Classroom. Most coniferous trees keep their green needles year round. Conifers do shed their needles, but most do not shed them all at one time like a **deciduous** tree. Needles are typically kept two to three years before they are shed.

Pines are usually associated with northern Minnesota, but pines also thrive in the sandy pine-oak woodlands of southeastern Minnesota. Photo: © MNDNR

POST 27

Because they grown on well-drained sandy soil, pine-oak woodlands are dry. They are also fire-dependent plant communities. According to Public Land Survey records, catastrophic fires occurred approximately every 135 years, with mild surface fires about every 15 years.

A unique plant species found in pine-oak woodland is the bracken fern. This fern can be identified by its single stem that emerges from the ground and splits into three parts. Also, in the spring or early summer, look for the delicate white flowers of Clayton's sweet cicely or the showy purple/pink flowers of wild geranium.

Species Spotlight: JACK PINE

Jack pine (*Pinus banksiana*) provides an excellent example of a tree that thrives in a fire-dependent woodland. Jack pine seeds are locked inside pine cones sealed with resin that only melts when exposed to high temperatures. When woodland fires occur, the seeds are released by the heat, allowing the jack pine to recolonize the newly burned, fertile woodland floor. Not only do jack pines need fire to open their cones, the seedlings also need full sun to grow. Fire also helps open the canopy, allowing the seedlings to receive direct sunlight.

See if you can identify a jack pine tree by its needles and cones. Needles come in bundles of two and are short, 3/4 to 1-1/2 inches long. Cones are 1-1/2 inches long and curved.
Photo: Mr.Icon on Flickr / CC BY-SA